In search for an ideal campus information service in undergraduate students' opinion

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Different organizing bodies within Mahidol University International College (MUIC), Thailand including both in- and extra-curricular organizations, had tried to create engagement within the college with various tools, such as the academic registration system, course tools, social networking websites, and blogs. Despite these overwhelming attempts to capture the attention of the students, they had never been engaged in the communication because information is scattered across various services and tools. With the problem above in mind, we were set to study on the reasons why the existing systems are not being able to hold students engagement, and to seek for an effective campus information system to serve undergraduate students where up-to-date technologies, such as high speed internet access and smart phones, were a part of their daily life. In order to acquire the complete set of requirements from students' opinions we used the technique of requirements elicitation that included five basic steps: fact-finding, requirements gathering, evaluation, prioritization and consolidation. We adopted the RESCUE process for the fact-finding and requirements gathering steps, the Kano model for the evaluation and prioritization steps, and the Volere template for the consolidation steps. According to the Kano model, we categorized the seventy-six requirements obtained into (i) attractive requirements, (ii) must-be requirements, (iii) one-dimensional requirements, and (iv) neutral requirements. The convenient samples were undergraduate students at MUIC where, according to one of our surveys, student accessed the Internet for an average of 10 hours a day via computers and mobile phones. Nineteen students participated in the first two requirements elicitation steps and seventy-four in the rest of the process. Examples of high- priority requirements were (i) attractive: integrated registration process for both academic and extra-curriculum activities, (ii) must-be: integration of all systems where students could access all of information in one login session, and (iii) one-dimensional: increasing systems reliability, especially in respect to time and performance. The highest-ranked negative requirement is political-related contents.

Keywords: University Information Service, requirements elicitation

Introduction

Mahidol University International College (MUIC) is an institute under Mahidol University (MU), Thailand, offering all English programs in various fields including business administration, computer science, and social science. With the total number of students being near three thousand this academic year, online information services are necessary for the

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efficiency of operations. MUIC have used a number of information technology, including the MU email service, the Online Access to Student Information System (OASIS) for academic activities (such as registrations and class scheduling), an e-learning system based on Moodle, and a website for the Student Association that has been on- and off-line for a while due to the lack of maintenance volunteer. In addition, various college organizations have utilized social media. For example, the library has maintained Facebook and Skype accounts so that students can interact with the library staff online, and student clubs have communicated their activities via Twitter. With various information systems available and mobile applications coming, we have wondered what technological experience our students have built.

We have conducted an informal survey within MUIC to voice students' experience. The major complaint has been that there are too many systems. Each system mentioned above is exclusive from each other and requires separate user accounts that the user needs to log in each system separately. As a consequence, information cannot reach the target audience because they have felt that too much effort is required. This informal study has motivated us to conduct a formal study to discover the actual characteristics of information systems that students would prefer as a channel they would rely on when accessing information from the college and the university.

Background

Requirements engineering is an interdisciplinary approach to delivers a system solution that satisfies customer needs (Electronic Industries Association, 1994; IEEE, 1994). A requirement describes a function a software product should perform. Multiple requirements are obtained to create a full set of requirements that describe the whole software product (Aurum & Wohlin, 2005). There are two main types of requirements, namely *functional requirements*, what a system should do, and *non-functional requirements*, what a system should be in term of performance, security, etc.

Developing practical and adequate requirements are critical to success of software projects (Aurum & Wohlin, 2005; Hall, Beecham, & Rainer, 2002). The process usually involves actual users of the future system. There are many challenges in gathering and developing useful requirements. Many users do not fully know how the system should be like until they start experiencing the system. In addition, ideal system solutions may differ greatly from existing solutions and also users' cognition of possible solutions.

Briefly, there are five steps in a requirements engineering process. First, *elicitation* is a communication process that is driven by conversations in meetings and interviews to produce as many requirements as possible. Second, *analysis* is a process that validates the elicited requirements for necessity, consistency, completeness and feasibility. Third, *documentations* assure the precise communication of requirements agreed by stakeholders to developers. Fourth, the *review* process ensures that the requirements are acceptable to be used as descriptions of the system to be implemented. Last, the *management* tracks that requirements are implemented and that the project conforms to any possible future requirement changes.

