Comparative Study of Requirement Engineering Methods

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Abstract— Requirements engineering is a software engineering process with the goal to identify, analyze, document and validate requirements for the system to be developed. Many requirement engineering methods have been developed. Requirement engineering for web applications is facing continuous changes. It involves extra effort from all the stakeholders in its design and applications in order to get the best results. In this paper, a systematic and chronological review of some Requirement engineering methods has been presented.

Keywords— Requirements Engineering, Web Based Requirement Engineering, Navigation

I. INTRODUCTION

Requirements engineering is concerned with identifying, modelling, communicating and documenting the requirements for a system, and the contexts in which the system will be used. Requirements describe what is to be done but not how they are implemented [Alan M. Davis] [1994] [5]. The RE process consists of two main phases i.e. *Requirement Definition* and *Requirements Management*.

As depicted from the Fig.1, Requirements definition includes four different phases i.e. Elicitation, Analysis, Documentation and Review where as Requirements Management includes Change Management and Traceability [Hennicker R. et. al.] [2000] [4].
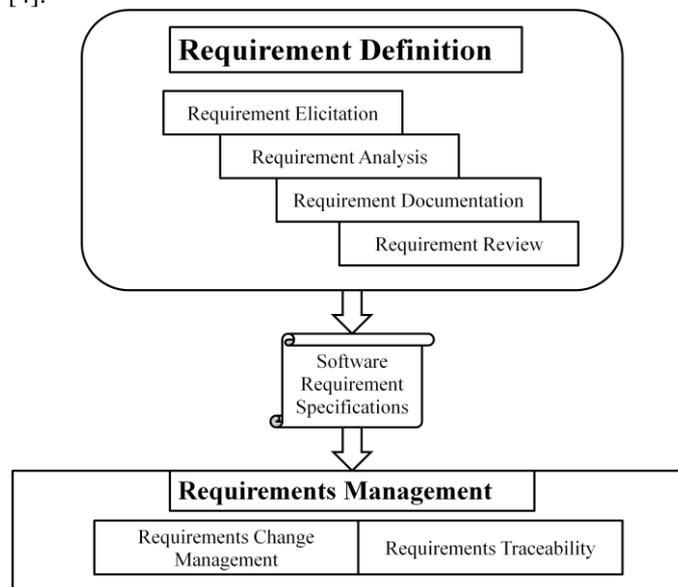

Fig.1. Requirements Engineering

When the requirement definition is complete, developer submits a formally imposed document which is called SRS i.e. Software Requirement Specifications document in which all the requirements collected during the different phases of requirement definition are written together. This document is then shown to the client to verify as to whether all the requirements are correctly specified or not. SRS document acts as the bridge to cover the gap between the client and the developer. The goal of requirements management is to capture, store, disseminate, and manage information as well as the changes (if any) made to the system. The next section discusses the different Requirement Engineering Methods that have been developed for the web development.

II. REQUIREMENT ENGINEERING METHODS

The main web proposals which contain the phase of the requirements handling in the life cycle of their development process are discussed here. The chronological arrangement here gives us an idea of how requirements engineering for Web applications has evolved.

A. OOHDM: Object Oriented Hypermedia Design Model

OOHDM was developed by Schwabe and Rossi in 1994 [Schwabe & Rossi] [1994] [Schwabe et al.] [1996]. It was one of the first approaches in providing a methodological solution for the development of Web applications. OOHDM was widely accepted method in 1998 [Schwabe D.] [1998] [8], and its first versions focused on design and did not include requirements engineering. OOHDM emphasizes the separation of the navigational aspect from other aspect such as the conceptual aspect and the interface aspect.

The process in OOHDM is divided in four phases producing the following results:

- The conceptual model, represented as a class model, is built in order to show the static aspect of the system.
- The navigational model consists of a navigation class diagram and a navigation structure diagram. The navigation class diagram represents the static possibilities of navigation in the system where as the navigation structure diagram extends the navigation class diagram including access structures and navigation contexts.
- The abstract interface model is developed using a special technique named ADVs [Schwabe D.] [1998] [8].
- The implementation consists in the implemented code and is based on the previous models.

B. WSDM: Web Site Design Method

WSDM is a user-centred approach for the development of Web applications that models the application based on the information requirements of the users' groups [De Troyer O.M.F. et al] [1997] [3]. It was the first approach that considered the problem of globally located users.

Its development process is divided into four phases:

- ✓ User modelling in which the users are classified and grouped in order to study system requirements.
- ✓ Conceptual design in which a class diagram is designed to represent the static model of the system and a navigational model to represent the possibilities of navigation
- ✓ Implementation design in which the models of the conceptual design are translated into an abstract language which can be easily understood by the computer.
- ✓ Implementation in which the implementation design result is written into some specific computer language.

C. SOHDM: Scenario-based Object-Oriented Hypermedia Design Methodology

The SOHDM approach [Lee H. et al] [1998] [7] was the first approach stressing the importance of a process that allows the analysts to capture and define the applications requirements. Although SOHDM has similarities with OOHDM [Schwabe D. et al] [1998] [8], but it suggests a requirement specification based on scenarios.

