

Proposed Algorithm using WARE for the Elicitation of Software Requirements

Sachin Gupta and Vinish Kumar

Abstract—Elicitation is all about determining the needs of stakeholders and learning, uncovering extracting and /or discovering needs of the users and other potential stakeholders. In software engineering, a requirement is a description of what a system should do. System may have dozen to thousands of requirements. Software requirements stipulate what must be accomplished, transformed, produced or provided. In the field of software engineering researchers, academicians and scientist have developed many models and framework to elicit and prioritize the software requirements. It is well documented that requirement engineering saves money. In this paper we have proposed an algorithm to elicit the software requirement for small scale organization.

Index Terms—Software Requirements, Elicitation Techniques, Analytic Hierarchy Process.

I. INTRODUCTION

In requirement elicitation, an analyst collects requirements and information from the stakeholders and prepares a plan for software development. The primary measure of success of a software system is the degree to which it meets the purpose for which it was intended. Requirement Engineering is the process of discovering the need of the stakeholder and documenting these needs in a form that is amenable to analysis [1]. Based on a case study of 12 companies Hall et al [14] observed that almost 50 % problems are because of the requirements problems. Therefore significant benefits can be achieved by improving requirements engineering process [35, 36]

One of the important goals of elicitation is to find out what problem needs to be solved and hence identify the system boundaries. Before the development of any software project it is important to elicit the software requirements properly. Now the problem of determining requirements is becoming increasingly more difficult because the IS development community is facing a new type of end- users. In the Software Engineering literature there are many elicitation techniques and the choice of elicitation technique depends on the time and resources available to the requirement engineer, and the kind of the information that needs to be elicited. We distinguish a number of classes of elicitation techniques such as [27, 28, 40, 41]:

1. Traditional Techniques

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Sachin Gupta is with the Department of Computer Science and Information Technology, Raj Kumar Goel Institute of Technology, Ghaziabad, Affiliated to U.P.Technical University, Lucknow, UP INDIA (e-mail: imsachingupta@rediffmail.com).

Vinish Kumar is with the Department of Computer Science and Information Technology, Sunder deep College of Engineering & Technology, Ghaziabad, Affiliated to U.P.Technical University, Lucknow UP, INDIA(e-mail: vinishkumar_2001@rediffmail.com).

2. Group Elicitation Techniques
3. Prototyping
4. Model Driven Techniques
5. Cognitive Techniques
6. Contextual Techniques
7. Wide Audience Requirements Engineering
8. Goal Oriented Requirements Engineering
9. Package Oriented Requirements Engineering

A. Traditional Techniques:

Methods in this group include a broad class of generic data gathering techniques, such as questionnaires and surveys, interviews, and analysis of existing documentation. [8]

B. Prototyping:

Prototyping allows the analyst to get feedback from the end –users about what they want and need by means of focused, iterative experimentation with new features and system attributes. It involves the close interaction between the analyst / designer and the end user.

C. Group Elicitation Techniques:

The purpose of this method is to elicit the requirements from the group of end users. It includes, brainstorming, Rapid Application Development and Joint Application Development.

D. Contextual Techniques:

These include the use of ethnographic techniques, and conversation analysis, both which apply the fine- grained analysis to identify patterns in conversation and interaction.

E. Cognitive Techniques:

These are techniques originally developed for knowledge acquisition. They include protocol analysis performing a task to provide the observer with insight into the cognitive process used to perform the task.

F. Model Driven Techniques:

These techniques usually provide a specific model of the type of information to be gathered and use this model to derive the elicitation process. Nuseibeh and Easterbrook [34] describe goal –based methods and scenario based methods.

G. Wide Audience Requirements Engineering (WARE):

WARE is a method for requirement analysis and specification that meets the needs for understanding and meeting the needs of Wide Audience End Users (WAEU) in Information System (IS) development. It helps the requirements engineering process in the international research projects. The different organizations that take part in these kinds of international projects can be divided at least into the following categories: Governmental funding organization, other nonprofit organization, and industrial

research centers [27, 28].

H. Goal Oriented Requirement Engineering (GORE):

Requirements are defined in terms of goals. The research on GORE [31] focuses on identifying different kinds of goal namely achievement, maintenance and soft goals. The methods [39, 40, 41], suggest that all soft goal cannot be identified easily because the stake holders are not fully aware with them.

I. Package Oriented Requirement Engineering:

In [30] the authors have proposed a new requirements elicitation method in such a domain of ERP (Enterprise Resource Planning), CRM (Customer Relationship Management), and SCM (Supply Chain Management). PORE can be formulated into 2 sub process namely (1) Package Selection where analyst compares the customer needs with function and /non- functions of packages and selects the suitable candidates of packages and (2) Requirements Evolution, where , he examines the selected packages with his customer and an approved part of specifications of packages are added into their requirements.