The scope of this work covers only the requirements elicitation step that is the first sub-process of the requirements engineering. There are also five steps in the elicitation process. First, *fact-finding* is the studying the organization' and users' characteristics and behaviors. Second, *requirement gathering* is the compilation of functions or characteristics that the system must have in the users' opinions. Third, *evaluation* identifies inconsistencies in the

collected requirements and examines the reason that a requirement has been stated. Fourth, *prioritization* is making judgments on which requirement is more important than another. Last, *consolidation* is integration of pieces of information gathered in previous steps and turning them into a set of requirements with the goals identified during fact-finding.

Requirements Engineering with Scenarios for a User-centered Environment (RESCUE) is a technique that has been used with success gather requirements to develop air-traffic-control systems in Europe and the UK (Maiden, Gizikis, & Robertson, 2004). The method is conducted via workshops that encourage *exploratory*, *combinatory*, and *transformational* types of creativity. In exploratory creativity, participants explore possible ideas to create new ones in a similar fashion to brainstorming. In combinatorial creativity, people create new ideas by combining and synthesize existing ideas. It is the improbability of the combination that allows those ideas to form. In transformational creativity, people are to think that things that were impossible are now possible, allowing ideas to be created beyond the limits of existing constraints. These different types of creativity are, in fact, not carried out individually, but rather multiple types of creativity are exercised at once.

The Kano Model is a method to evaluate and classify the elicited requirements (Sauerwein, Bailom, Matzler, & Hinterhuber, 1996). Five classifications in the model are *must-be*, *one-dimensional*, *attractive*, *indifferent*, and *reverse*. If must-be requirements are not fulfilled, the user will be extremely dissatisfied. However, if the requirement is fulfilled, their satisfaction would not increase beyond being neutral. Therefore, this type of requirements would be the basic criteria for a product. One-dimensional requirements increase the user satisfaction with the level of fulfillment. The higher the fulfillment leads to higher satisfaction. Attractive requirements have the greatest influence on customer satisfaction. Without the requirement, customer would not be dissatisfied. However, the existence of the requirement would increase customer satisfaction greatly. Indifferent requirements make no different to users having or not having it. The reverse type signals dissatisfactions of certain requirements.

A modified Kano Model developed by Rejeb, Boly and Morel-Guimaraes (Rejeb, Boly, & Morel-Guimaraes, 2008) prioritizes requirements in addition to classification by calculating three scores for each requirement:

- Functional Score (SI) = $\frac{\sum \text{degree of satisfaction with existence}}{\text{number of responses} \times 2}$

- Dysfunctional Score (DI) = $\frac{\sum \text{degree of dissatisfaction with inexistence}}{\text{number of responses} \times 2}$

- Reverse Score (RI) = $\frac{\sum \text{degree of dissatisfaction with existence}}{\text{number of responses} \times 2}$

Then we can plot each requirement using the SI and DI scores as shown by example in Figure 1. Where a requirement is plotted determine its Kano classification. For example, if a requirement falls in the left, top area of the graph, it is classified as “attractive.” The reverse score is used to ensure that there is no extra feature that could dissatisfy users.

