

A Cognitive Requirement Specification Model

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Abstract: Eliciting/Gathering information from the customers in requirement phase is the most crucial task in the development of the software development process, because this phase builds the base for the success or failure of any software product. Requirements specification process highly depends on the knowledge and mental abilities of the customers. In this paper, we are proposing a cognitive requirement specification model based on the cognitive classification of customers.

Keywords: Eliciting requirements, requirements specification, requirement engineering, cognitive model, agile method, prototyping, quality assurance.

I. INTRODUCTION

One of the biggest problems in software engineering is to understand stakeholders' needs and then to analyse these needs properly to build a system that meets their needs. Actually, requirements specification and managing customer requirements are the two largest problems of the software industry [1] and, therefore, one of the leading root causes of software failures. To solve this problem, different techniques are discussed in the literature. The meetings and workshops are proposed to be the most important and effective techniques to collect the real needs of the stakeholders. If they are organized properly, they can collect the most of the requirements. In addition, according to cognitive science this type of gathering, where all stakeholders meet together, is helpful to increase the knowledge of the collective activities involved in software development process [2], [3]. However, meetings and workshops are sometimes not suitable due to several reasons. For example, gathering of all the stakeholders at a particular time and place is also not very practical. Sometimes, workshops and meetings increase the cost of the product drastically. In these cases, other formal communication techniques may be the better option for small products.

Normally, a project starts with formal communication with customers. Based on customer's feedback, developers make a quick plan and create an interface. After discussing again with the customer for the interface, the developer starts developing the software. This way of development is called the prototyping and is most common in software development process [6]. However, there is flaw in this technique. The requirements are collected from the customers without

knowing their knowledge and awareness' for the product. Mental ability of a customer is also important factor for showing their real needs. These all points indicate that eliciting the real requirements from customers is based on the mental mechanism and the knowledge of the customer in the particular area, which of course is related to cognitive capability of the customer. Our present work is concerned to this issue. For evaluating the cognitive capabilities of customers for eliciting the requirement, we first developed a set of questions. Based on the answers of these questions, we divide our customers into two categories based on their cognitive capabilities. Further, based on their cognitive capabilities, we proposed two different types of model for eliciting the requirements. In our model we tried to propose a template to collect the information from customers in such a way, that none of the requirements is left. And as a result, the company should be able to deliver the product, which satisfies the customer's needs.

The paper is organized in the following way. The evaluation techniques for the classification of customer are discussed in section 2. We proposed our model in section 3. A comparison with similar approaches is given in section 4. The conclusion drawn is in section 5.

II. CLASSIFICATION OF CUSTOMERS BASED ON THEIR COGNITIVE AND TECHNICAL CAPABILITIES

Software engineering requires too much effort. In the past years, software engineering got more information. By getting so much information it became more complex. Understanding requirements is the most difficult and the most mistake prone phase of software development. Therefore, huge amount of effort and time are spent for this stage. Still there are situations in which the requirements are misunderstood.

The popularity of prototyping and agile software development are the indicators of the need for much simplified phases during the software development process. For this reason, we propose a new model "Cognitive Requirements Specification Model" (CRSM), which helps agile development, to have more simplified requirements specification phase. Thus, requirements can be understood more clearly and because of this, the specification of the requirements become more reliable. And all of these come true in less effort and less time.

It is worth to mention that CRSM is not a software development model, but a requirements specification model. Our model can be used only in requirements phase of a development model.

This model can also be successfully used in agile development process because; this model encourages agile development principles and techniques. CRSM simplifies requirements phase and makes the specification more reliable.

To apply CRSM, developers must be aware of the knowledge of the customer and their cognitive capabilities. We prepared two set of questions to understand the technical and cognitive capability of the customers. In the first set, we presented a set of questions for evaluating their technical capabilities.

The questions are:

- [1] Have you ever worked with UML or any other modelling language?
[a] Yes [b] No
- [2] Do you want to involve in our modelling or only in interface design?
[a] Modelling + Interface [b] Only interface
- [3] Have you involved in software requirements validation test before?
[a] Yes [b] No
- [4] Do you know software quality attributes?
[a] Yes [b] No
- [5] How many software quality attributes do you know?
[a] 3 or more [b] Less than 3
- [6] Do you think all software quality attributes can exist in a software product to a maximum extent?
[a] Yes [b] No

For evaluating cognitive capabilities, we must have to know the customers background, their educational status, experience, expertise in the area of the project.

