Social Network Service-based Impact Analysis of Customer Requirements

Dong-Min Seo[1], Neung-hoe Kim[1], Dong-Hyun Lee[1],
Jung-Dong Kim[1*] and Joseph S. In[2]

[1]Department of Computer Science and Engineering, Korea University
Anam-Dong, Sungbuk-Gu, Seoul 136-713, Republic of Korea
{kamiseleos, nunghoi, tellmehenry }@korea.ac.kr, kjdvhu@gmail.com[*]

[2]Irvington High School, 41800 Blacow Road, Fremont, CA 94538, USA
josephisin1995@gmail.com

Abstract

Many researchers in the field of requirements engineering are now focusing on eliciting requirements only from market influencers, that is, people who have a great influence on the market success of products. However, acting on the requirements expressed by customers without validating them can cause a product to fail in the market. Therefore, the importance of a requirement proposed by a customer should be validated by various other customers. Social Network Services (SNSs) are an important tool for validating customer requirements. They offer various advantages, such as ease of access and ease of use, and the diversity of their users. We therefore propose a method for analyzing the impact of customer requirements, based on SNSs. Our proposed method considers various factors, such as the time a customer spends on transmitting messages, the number of customers receiving the messages, and the opinions expressed in the messages. The method makes it possible to evaluate the impact of a customer's requirements and to support a software project through prioritizing these requirements.

Keywords: *Customer Requirement Analysis, SNS, Social Network Service, Impact analysis*

1. Introduction

For the success of a software project, eliciting customers' requirements and satisfying their needs are very critical factors [1]. If the software does not include the customers' requirements, which reflect their needs, ultimately the developed software will be a failure. Alexander [2] stated that the major reasons for software development failures are related to customer requirements. Wiegers [3] also claims that understanding customer requirements is important to the success of a project.

Many studies in the field of requirements engineering are now focused on eliciting requirements only from influencers, that is, those who have a strong influence on the market success of products. However, this method has limitation that it is difficult to validate dissimilar importance of requirements between influencer and hidden customers. It is hard to collect agreement of hidden customers about eliciting requirements from influencer due to temporal and spatial constraints. In addition, it does not measure difference of the time nevertheless their importance of requirements is changed as time passed. As a result, it cannot compare requirements and determine which are more important, and products eventually fail in the market.

The opinion of various customers is therefore necessary to validate the importance of requirements that have been proposed. Social Network Services (SNSs) are an important tool for validating customer requirements, having the following advantages. 1) By analyzing the opinions of various users of SNSs, software developers can discover more customers' requirements than they can through interviews and surveys [4, 9]. 2) SNSs offer their users more opportunities to express their opinions freely using various channels, such as micro blogs and Twitter and Facebook [4, 11, 12]. 3) SNS users are connected by shared hobbies and interests, and developers can easily approach specific groups and thus elicit the customers' requirements continuously [4, 12].

We therefore suggest a method that analyzes the impact of a customer's requirements based on data collected from SNSs. By adapting a method for analyzing the impact of users of social media proposed by Josephs [13], we have developed a method for calculating the quantitative value of the impact of a customer's requirements, utilizing data collections of users' opinions expressed on SNSs. Our proposed method considers various factors, such as the time a customer spends transmitting messages, the number of customers to whom the messages are sent, and the opinions expressed in the messages. As a result, it is possible to establish the priority of various requirements and find requirements that reflect on advertisement.

This paper is organized in five sections. In Section 2, we discuss related studies on SNSs based on requirement engineering. Our proposed method is described in Section 3 and a case study is given in Section 4. Finally, in Section 5 we present our conclusions and future work.

2. Background

A social network can be defined by the relationships among its members. Wasserman and Faust [7] describe a social network as one whose members are interconnected through similar features, such as interests, friendships, and location. A social network is also defined as a set of *Node* (or *Actor*) and *Edge* (*ties*). A *Node* can be an individual person, but also a company, a specific department of a company, or a country. An *Edge* is the relation between *Node*s based on shared specific features.