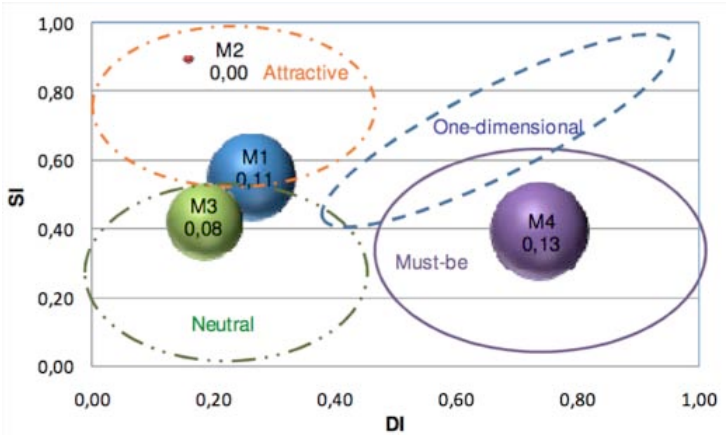

Figure 1: Example of results from the modified Kano model

Methods

In the fact-finding step, we sought fifteen MUIC students of various major, age, gender, class year and background and split them into three groups in which the diversities were optimized. The requirements gathering step includes two creative workshops. Use cases of existing systems were drawn and shown to every group to give them a big picture of what the current systems are capable of doing. After that, they were asked to suggest any functional or non-functional requirements they want or expect from the systems without thinking about constraints. They were later asked to pinpoint any constraints or undesirable elements of the existing systems and to suggest alternatives or workarounds for those constraints. Lastly, they were asked to compare the current systems with other applications, websites and services and see if we can extract or adapt some functions or characteristics from those things to be included to our systems. Finally, we get lists of suggestions, uses, problems and situations regarding the system. An example of the workshop log is shown in Figure 2.

#	RID	Dialogue	Note	Functional	Non-functional	Question
W3-D-022	R1	Or otherwise, just add additional text that we need to read.	Suggestion: resources, text and materials download.			
W3-D-023	I1	So now we don't need to care if your suggestions are possible or not, or good or bad.				
W3-D-024	R1	Can they not separate IDs? Can they make it a part of OASIS? Because when we access e- learning, we have to type in our ID and password again.	Suggestion: share account with OASIS		Share account with OASIS	If you CAN login to e-leaning system using your OASIS account, how would you feel?

Figure 2: Example of a log from the workshop

From the lists of suggestions, uses, problems and situations regarding the systems, we extracted possible functional and non-functional requirements. From that raw set of requirements, according to Kano model, we created two questions for each requirement, one functional ("If the system meets the requirement X, how would you feel?") and another dysfunctional ("If the system does not meet the requirement X, how would you feel?"). An

example of the question pair is shown in Figure 3. Figure 4 shows a typical set of answer to questions shown in Figure 3.

#	Reference	Question
Q-001	S-001	If there are frequent updates to news and information, how would you feel? If there are less frequent updates to news and information, how would you feel?
Q-002	S-002	If all information related to you, scattered in various systems, are gathered into single place, how would you feel? If all information related to you continues to be scattered in different sites, how would you feel?

Figure 3: Example of functional/dysfunctional questions derived from workshops

Answer	Score
This would be very helpful to me.	+2
This is a basic requirement for me	+1
This would not affect me.	0
This would be a minor inconvenience, I can live with it that way.	-1
This would be a major problem for me and I can't accept it.	-2

Figure 4: List of Kano-styled answer choices and their scores

All questions generated during the requirement gathering were compiled into a questionnaire and were distributed to fifty MUIC students. After getting the questionnaire back, we then calculated the functional, dysfunctional, and reverse scores from the students' answers. To consolidate requirements, for each of them, we first determined its type according to the schema in Figure 5. Then, we gave the requirement a description, provided rationale, traced back its originator, determined its fit criterion, and filled in the rest of the data according to the Volere requirements specification template (snow card) (Atlantic Systems Guild).

Requirement Type ID	Requirement Type
9.	Functional and Data Requirements
10.	Look and Feel Requirements
11.	Usability and Humanity Requirements
12.	Performance Requirements
13.	Operational and Environmental Requirements
14.	Maintainability Requirements
15.	Security Requirements
16.	Cultural and Political Requirements
17.	Legal Requirements

Figure 5: List of requirement types

Results

There were the total of 77 requirements extracted during the elicitation process. The results were calculated into three scores, as shown in the example in Figure 6. All results according to the calculation were displayed in Figure 7.