1. Does the customer work in an area closely related with IT?

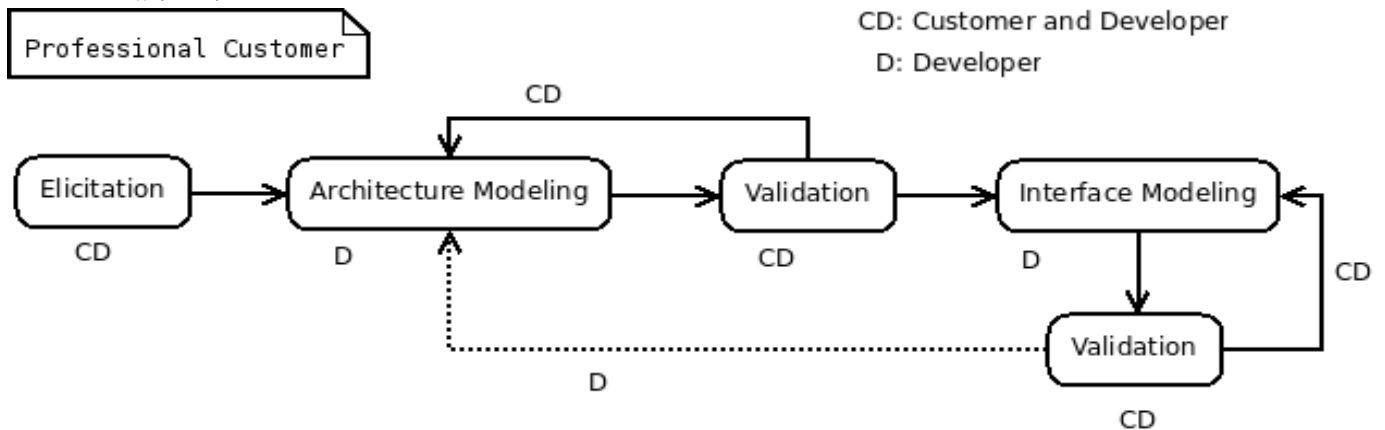


Figure 1: CRSM for Professional Customers

2. What is the customer's computer knowledge?
3. Does he or she have experience in the particular type of product or domain?
4. Does the customer have experience with similar type of product or domain?
5. Is the customer able to express his or her needs clearly?

In the first set of questions, if all the answers are 'a', then the customer can be reckoned as a professional one. Therefore, the model for professional customers should be followed. If any of the answers is 'no', then customer can be reckoned as an amateur one. However, those questions are not exact and enough to come to a certain notion. Therefore we also propose the second set of questions to be taken into consideration. In the second set, there is not a certain rule to exactly say that the customer is professional or amateur, although, answers that are given by the customer to those questions can make things clear for the developers' side.

Actually, the classification of customers into professional and amateurs is a cognitive phenomenon [4]. Kushwaha and Misra [4] have classified the end users into three categories professional, amateur and novice, however, it is not clearly mentioned in the paper that which criteria they adopted to distinguish between end-users. Actually, they follow the guidelines given by Wang [5], but classifications given by Wang are for the software engineers /programmers. Further, we could not understand the significance of novice customers. From the cognitive classification point of view, there are not too much difference between novice and amateur customers. By considering these issues, we developed our CRSM model for two types of customers: professional and amateur.

III. THE PROPOSED MODEL: A COGNITIVE REQUIREMENTS SPECIFICATION MODEL (CRSM)

Based on the discussion in the previous section, we are proposing our model in figure 1 and figure 2.

Here are the steps of CRSM model for professional customers (Figure 1):

1. Firstly, elicitation should be done by the developer and the customer.
2. Architecture modelling should be done by the developer.
3. Validation of the architectural model should be done both by the developer and the customer. If there is a problem in the model, then the developer returns back to architectural modelling but this time discussing the model with the customer. The modification of the architectural model should be done together with the customer.
4. Interface should be modelled by the developer.
5. Validation of the interface should be done both by the developer and the customer. If there is a problem in the interface, then the developer returns back to interface modelling but this time discussing the model with the customer. Before changing the interface model, the architecture model is also checked by the developer and if necessary, then the architecture model is modified. The modification of the interface should be done together with the customer.

