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Use Case Elicitation Method Using "When" Sentences from User Reviews

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Abstract

User review sites are spaces where users can freely post and share their opinions, which are trusted by many people and directly influence sales. In addition, they overcome the limitations arising from existing requirements collection and are able to gather the needs of large numbers of different people at a low cost. Therefore, such sites are attracting attention as new spaces for understanding user needs. In a previous study, a user review analysis was attempted using 5W and 1H, and we inferred that a sentence containing "when" has special information based on the user experience. In addition, the requirements of the derivative activities in a user review can identify more user needs than the general requirements of derivative activities. In this paper, we propose a systematic method of deriving "when" sentences contain meaningful information from user reviews and converting them into use cases, which is one of the requirements of a specification method. This method converts unstructured data into structured data such that it can be included as the user requirements during software development from user comments expressed in natural language. This method will reduce project failures and increase the likelihood of success by enabling an efficient collection and analysis of user needs from valuable user reviews.

Keywords: *User Review, Use Scenario, Use Case, Software Requirement Development*

1. INTRODUCTION

User review sites are spaces where users can freely post and share their opinions on software. Many people rely more on user reviews left by real users than those promoted by profit-related companies or organizations, and thus user reviews have a direct impact on software sales [1-3]. User reviews are currently produced in large numbers every day, and the needs of large numbers of different people can be gathered for less cost than traditional software requirement gathering activities. Although there is an issue in data processing owing to the large amount of data, there is an advantage in eliminating the limitations in existing software requirement collection activities [1, 4-6]. Therefore, the value of user reviews has been recognized as a new area for understanding the needs of users throughout various fields and research in this regard has

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been attempted. In addition, existing studies in the software field have found that important information on software development, such as feature requests and functional complaints related to software, is included [7].

User reviews written in natural language are being studied to derive meaning through various methods [8]. In a previous study, the 5Ws and H were used to analyze user reviews, and a sentence including "when" allowed speculating the high possibility that the user has special information, including a specific time and place, based on experience [2]. Even if the needs of users are identified through the requirements derivation during the early stages of software development because of the nature of the user reviews, it is possible to grasp the needs of many more people than those participating in the requirements derivation activities in general, and those who have used the software [1, 4-6]. Sentences that include "when" are likely to be meaningful user reviews, and such reviews are the needs of future users that stakeholders related to software development must understand. In addition, identifying the needs of people from user reviews can reveal those needs that are not found in the existing activities deriving the general requirements.

In this paper, we propose a systematic method for deriving "when" sentences that are likely to contain meaningful information from user reviews and convert them into use cases, one of the notations of UML (Unified Modeling Language), such that they can be included in the software requirements.

2. PROPOSED METHOD

In the requirements development activities, meaningful user reviews have been reflected using a "when" sentence, and the procedure of the method included in the software requirements has been defined through the derivation of a use case [9]. This procedure consists of four stages: software target selection and user review conditions, elicitation of sentences including "when" from user reviews, definitions of the derived sentences as a use scenario, and elicitation of use cases using the use scenario, as shown in Figure 1.

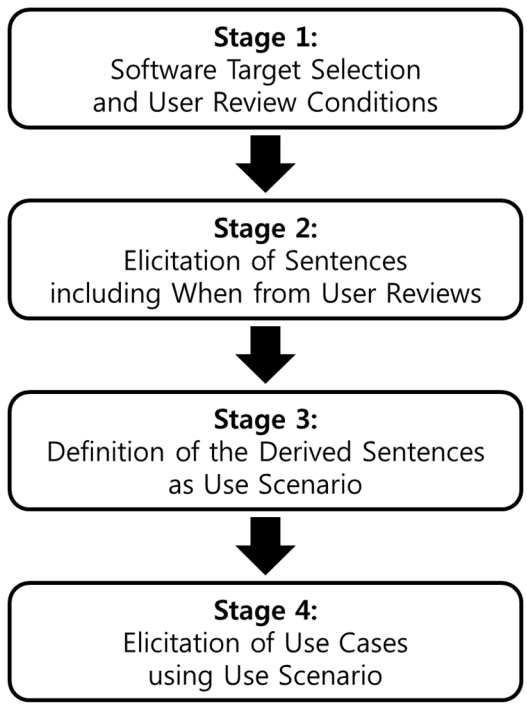


Figure 1. Overall process of the proposed method

This method can be applied regardless of whether the software being developed is the first version or a development phase of a follow-up version. However, because the software related to the business requirements of the software to be developed has already been developed and evaluated by users in the market, it can be applied when a user review exists.