Priority	Question	SI	DI	SI+DI	RI
1	Q-052	0.93	0.65	1.58	0
2	Q-059	0.90	0.64	1.54	0
3	Q-063	0.89	0.58	1.47	0
4	Q-054	0.89	0.52	1.41	0
5	Q-028	0.88	0.52	1.40	0.02

Figure 6: Questions ranked with highest combinations of SI and DI scores

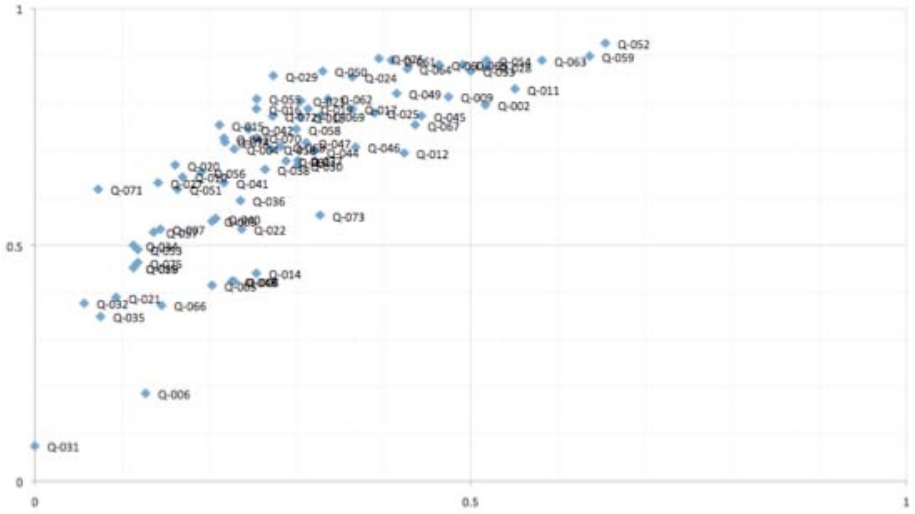

Figure 7: Requirements mapping from the questionnaire's results

The first two highest FI and DI scores were:

- Q-052 The need for better performance of OASIS
- Q-059 The system should let students know which courses would be opened on which trimesters

These two requirements were also ranked highest when with the FI score or the DI score alone. That indicated how high students had evaluated these two criteria.

Other high FI scores are:

- Q-063 The system shall offer course requirements, course descriptions and course syllabus for students to view in one place.
- Q-054 The system shall send an e-mail to notify the student when their class is cancelled.
- Q-028 The system shall allow student to contact course instructors.
- Q-011 The student shall be able to access the system from anywhere (i.e. from their homes, etc.).

An example of high RI-valued requirements was:

- Q-006 (0.25) for including political contents in news

Examples of snow cards for the first two highest requirements were shown in Figures 8 and 9, respectively.