The paper is organized as follows: In section 2 we present the background and related work. In section 3 we have proposed the algorithm that will elicit the requirements. In section 4, experimental work is carried out, and finally we conclude the paper in section 5.

II. BACKGROUND AND RELATED WORK

Elicitation is all about determining the needs of stakeholders and learning, uncovering extracting and /or discovering needs of the users and other potential stakeholders [2]. Requirement elicitation is recognized as one of the most critical knowledge intensive activities of the development of software. Studies by [3] indicate that 70% of the system errors are due to the inadequate system specification and 30% of the system errors are due to design issue. The analysis of secure software system based on the system requirements elicited in the form of use case and misuse case. Use cases have proven helpful for elicitation of communication about, and documentation of the function requirements. The integral development of use and misuse cases [8, 10, and 11] provides a systematic way for the elicitation of both the functional and non functional requirements [13].

D. Firesmith [6], have worked for prioritization dimensions, prioritization approach, prioritization techniques and processes. This paper does not explain how the software requirements will be prioritize mathematically? It has only a list of prioritization techniques. In [5] C. Kuloor and A. Eberlrin have explained the requirements engineering for software product lines. It has limited number of elicitation techniques. In [12] J.Karlsson, C Wohlin, and B.Regnell have evaluated six different methods for prioritization software requirements. In this paper, authors have found that Analytic Hierarchy Process to be the most promising method. But in literature we have found the some weaknesses of the AHP. The limitation of the AHP is that it only works because the matrices are all of the same mathematical form-known as positive reciprocal matrix. To create such a matrix requires that, if we use the number 9 to represent A is absolutely more important than

B then we have to use 1/9 to define the relative importance of B with respect to A. Some people regard that as reasonable: others are less happy about it. This paper does not include any elicitation technique. We know that without eliciting any requirements we cannot prioritize it.

So in order to prioritize the requirements, there should be a list of elicitation techniques. Researchers, scientist and academician in the field of software engineering have proposed several techniques to elicit the software requirements. In [19] authors have proposed an approach for the software requirements elicitation. They have used the several steps like training sessions to eliminate “lack of user input” and “poor understanding”, recording keywords, pictorial representation of needs and wants to reduce language barriers etc. but this approach does not have the information that how we will prioritize the requirements? In [1] the authors have provided the different elicitation technique and criteria for its selection. In [15] the authors have proposed a framework to elicit and prioritize the software requirements using AHP and QFD [16, 17, and 22] but this framework does not rank the requirements by the relative level of threat. In [23] the authors have presented an approach for requirements prioritization using B tree. In this paper the authors have mentioned that AHP is most promising method, although it may be problematic to scale up and they have also discussed that AHP are not useful for project that have large number of requirements. They have included AHP, Hierarchical AHP, spanning tree matrix, bubble sort, binary search tree, priority groups, and B tree in the same category. But without having any data we cannot prioritize anything.

So AHP is a technique which is used to find out the importance weight of the requirements, after applying the AHP on the given set of requirements, we can use spanning tree matrix, bubble sort, binary search tree, priority groups, and B tree. It means we have to divide the given approaches into 2 groups. In the first group we have considered only AHP and Hierarchical AHP, and in the second category we will have to consider the spanning tree matrix, bubble sort, binary search tree, priority groups, and B tree. In the continuation of the earlier work we have proposed a framework that will elicit the software requirements and also prioritize it and also rank the requirements by the relative level of threat associated with each requirement. Using an elicitation method can help in producing a consistent and complete set of security requirements. However, brainstorming and elicitation methods used for ordinary functional (end-user) requirements usually are not oriented toward security requirements and do not result in a consistent and complete set of security requirements. The resulting system is likely to have fewer security exposures when security requirements are elicited in a systematic way. In this paper we have proposed an approach to elicit the software requirements. A number of requirements elicitation techniques have been developed to extract requirements from a user. The goal of JAD (Joint Application Development) is to involve all stakeholders in the design phase of the product via highly structured and focused meetings. Typical participants in the session include a facilitator, end users of the product, main developers, and observers. In the continuation of above work we have

proposed an algorithm which is the extension of the algorithm proposed by Mohd. Sadiq et al [] using Wide Audience Requirements Engineering (WARE).

III. PROPOSED SOFTWARE REQUIREMENT ELICITATION ALGORITHM.

In this paper we have proposed an algorithm to elicit the software requirement which is the extension of the algorithm proposed by Mohd. Sadiq et al [36]. In [36] author have proposed an algorithm to elicit the software requirement using AHP, but in this paper there are no description about the Wide Audience Requirement Engineering (WARE) and goal oriented requirement engineering. These two requirement engineering are very important according to the elicitation point of view. In the proposed algorithm we have used only the WARE.