An SNS can be used effectively to collect customer opinions [4], and requirements can be extracted from these customer opinions. In particular, SNSs, being bidirectional, make larger scale communication possible. For this reason, many researchers utilize SNSs for extracting customer requirements. In addition, recently software engineering researchers have utilized SNSs in various ways. Several researchers have also investigated how SNSs can be used to facilitate software projects. For example, in the field of software product line engineering (SPLE), user feedback facilitates product configurations. Using this feedback, a developer can reconfigure products during their lifetime [9].

In the requirements engineering field, Lee, et. al., [4] proposed a process for eliciting customer requirements. They suggested criteria that can be applied in opinion searches based on keywords, and presented a method for refining users' opinions so that they can be used to extract requirements.

3. Impact Analysis of Customer Requirements Method

In this study, we introduce an SNS-based analysis of the impact of customer requirements, showing in particular how to apply the method to SNSs and how to analyze the impact of customer requirements. To solve problem which is difficult to select important requirements for customers, we prioritize requirements using collecting data from SNS. Our proposed

method considers various factors such as analyzing relations of customers, measuring frequency of messages between customers and time arising messages.

Figure 1 shows overview of impact analysis of customer requirement. Our proposed method utilizes data of messages which is mentioned by user from SNS such as Twitter, Facebook, and LinkedIn. Our proposed method is organized by three steps; "Considering customer's impact", "Measuring impact value of customer requirement" and "Prioritizing Requirements". Each step describes bellows more detail.

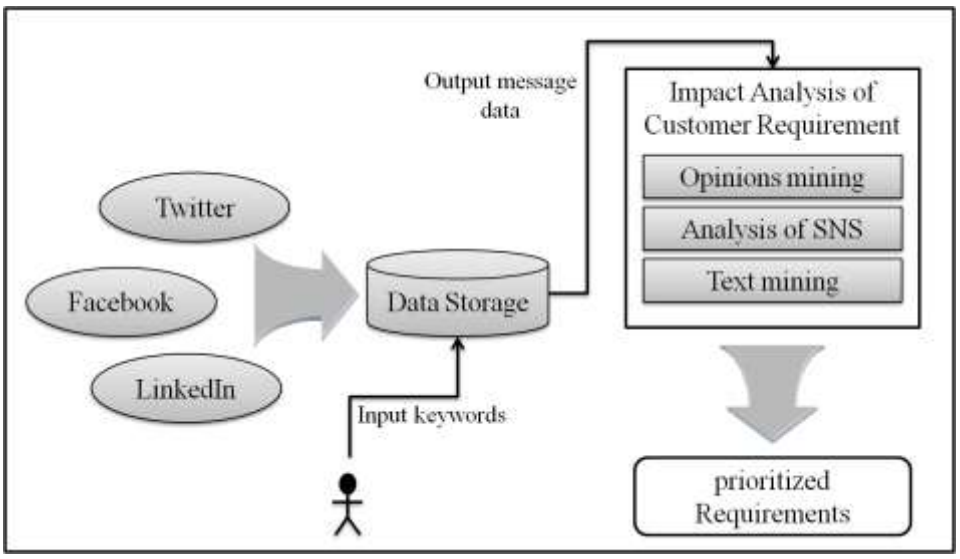

Figure 1. Overview of Impact Analysis of Customer Requirement

Step 1. Considering Customer's Impact

Our proposed method, the objective of which is to find the impact of customer requirements, improves on the previous method. The impact value of a specific customer's impact is calculated as

$$RI_i = Follower(i,j) \times Weight\_Tier(i) + Bridge(i)$$

Here RI_i denotes the impact value of a specific Node *i* (an SNS user*). Follower(i,j)* is defined by the number of followers, and is counted as the number of followers called Node *j* (an SNS user and the hidden customer). *Weight_Tier(i)* is multiplied by *Follower(i,j),* and it is calculated the weight value of Tier at Node *i.* Table.1 shows Weight value following tier. Generally SNS messages are delivered by five tiers. In this paper, we only consider five tiers.

Finally *Bridge(i)* represents 0 or 1. Its value means Node *i* have a role witch connect multiple upper nodes and multiple lower nodes. If specific node is bridge, It have important role for delivering messages. We therefore, consider this importance by calculating value of bridge.

