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A Genteel Requirement Engineering for Web Applications

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ABSTRACT: Requirements engineering is a software engineering process with the goal to identify, analyze, document and validate requirements for the web application to be developed. One of the most important factors of success in the software development is the elicitation, management, and analysis of requirements which is used to assure the quality of the resulting software. This is especially true in Web engineering due to the heterogeneous audience of the Web, which may lead to websites difficult to comprehend by visitors and complex to maintain by designers. The development of Web systems usually involves more heterogeneous stakeholders than the construction of traditional software. In addition, Web systems have additional requirements for the navigational and multimedia aspects as well as for the usability as no training is possible. Therefore a thorough requirements analysis is even more relevant. The most useful requirements analysis specifies in detail what the user should be able to accomplish on the site and provides guidance on designing site interactions. Proposed work focuses on various requirements analysis tasks and in each task navigation and customization phases should be concentrated as they play important role in web application development. First step is to produce various artifacts that provide different lenses on the system and its uses to elicit more detailed requirements, such as actor tables and use cases. Negotiation of priorities is followed by this. Categorizing the structural requirements is followed then which includes the application and program flow. Subsequent strides are documentation, validation and finally managing the requirements.

KEYWORDS: Requirements Engineering(RE), Requirements elicitation, Requirements analysis, Requirements validation, Requirements management, Stakeholder

I. INTRODUCTION

Web Engineering [2] is systematic, disciplined and quantifiable approaches to the cost effective development and evolution of high-quality applications in the World Wide Web. Though Web engineering requires support from traditional applications, it has a broader context than traditional software engineering. It is a combination of software engineering, hypermedia and multimedia engineering, marketing, graphic design, cognitive science and human computer interaction [3].

In contrast to traditional software systems that are built using a homogeneous technology, Web-based applications run in a heterogeneous computing environment that includes multi platforms, multi-browsers, and multimedia support. Many Web applications transcend the national boundaries. They become much more widespread in their use than traditional software systems. Thus, engineering for the Web should relate to diverse cultural contexts.

Requirements engineering [1] is a software engineering process with the goal to identify, analyze, document and validate requirements for the web application to be developed. Requirements analysis [17] is critical to success and this must be the first step when developing web application. Understanding the requirements in advance helps to ensure that business goals and user needs are met, and that the solution achieves what it was designed to accomplish. In a website redesign project, requirements should map directly to any point of pain or frustration that users experience with the current site. The new web or mobile experience should be customized to satisfy business goals and user needs; if there is no good understanding of those needs at the beginning of the project, a site or application that neither achieves goals nor delights users. Requirements analysis is an iterative process that begins with an initial brainstorming session and continues throughout the development cycle. After the initial requirements have been formulated, reviewed, revised and prioritized by the clients, if possible - follow up with "Wants and Needs" sessions. These sessions will allow prospective site or application users (or past users in the case of site redesigns) to validate the requirements findings



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and identify to what degree they're on track with users' needs. Bring that information back to analysis team to develop the appropriate web strategy.

Web developers should keep the following principles in mind when performing RE. Developers have to understand how the system is embedded in its environment. The objectives, expectations, and requirements of stakeholders have to be acquired and negotiated repeatedly to address the dynamically changing needs in projects. Requirements should be acquired iteratively in Web application development. Typical risk items are the integration of existing components into the Web application, the prediction of system quality aspects, or the inexperience of developers. The quality of the user interface is another success-critical aspect of Web applications. The operational environment of a Web application is also highly dynamic and hard to predict. Many stakeholders, such as potential Web users, are still unknown during RE activities. Project management needs to find suitable representatives that can provide realistic requirements. The development of Web applications requires the participation of experts from different disciplines.