The following six tasks are performed during the life cycle of SOHDM:

- ✓ Analysis, where requirements are describe using scenarios.
- ✓ Object model realization, where a class diagram is built in order to present the static structure of the system.
- ✓ View design, which expresses how the system will be presented to the user.
- ✓ Navigational design, where a navigational class model is developed in order to express the possibilities of navigation in the system.
- ✓ Realization of the implementation, where Web pages, the interface and also the database are developed.
- ✓ Construction of the system, where the system is built.

D. UWE: UML-based Web Engineering

UML-based Web Engineering (UWE) is a methodological approach for the development of Web applications based on the Unified Process [Jacobson I.] [1999] [6]. It is based mainly on the most relevant concepts provided by other methods, but defines a UML notation (UML profile), sticks to the diagrammatic techniques proposed by the UML and defines a systematic and semi-automatic design process [Hennicker R.] [2000] [4]. UWE covers the whole life cycle of Web applications and focuses on adaptive applications. It includes a specific requirements engineering phase where requirements elicitation, specification and validation are handled as separate activities of the process. The final result of the requirements capture in UWE is a use case model completed with documentation describing the users of the application, the adaptation rules, the interfaces and the details of the use case relevant for the use case implementation, which can be described textually or modelled by UML activity diagrams. UWE classifies requirements into two groups: functional and non-functional. UWE uses the techniques such as interviews, questionnaires and checklists for the requirements capture, and use case diagrams for the requirements specification. UWE uses walk-through, audits and prototypes for the validation.

E. WebML: Web Modeling Language

The Web Modeling Language (WebML) is a high-level specification language for the development of hypermedia applications. WebML uses E-R and Use case diagrams. This consists of a set of activities to be performed for the development of Web applications, such as requirements specification, data design and hypertext design [Ceri S. et al.] [2003] [2].

The methodology focuses on collecting the requirements and specifying them. According to this model, the techniques that should be used are interviewing and analysis of documentation, but the checklists should be used for requirements capture. Requirements collection is done by identifying the user and their personalization needs. Acceptance tests are performed to check non-functional requirements.

F. NDT: Navigational Development Techniques

NDT was presented by Maria Jose Escalona in 2004 [Escalona et al.] [2004] [1]. NDT is a methodological process for the Web application development that is focused on the requirements and analysis phases. It proposes the use of textual templates in the requirements phase and the systematic derivation of analysis models from these templates. This approach proposes the use of prototypes to validate requirements. The NDT tool [Escalona et al.] [2003] has been developed in order to support this approach. The development process of this approach is divided in three main stages:

- ✓ Requirements Treatment: In this phase, the Web application requirements are collected and described.
- ✓ Analysis: In this phase, analysis models are systematically derived from the requirements specification. These analysis models are the conceptual model and the navigational model.
- ✓ Prototyping: This phase consists in the development of Web application prototypes from analysis models. These prototypes are used to validate requirements.

This approach is developed to handle all the web application requirements.

G. OOWS: Object-Oriented Web Solutions

OO-Method [Pastor et al.] [2007] [9] is an Object Oriented software production Method to automatically generate information systems. OO-Method is used to model the system in different abstraction levels which helps to distinguish between the problem space and the solution space. The system is represented by a set of Conceptual Models that represents the static structure of the system using Class Diagrams and the behaviour using state and Functional Diagrams. OOWS is the extension to OO-Method which was used to model and generate Web Applications. The development process is divided into two major steps:

- ✓ System Specification: In this step, conceptual OOWS schema is created.
- ✓ Solution Development: In this, a strategy oriented towards generating the software components that gives the final software product is defined.

The OOWS Web Engineering Method considers three models which are used to describe the different concerns of a Web Application:

- ✓ User Model: A User Diagram allows us to specify the types of users that can interact with the Web system. The types of users are organised in a hierarchically using their inheritance relationships.
- ✓ Navigational Model: This model defines the system navigational structure. Navigational ma is used to describe the navigation allowed for all the users. The map is drawn using a directed graph where the nodes represent Navigational Contexts and the arcs represent navigational links. These are used to define the valid navigational paths.
- ✓ Presentation Model: This model helps to specify the visual properties of the information that will be shown on the web page. A set of presentation patterns is proposed to be applied over our conceptual primitives.

III. RELATIVE EFFECT OF REQUIREMENT ENGINEERING METHODOLOGY

- In the beginning, requirements were collected in the text format and these requirements were unable to describe the navigation and layout required for the development of any web application.
- Later on, the models such as UWE started considering the navigational requirements individually but not globally. So, relating the data requirements with navigational requirements was not possible.
- NDT started considering the textual templates for describing the requirements.
- The method started considering the navigational aspect but, the navigation was considered for a single web page and not for the entire web application.

IV. CONCLUSION

It has been concluded that the models that have been developed for the different web applications do not consider the navigational aspect which is very important for any web application development. So, the future research can be made to develop a standard which can be used for describing the navigations among different requirements.

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