A. Elicit the software requirements with the help of the following

- 1) Collect information about user expectations.
- 2) Train the Clients, Users and Managers.
- 3) Write the description of the user need for the proposed system.
- 4) Now you can apply Wide Audience Requirement Engineering (WARE) because, it helps the requirements engineering process in the international research projects. The different organizations that take part in these kinds of international projects can be divided at least into the following categories: Governmental funding organization, other nonprofit organization, and industrial research centers [27,28].

B. In this algorithm we have used AHP technique for prioritization. For using AHP {Create the overall performance matrix}

Then calculate the Eigen vector (Importance Weight).

C. Find out the risk associated with each requirement.

D. Compare the values of the importance weight of software requirements with step 3 and then rank or prioritize the requirements.

(Proposed Algorithm using WARE)

IV. EXPERIMENTAL WORK

Software Requirement Specification is the first step in the software development which is used to capture the requirement of the client. Before the designing phase SRS team write the user manual i.e. SRS and from this SRS we collect the information about the user need and expectations. This careful compilation of information will be used in the next phase to train the clients/ user and make them aware of what they can and cannot expect from the software developers. In this stage stakeholder also learn about the limitations of the computer resources and functionalities, and availability of other resources.

Once we have collected the information about the user need and expectation; the next step is to train the clients, users and managers. At this stage, missing user input can be supplemented. 1.3 Write the description of the user need for the proposed system: After the successful completion of the above steps, each stakeholder will write the description of

his/ her needs of the system that the clients want to develop. Since the clients and customers are already educated about the computer limitations and availability of resources through the training sessions. In this stage expectations of the development process become clearer.

In this paper we have used Analytic Hierarchy Process. The Analytic Hierarchy Process (AHP) is a structured technique for dealing with complex decisions. Rather than prescribing a "correct" decision, the AHP helps the decision makers find the one that best suits their needs and their understanding of the problem. Based on mathematics and psychology, it was developed by Thomas L. Saaty [20] in the 1970s and has been extensively studied and refined since then. The AHP provides a comprehensive and rational framework for structuring a decision problem, for representing and quantifying its elements, for relating those elements to overall goals, and for evaluating alternative solutions. It is used around the world in a wide variety of decision situations, in fields such as government, business, industry, healthcare, and education. In this paper we have elicited the software requirement for numerical based scientific computation based software and the values of the corresponding requirement are arranged in the following table.

TABLE-01

	1	2	3	4	5	6
1	1	5	1/7	9	7	1/3
2	1/5	1	1/9	1/3	5	7
3	7	9	1	1/5	3	1/5
4	1/9	3	5	1	1/7	9
5	1/7	1/5	1/3	7	1	9
6	3	1/7	5	1/9	1/9	1

V. CONCLUSIONS

In this paper we have proposed an algorithm to elicit the software requirement using WARE. Using this algorithm we can elicit the software requirements on the basis of the type of organization. Proposed algorithm mainly focuses on the small scale organization, because in small scale organization there is direct interaction with the end users and we know the type of end user, who will use the system.

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Vinish Kumar was born at Ghaziabad district of U.P. India, on 14th October, 1980. Currently he is pursuing Ph.D. in Computer Science from Singhania University. He did Master of Technology in Information Technology from Allahabad Agricultural Institute, A Deemed University, Allahabad , U.P., India, in 2007 and Bachelor of Engineering in Computer Science and Engineering from S.D. College of Engineering and Technology Engineering ,MuzaffarNagar, U.P. India in 2001.

He has more than 10 years of teaching experience and currently he is working as an Associate Professor of Computer Engineering in department of Computer Engineering, at SunderDeep College of Engineering and Technology (Affiliated from U.P. Technical .University ,Lucknow) Ghaziabad ,U.P. India. He has communicated 3 research papers in international journals and 4 research papers in national journals and conferences.

Mr.Vinish is a Life member of The Indian Society for Technical Education (ISTE), and Computer Society Of India (CSI), International Association of Computer Science and Information Technology (IACSIT), Singapore. Mr. Vinish has also chaired the session of National Conference on Emerging trends in Embedded Technology 2009(SGIT-ETET-2009), Ghaziabad; India. Ha has also attended various Technical Workshops and actively participated in Faculty Development Programs.

Dr. Sachin Kumar was born at Meerut district of U.P. India, on 20th October, 1979. He did his Ph.D. in Computer Science from C.C.S.University, Meerut U.P., India in 2007 and Master of Technology in Computer Science from Shobit University, Meerut U.P., India

He has more than 10 years of teaching experience and currently he is working as an Associate Professor in Information Technology Department at Raj Kumar Goel college of Engineering and Technology (Affiliated from U.P. Technical .University, Lucknow) Ghaziabad, U.P. India. He has published more than 24 research papers in international and national journals and conferences

Dr. Sachin has published 2 Books on Programming Languages and designed the Course material on Operating System for I.G.N.O.U. New Delhi. He has guided more than 10 Post Graduate Level Thesis work .He is a Life member of Indian Science Congress Association.