II. PRE-DEVELOPMENT STEPS

A web application requires a team of people steered by common strategies and goals using a set of tools to generate design and code. However before beginning the development of the application, it is important to do requirements engineering. It is an important step in the development of a web application because the end result is entirely dependent upon the way the requirements are defined. The requirements of the system are defined in this phase, though it doesn't specify how they will be accomplished. It deals with 'what', rather than 'how' of the system. The output of this phase is the requirements document. This document forms the foundation for building the project. The requirements document should be written in such a form that it is easy to decompose into algorithms and data structures.

It is important to create a visual model of various aspects before writing one line of code. In doing so, it will help to eliminate any problems and ensures the functionality that needs to be in the application doesn't get missed. Referring back to this map will be used to ensure that the process of developing web application never get off track.

The pre-development into the following steps:

- Requirements Gathering
- Requirements Prioritization
- Requirements Prototyping
- Requirements Documentation
- Requirements Validation
- Requirements Management

2.1 REQUIREMENTS GATHERING

A requirement gathering is the task of communicating with customers and users to determine what their requirements are [4]. At this stage, breaking down the grand idea into smaller, more manageable chunks of functionality is needed. For example, a user wants to add a new web page to their site. How should this happen? On a high level, they would click a button which would show them a page allowing them to enter the content. To break this down further, there is the need of asking more questions. Can the user put in photos? How do they insert them? How do they get on the server? What if the user wants to format the text? Answering these questions will help to determine what features need to implement. The final list of requirements should state what functionality the application must have, should have. Brainstorm every idea and write it down, good or bad. If the developer is working as part of a team, they should get everybody's input. Get input from end users and from people that have used a similar type of application. Many stakeholders, such as potential Web users, are still unknown during RE activities. Project management needs to find suitable representatives that can provide realistic requirements.



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2.1.1 Techniques for Elicitation

- Interviewing [5][6]
- Joint Application Development (JAD)[7][18]
- Brainstorming
- Concept Mapping
- Storyboarding
- Use Case Modeling
- Questionnaire and Checklist
- Terminology Comparison

2.2 REQUIREMENTS PRIORITIZATION

Requirement prioritization [8][9] is used in a situation where most valuable features are delivered as early as possible within tight schedule. Both the customers and developers provide input to this process by mentioning their priority for the system. Web applications and their environments are highly dynamic and requirements and constraints are typically harder to stabilize. Many Web projects are design-to-schedule projects, where all activities and decisions have to meet a fixed final project. The negotiation and prioritization of requirements are particularly crucial under such circumstances. Frequent examples of changes are technology innovations such as the introduction of new development platforms and standards, or new devices for end users.

2.2.1 Techniques for prioritization

- Pair-Wise Comparison
- Analytical Hierarchy Process[10]

2.3 REQUIREMENTS PROTOTYPING

Prototypes are a valuable tool for providing a context within which users are able to better understand the system they want to build. There is a wide variety of prototypes that range from mock-ups of screen designs to test versions of software products. In Quick Prototyping [12] a mockup is generated from use cases and screen designs. Such choice seems to be reasonable, since most projects use scenarios or use cases to write requirements (>50%) and user interfaces designs to visualize future system (>65%).The prototype is "quick" as it can be automatically generated from the requirements specification. It is also "cheap" as after changing requirements the mockups can be easily regenerated. Mockup is a simple web application that presents use cases together with screen designs attached to each step. An end user can animate the use cases to understand the application under development and can perform a review (the prototype collects feedback from a number of end-users and presents reports).

The requirements catalogue obtained in the Requirements Specification activity is the input work product of the prototype [13] construction process. This process automatically generates a Web application prototype from the requirements catalogue. Both the Web application prototype and the requirements catalogue constitute the input work products of the last activity in the RE process: Validate Requirements.

2.3.1 Benefits of Prototyping

- A software product is obtained in the RE stage without programming effort.
- Analysts can obtain as many Web application prototypes as they need and the changes can be automatically reimplemented.
- The prototype can be obtained as soon as the requirements model is constructed.
- Traceability aspects are used to detect the wrong requirements.