Table 1. Weight Value Following Tier

Tier	*Weight_Tier(i)*
1	0.6
2	0.7
3	0.8
4	0.9
5	1.0

Step 2. Measuring Impact Value of Customer Requirement

The customer requirements impact value (CRIV) is a measure of the total impact value of a customer's requirements for deciding prioritization, taking into account the number of customers to whom messages are sent, and the time the customer has spent sending these messages. CRIV is calculated as

$$CRIV = \sum_{i=1}^{n} \frac{RI_i}{t_i} S_i$$

If any customer has mentioned a requirement and related him/her, we will consider the opinion of this customer (e.g. n means the number of SNS's users mentioned specific requirements). As a result, we obtain the impact value of a customer requirement. t_i denotes the time spent by the customer sending messages to the other customers. S_i denotes the number of customers who really receive the messages.

Step 3. Prioritizing Requirements

In this step, prioritization of requirements is decided through impact value measured previous step. Our proposed method prioritizes requirements following impact value, and it is possible to prioritize feature by summing impact value of requirements. After finishing this step, our proposed method shows Prioritizing Requirements reflected impact analysis of customer requirements.

4. Case Study: Impact Analysis of Requirement in Twitter

A case study was carried out through the analysis of Twitter which is famous Social Network Services. Twitter provides applications for its various functions based on an API and it is used diverse users more than 100milion people. The case study on impact analysis of requirements was progressed over one month, from May 1 to 31, 2011. The case study was also conducted in Korean language. Approximately one hundred thousand tweets are collected

4.1. Experiment

For the experiment, first we targeted GalaxyS2 and three keywords including the product. Each keyword takes a role of feature. Three keywords are shown by feature in Table 1. 15 Customers are identified by considering relations of customers. ID, the Number of followers, and maximum tier are measured (*RI*) through each customer.

Table 2. Impact Analysis of Reuqirements in Twitter

Number	ID	Feature	Follower	Bridge	Max Tier	Max time of retweet	Impact
1	Customer1	Camera	5	X	3	1	4
2	Customer2	Camera	4	O	2	2	3.8
3	Customer3	Camera	4	X	1	10	2.4
4	Customer4	Camera	3	X	1	10	1.8
5	Customer5	Camera	6	X	2	2	4.8
Number	ID	Feature	Follower	Bridge	Max Tier	Max time of retweet	Impact
6	Customer6	Battery	5	X	3	1	4
7	Customer7	Battery	14	O	3	1	12.2
8	Customer8	Battery	2	X	2	1	1.4
9	Customer9	Battery	7	X	2	10	4.9
10	Customer10	Battery	18	X	1	10	10.8
Number	ID	Feature	Follower	Bridge	Max Tier	Max time of retweet	Impact
11	Customer11	Design	1	X	1	1	0.6
12	Customer12	Design	6	X	4	1	5.4
13	Customer13	Design	3	X	2	10	2.1
14	Customer14	Design	2	X	1	10	1.2
15	Customer15	Design	1	X	1	10	0.6

Following Our proposed step1, impact values (RI_i) are measured. Table 2 shows impact values for some customers. Through this result, we progress step2 for measuring impact value of requirements.

Table 3 shows priority of requirements following impact value of customers. Most important requirement is related to Battery. Especially battery of requirements takes possession of high priority and average of spent of retweet time is also highest. After that, finally we can also prioritize the features on the basis of Impact value by summing results.

Table 3. Priority of Requirements

Priority	Requirement	Feature	Impact Value(CRIV)
1	Requirement7	Battery	2.978
2	Requirement6	Battery	2.924
3	Requirement12	Design	2.272
4	Requirement1	Camera	1.192
5	Requirement5	Camera	0.516
6	Requirement2	Camera	0.392
7	Requirement8	Battery	0.28
8	Requirement9	Battery	0.22
9	Requirement10	Battery	0.216
10	Requirement11	Design	0.12
11	Requirement13	Design	0.066
12	Requirement3	Camera	0.048
13	Requirement4	Camera	0.036
14	Requirement14	Design	0.024
15	Requirement15	Design	0.012

Table 4 shows result of Comparing Frequency and CRIV. Collected data from Twitter recorded that most important priority feature is camera. On the other hands, camera recorded lowest priority of feature in our method.