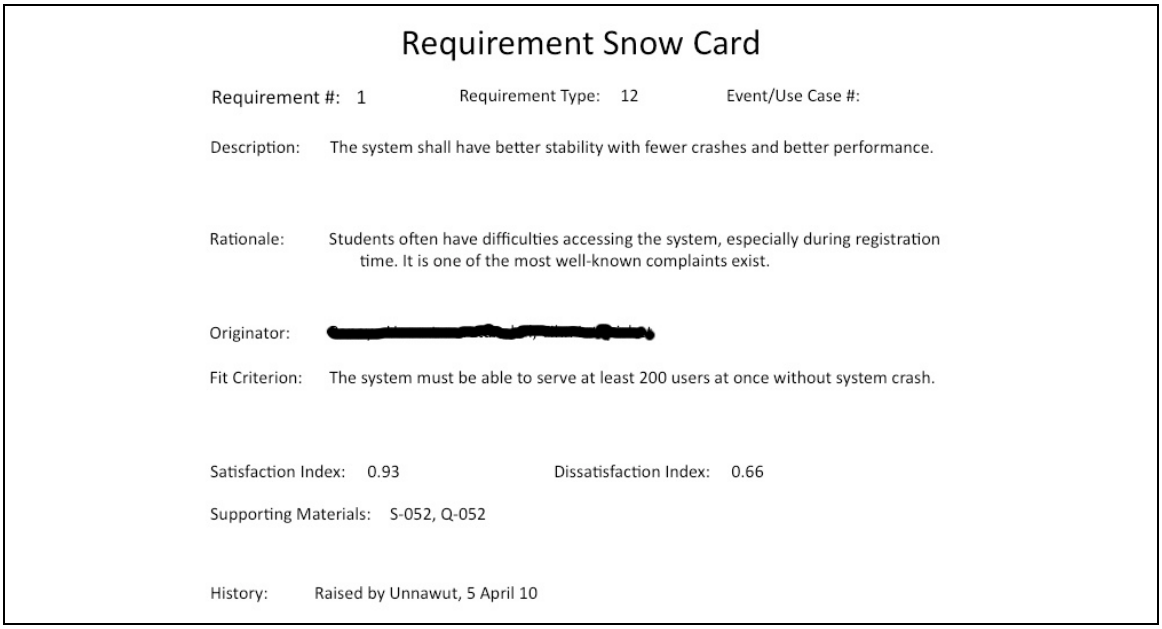

Figure 8: Snow card for Q-052

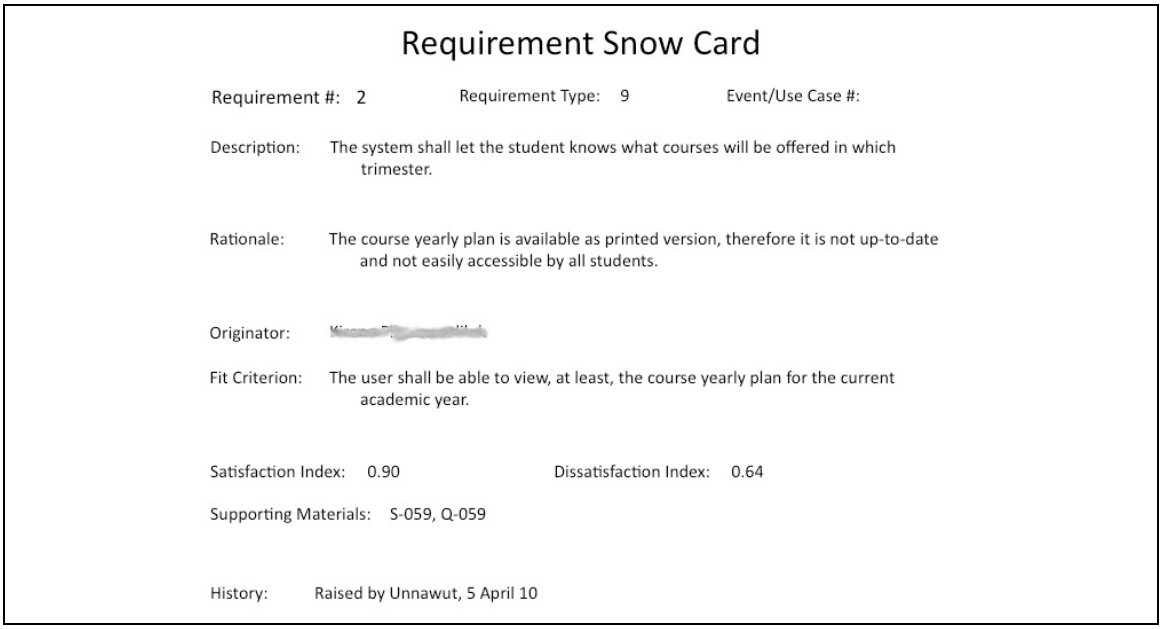

Figure 9: Snow card for Q-059

Conclusions

The output from this project could be considered as a single viewpoint from one type of stakeholders. It is important that, before implementing the requirements into a real system, more viewpoints are needed to be taken into account, such as viewpoints of staff and lecturers. Nevertheless, it is important to take into account that, although derived from one viewpoint, MUIC students are one of the very direct stakeholders who would use and gain benefit from the improvements to the system.

In order to successfully implement a system, requirements management is also an area to tackle. Requirements management is needed to ensure not only that we've extracted the right requirements, but also to ensure that the requirements are implemented as expected, as well as follow up on any changes to the requirements that might be necessary.

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