The following steps (of our CRMS model), are proposed for amateur customers (Figure 2):

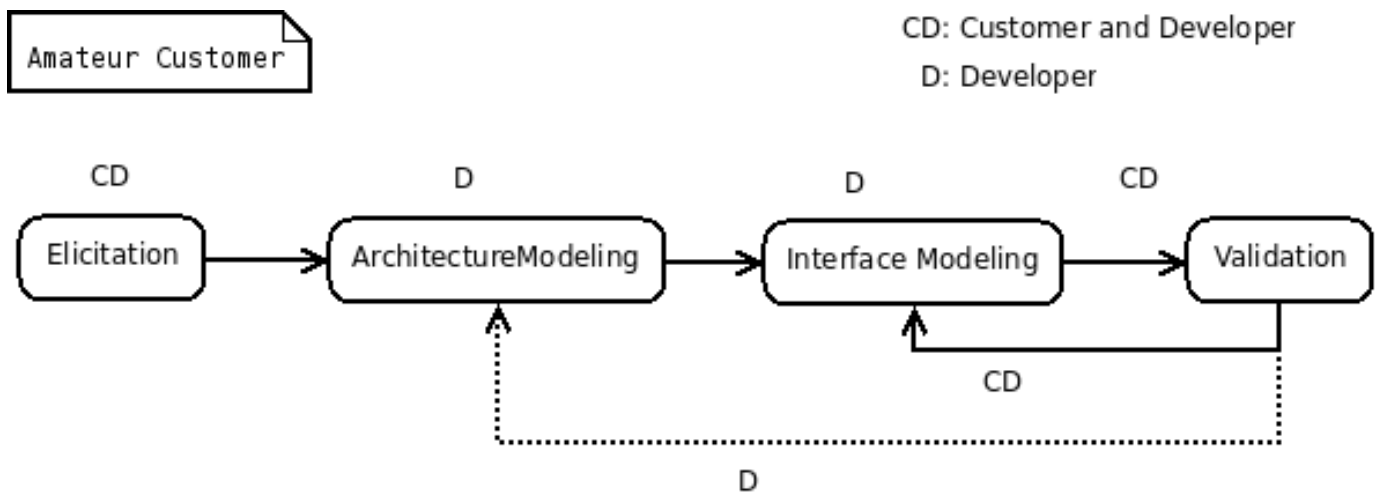


Figure 2: CRSM for Amateur Customers

1. Firstly, elicitation should be done by the developer and the customer.
2. Architecture modelling should be done by the developer.
3. Interface should be modelled by the developer.
4. Validation of the interface should be done both by the developer and the customer. If there is a problem in the interface, then the developer returns back to interface modelling but this time discussing the interface model with the customer. Before changing the interface model, the architecture model is also checked by the developer and if necessary, then the architecture model is modified. The modification of the interface should be done together with the customer.

IV. COMPARISON WITH OTHER MODELS

Our model is different from other models, because it does not require any type of documentation. Moreover, it handles different situations such as working with professional and amateur customers. CRSM offers a simple solution to the most confusing phase of software development which is requirements specification.

In waterfall model, there are feasibility study, requirements elicitation, requirements analysis, requirements specification, and requirements validation which come one after another. If any problem occurs with one of them, then one step back is gone. Also, feasibility report, requirements document, system models, etc. are required [6].

Prototyping starts with communication. Later, developers make a quick plan and create an interface. After discussing the interface with the customer, they start developing the software.

CRSM may not be suitable for big and complex projects. Because of not going into much details and lacking of thorough analysis, it is better not to use in complex projects. However, the model encourages fast delivery and customer-friendly development. Before starting to implementation, customer gives opinion on the interface. If the customer is amateur, then the customer is not involved in modelling. If the customer is professional, then the customer is also involved in modelling and there are two validation stages; one after modelling and another after interface. Implementation phase starts after CRSM. CRSM does not include upcoming stages.

V. CONCLUSION:

A big number of software products fail due to unclear requirements. Problem which occurs during requirements specification stage is automatically carried to other stages growing bigger and bigger. To understand the requirements clearly, software professionals or developers should understand the customer itself. Customers' technical knowledge varies. It may not be suitable to apply a specific technique to every customer, because for some that technique may be a waste of time and for others something inconceivable. Therefore, in this paper, we separated customers into two, calling them professional and amateur. We proposed some questions which may be helpful to understand whether the customer is professional or amateur. We also presented CRSM model for the requirement specification phase. It is based on the classification of the customers into professional and amateur. According to the given answers, one of the two sub-models of CRSM should be followed. The CRSM model is suitable for small projects and small companies. Our model can be improved after further research and experience. We hope that our work will be useful for the software community.

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