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2.4 REQUIREMENTS DOCUMENTATION

Once a requirement is elicited, modeled and analyzed it should be documented in clear and unambiguous terms[11][14]. Requirement analysis is an input to requirement documentation and the output of this process is a well-structured and defined specification. It is used to communicate the requirements between stakeholders. A good requirement document should be correct, complete, consistent and feasible because it is used as a baseline for evaluating subsequent process of system. An unambiguous, concise and clear stated document is also used as a base for validating the stated requirements and resolving stakeholder's conflicts. Both the functional and non functional requirements are represented in requirement specification. Set of use cases are used to describe all the interaction that the user have with system. Even if the developing site is static, it's important to map it out visually and refer back to it continually during development to ensure that nothing is missed. For the requirements definition activity, many techniques have also been proposed

2.4.1 Techniques for Documentation

- Application Flow
- Natural Language
- Glossary and Ontology
- Templates
- Scenarios
- Use Case Modeling
- Formal description

2.5 REQUIREMENTS VALIDATION

Validation is used to clarify that the requirement documents are unambiguous, consistent and complete and that the stakeholders are satisfied with the final requirement specification. The goal of this process is to answer the question, "Have we got the requirement right?" Techniques like requirement inspection, requirement checklist and requirement testing are used to find the defect to improve the quality of a requirement as well as to make sure that certain criteria meet regarding information elicited and specified.

Requirements need to be validated for checking the correspondent user's needs and the customer's requirements[19]. Only few approaches provide techniques to validate requirements. Most of them only define some guidelines about how developers and customers should review the requirements specification in order to find inconsistencies and mistakes. In Web engineering, the openness of the Internet facilitates novel forms of direct user participation in requirements validation, e.g., through the online collection of user feedback.

2.5.1 Techniques for Validation

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- Review or Walk-through
- Audit
- Traceability Matrix

2.5.2 The Validation activity has two different output work products:

- (1) A set of corrections
- (2) A validated requirements catalogue

2.6 REQUIREMENTS MANAGEMENT

Requirement management is used to identify, organize and track the entire changing requirement in a project as well as impact of these changes[15]. It is a continuous process whose goal is to make sure that organization meets the expectation of stakeholders. When building web applications, strong temptation exists to "just build it." After all, the tools available today for web engineering are just so easy to use. The operational environment is so tolerant of



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implementation problems and the constant evolution in the expectation of user community. On the other hand, almost every type of application, including those that are highly financial-critical and life-critical, is migrating to the web. This trend works against the attitude of “just build it.” So, the answer cannot be “forget about requirements; we’ll figure them out later.” And the answer cannot be “write a formal requirements specification for all parties to approve prior to system implementation.” Requirements management exists to reduce risk, but it also needs to be made simpler, not more complex. And in today’s competitive world we need to find ways to accelerate system development dramatically; modern requirements management must thus reduce, not extend, the effort.

The heart of requirements management [16] is dealing with requirements changes. Each proposed change needs to be reviewed and the likely impact of implementing the change evaluated before it is approved by the appropriate body of decision-makers. This body is typically called the change control board. Change request decisions must be communicated to all who are affected so approved requirements changes can be incorporated into the software in a controlled way. Project plans need to be updated to remain current with the new requirements. The part of requirements management that no one likes – but which is the harsh reality – is the need to negotiate new commitments based on the estimated impact of changed requirements.

III CONCLUSION AND FUTURE WORK

The majority of the requirements development activities occur during the early concept and requirements phases of the life cycle. Continued elaboration of the requirements, however, can progress into the later phase of the web application development life cycle. The reason is web-based systems are more user-oriented than traditional software systems. And the users are heterogeneous in nature and there exist different culture. This paper suggested various requirement engineering activities which are used for developing web application.

- The existing requirements engineering techniques can be researched in detail to build new techniques.
- Different types of tasks could be assigned for various categories of web applications.
- The requirements engineering should give the feel of understanding of the full software product.
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