2.1 Software Target Selection and User Review Conditions

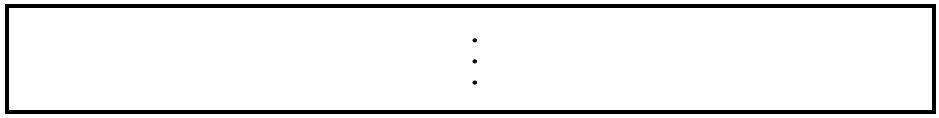
If there is no similar software previously developed in the organization, user reviews cannot be obtained on their own, and thus the relevant software must be selected. Depending on the business requirements of the software development, similar existing software, or software from other domains, may be targeted. The software to be developed and the business requirements are similar, and the target is selected among the candidate group for software that has already been developed and is being evaluated by the market. Once the targets are selected, users then set the conditions for user reviews written to each target. This may vary depending on the software, although user reviews are produced in large quantities every day. Therefore, the user reviews to be analyzed should be limited by setting the conditions for such reviews. Because a user review analysis should eventually be manually analyzed by people even if the process is automated, it is necessary to control the number of user reviews to be analyzed by setting the conditions. The conditions for user reviews can be varied depending on the conditions as needed, such as duration, grade, and emotion, and can be set in accordance with the time and cost available and the purpose of collection.

2.2 Elicitation of Sentences including When from User Reviews

Most user reviews are written in natural language. Basically, they therefore go through the process of the Natural Language Processing (NLP) technique and derive sentences including "when." This derives sentences including "when" according to the set conditions selected in Stage 1. Table 1 shows some of the sentences, including "when" sentences, in a user review of actual software.

Table 1. Sentences including "when" from user reviews

No.	*User review*
1	The app can translate text and audio to help you when you're stuck.
2	But when I download it again and log in to my account I lose all messages and all the people I was talking to and this is very bad.
3	I created a group and wanted to use the "teach" feature but found I still couldn't use it when I went to the specified link.
4	Is there any way to have the option to choose the language when it translates?
5	I hope the messages will not disappear anymore when the app is uninstalled.



Sentences including “when” have special information, including the specific time and place, based on user experience. These are the considerations of stakeholders when developing software and are needs for future users that may not be obtained from the derivative activities of the general software requirements. This paper reviews the derived user reviews and removes those reviews that have the same meaning. In addition, duplicate user reviews are organized together. In addition, the numbers of duplicated and deleted user reviews with the same meaning are counted and recorded. The number of deleted user reviews was later calculated for the importance of the use case.

2.3 Definition of the Derived Sentences as Use Scenario

The derived sentences including “when” are user opinions as they were written by the current user, and thus must go through a conversion process to be included in the software requirements. To change from a user review in natural language to a use case, this is first defined as a use scenario. The use scenario describes one example of the use of a system [9]. There is various information in the use scenario of user reviews in addition to the use scenario. However, only information on the use scenario is used to derive the use cases. There may only be one usage scenario or a number of use scenarios in the user review. Therefore, it is listed based on a one-use scenario through a review. Each scenario derived from a user review has the same number of deleted user reviews as the corresponding user reviews themselves. In addition, while defining the scenario, the scenario that is not related to the business requirements of the software to be developed is deleted. Finally, the use scenario related to the business requirements and the number of user reviews deleted for each use scenario are listed.

2.4 Elicitation of Use Cases using Use Scenario

A use case is a set of related use scenarios, and a use scenario is a specific element of a use case. By generalizing through the use scenario, a use case can be derived [9]. Each scenario is identified, and the grouping related scenario is applied. In addition, use cases are derived through a grouped scenario. The use case has the importance of the use case as the sum of the number of user reviews deleted that the corresponding scenario has. This has a high importance for use cases derived in relation to the parts mentioned in a number of user reviews. The importance of the use case helps to find an optimal use case combination based on limited resources. This can effectively improve the system services by supplementing them sequentially through a reflection of the use case priorities during the operation and maintenance of software after release [10].

3. CONCLUSION AND FUTURE PLANS

This paper deals with user reviews, which are currently recognized as a new way to understand user needs. We define a systematic method of deriving “when” sentences containing meaningful information using NLP techniques from numerous user reviews and convert and derive use cases, one of the requirements of specification methods, allowing simple user opinions to be included in software requirements. We included this in the software requirements development stage, and set up a total of four stages: selecting software targets and setting user review conditions, deriving sentences including “when” from user reviews, defining

the derived sentences as use scenarios, and deriving use cases using use scenarios. Through this method, it is possible to efficiently collect and analyze the needs of a large number of diverse people from valuable user reviews, minimizing the failure of software development projects, and increasing the chances of success.

We have conducted such research because most "when" sentences clearly include the user's needs, but in our future studies, we plan to find additional features that can grasp the user's needs from user reviews in addition to "when" sentences, and research ways to include them in the software development stage.

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