Table 4. Result of Comparing Frequency and CRIV

Feature	Frequency (Priority/Count)	Impact Value of Customer Requirement (Priority/CRIV)
Camera	1/(230)	3/(2.184)
Design	3/(201)	2/(2.494)
Battery	2/(224)	1/(6.618)

4.2 Validation

To validate our method, we performed a survey with ten customers using product. Through eliciting requirements by our method, we take each priority from them. We also conducted statistic analysis, which Kendall's Coefficient of Concordance (Kendall's W). It can be used for assessing agreement among raters. Kendall's W ranges from 0 (no agreement) to 1 (complete agreement).

Table 5

Requirement	Sample number	Average	standard deviation	Minimum Priority	Maximum Priority
Requirement7	11	1.7273	0.78625	1	3
Requirement6	11	2.4545	1.86353	1	7
Requirement12	11	2.6364	1.12006	1	5
Requirement1	11	4.0909	1.57826	2	8
Requirement5	11	5.0909	1.04447	4	7
Requirement2	11	6.7273	1.73729	4	10
Requirement8	11	6.3636	1.28629	4	9
Requirement9	11	7.5455	1.12815	5	9
Requirement10	11	9.0000	1.09545	8	11
Requirement11	11	10.1818	1.94001	7	13
Requirement13	11	11.1818	1.32802	10	13
Requirement3	11	12.3636	1.50151	10	15
Requirement4	11	13.3636	1.74773	10	15
Requirement14	11	13.4545	1.21356	11	15
Requirement15	11	13.6364	1.43337	11	15
significant level	0.000	Kendall's W		0.901	
chi-square	138.729	Dgree of freedum		14	

Table 5 shows the result of Kendall's W. As shown by the value of Kendall's W (0.901), we should check that our method is suitable for priority through high agreement of value.

5. Conclusions

Customer requirements are an important role of software project, especially impact of customer requirement is evaluated by diverse customers. So we proposed method using Social Network Service to analyze impact of customer requirement. Our proposed method shows quantitative value about importance of customer requirement. As a result, we were able to find the important requirements. As well as, we confirmed that SNS have advantages which very usefulness of requirement engineering. We also expect to be utilized our method to advertisements and product developments.

Future work remains for improving our method. First we need to validate effectiveness of the method in real project. Second we need to improve experimental results for using various Social Network Services such as Facebook, LinkedIn and Youtube. Finally we should extend the method to be enabled to accept other requirement engineering phase such as requirement conflict resolution and negotiation.

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Authors

Dong-Min Seo

Dong-min Seo is an M.S. candidate with the Department of Computer Science at Korea University, Seoul, South Korea. He received his B.S. degree from Department of Computer Engineering, Korea Polytechnic University, in 2011. His research interests include social network, requirements engineering, and embedded software engineering.

Neung-Hoe Kim

Neung-Hoe Kim is a Ph.D. candidate with the College of Information and Communications, Korea University. His research interests include requirements engineering, value-based software engineering, software engineering economics, and embedded software engineering. He received his M.S. degree in Computer Science from Korea University.

Dong-Hyun Lee

Dong-Hyun Lee is a Ph.D. candidate of the College of Information and Communications at Korea University. His primary research interests are in software engineering on embedded system, value-based software engineering, and ubiquitous computing. He received his M. Sc.degree in computer science and B.S. degree in electrical engineering from Korea University.

Jung-Dong Kim

Jeong-Dong Kim received his M.S. and Ph.D. degrees in Computer Science from Korea University at Korea, in 2008 and 2012, respectively. He is a research professor, Center for Autonomous and Self-Adaptive Software (CAAS), Department of Computer Science and Engineering, Korea University, Seoul, Korea.

Joseph S. In

Joseph S. In is a senior student at Irvington High School. He worked Intenuum, Inc. as an intern from 2009 to 2010 to perform scientific research of better marketing strategy on the mobile environment and published two research papers: He also worked NeuroSky, Inc. in 2012 as an intern to analyze concentration and relaxation by the EEG data of MindWave. He is interested in social network service, mobile marketing strategy, psychology and sociology, and start-up business.Author’s profile.