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A methodological framework for the analysis and design of Adaptive Web-based Information Systems

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Abstract

Due to the growing popularity and complexity of the Web, designing a web site is becoming a complex and difficult process, that needs to be supported by more powerful Web engineering methods.

In this paper, we present our ongoing research on defining a methodological framework for the analysis and design of Adaptive Web-based Information Systems (AWIS). Adaptive systems use knowledge about a particular user, represented in the user model, to adapt their information, organization, and presentation to that user.

Our approach is driven by an elicited set of High Level Users Goals, which allows intended users to come closer to satisfying their specific needs and preferences. It is composed of a number of process step guidelines along with their respective product models, that enables the Web designer to model his/her AWIS at different levels of abstraction. Thus, an AWIS is modeled at the conceptual level as modular adaptive views over the Information Domain, the conceptual schemas are then transformed into a logical level representation, which enables the actual implementation of the AWIS.

Keywords : User Goal-Driven Navigation ; Adaptive Web Application ; Methodology ; User Modeling.

Introduction

The WWW is becoming a key medium for information dissemination, entertainment, and communication. Today existing Web Sites cover a very large spectrum, ranging from kiosk sites, such as personal home pages, to very large and dynamic transactional applications, like electronic commerce systems.

Because different Web users have distinct goals, and approach a Web site with their own concerns and interests, the Web designers need to build Web sites that adapt them to match the individual user's needs.

A number of researchers have already recognized the importance of design methods for Web-based Information Systems, and have proposed a set of methods (For details, please refer to

[Isa95][Sch95][Atz95]). However, those methods have two main drawbacks. Firstly, they are limited to the conception of Kiosk Web site, secondly, they pay less attention to the user dimension. In this paper, we propose a methodological framework for the analysis and the design of Adaptive Web-based Information Systems (AWIS). Adaptive Web-based Information Systems are a new generation of Web-based Information Systems that build a model of the individual user, and apply it to adapt the information and the links presented to that user[Bru97]. Aware of users goals and knowledge, AWIS can support them in their navigation by suggesting the most relevant links to follow.

Like traditional Information System engineering methods, the proposed approach considers three levels of abstraction: conceptual, logical, and physical. The conceptual level consists in a set of process guidelines along with the product models, that help the Web Designer build different conceptual navigation structures or views of his/her future AWIS. On a logical level, by using a set of rules, the designer transforms the conceptual navigation schema into a set of logical pages and links, which enables the actual implementation of the AWIS.

Another important feature of our approach is the clear separation of the three tasks of building Web sites : the management of the Web site's data, the management of the structure of the site, and the visual presentation of the site's pages[Atz95]. This neat separation allows, for instance, building different interfaces for the same navigational model, or different navigational models over the same data model, leading to a higher degree of independence and flexibility. In addition, this separation facilitates many site management and maintenance tasks, such as integrating data from multiple sources, modifying a site's structure over time, and enforcing integrity constraints on sites. The next section gives a general overview of the approach.

Overview of the Proposed Approach

In this section, we present a general overview of our approach to AWIS design. We describe the different processes, how they relate to each other and how they contribute to AWIS.

We assert that building a Web Application is a six-process step, in which a product model is created

at every step, based on the previous one, and the last step is the actual application implementation.

The method consists of the following steps: modeling the potential users elicited goals, identifying and modeling the different categories of potential users, modeling the Information Domain of the Web application, modeling the Conceptual Web Navigation, modeling the Logical Web Hypertext, and the actual Implementation.

- **Potential Users Goals Modeling**

This step consists of eliciting, classifying, and describing the high level goals that the users may achieve when using the AWIS. For instance, when using a library AWIS, the user may want to access to information about a book copy, or reserve the book copy.

- **Potential Users Modeling**

In this step, we identify, classify, and build a model of the potential users of the AWIS, which is based on two main concepts. The first is the concept of *User Role* which refers to the roles the users may play, using the AWIS. The second is the concept of *User Profile*, which captures the preferences, interests, knowledge, ... of these users. The product of this step is the User Type Schema (see figure 1).

Some examples of types of potential users are the library subscribers, who are not familiar to the Internet, or the simple visitors who visit the Web Application for the first time.

- **Web Application Domain Conceptual Modeling**

In this step, the information domain model of the AWIS is created. It is composed of two parts: the unstructured information part, and the structured information part. The former refers to a textual, informal description of a concept or idea, like the textual description of the history of the library. The latter is based on well known object oriented modeling paradigms as OMT [Rum95], O* [Lee94]. The main concern during this step is to capture the AWIS domain semantics, as neutrally as possible, with very little attention for the users, their tasks or their goals. The relevant objects and relationships of the AWIS domain are represented. These objects and relationships form the basis of the AWIS, as many of them will finally show up as navigation nodes and links. The product of this step is the Web Based Information Conceptual Schema.

In many situations, the structured information part is currently tailored or enriched from an already available Conceptual Schema of the Domain, for

example if the target application is a Web interface to an existing database application. The product of this step is the Web Based Information Conceptual Schema (see figure 1).

- **Web Navigation Conceptual Modeling**

The key point of our approach is that we consider a navigation session within an AWIS as the fulfillment of elicited high level goals, by the user. Moreover, we think that users with different profiles may achieve the same goal in different manners. So, this step mainly consists in associating a set of navigational structures that we call *Way of Navigating* (WoN) to each elicited goal.

Thus, a WoN refers to the best navigation way for users with certain profiles, to achieve their desired goal. Its structure is mainly made out of a number of relevant *Navigational Nodes* (NN) connected by *Navigation Links*, where each NN can hold information from the conceptual domain. Thus, this step shows how the conceptual domain information can be navigated in the target AWIS. The set of WoNs associated to one elicited goal forms what we call *Navigational Semantic Unit* (NSU). The product of this step is the Navigational Conceptual Schema (see figure 1).

The NSU concept represents adaptive operationalizations of an intended user goal; it is the basic building block of this step as we consider a Conceptual Navigation Schema in terms of one or more organized NSUs.

- **Web Hypertext Logical Modeling**

Once we have defined the conceptual Web navigation model, stating how concepts can be navigated in the target AWIS, it must be made perceptible to the user. This means defining the way in which the navigational elements defined will look like. The logical Web hypertext modeling step is concerned with these aspects. The designer applies a set of conversion rules to transform each navigational element in the conceptual navigational schema into a logical element in the logical model.

- **Implementation**

In this step, the designer builds the actual AWIS, by mapping the logical Web hypertext elements into concrete interface objects available in the chosen implementation environment. We define a set of rules for mapping the logical model to the platform of choice.

Figure 1 summarizes the process steps, the precedence among them, and their major products

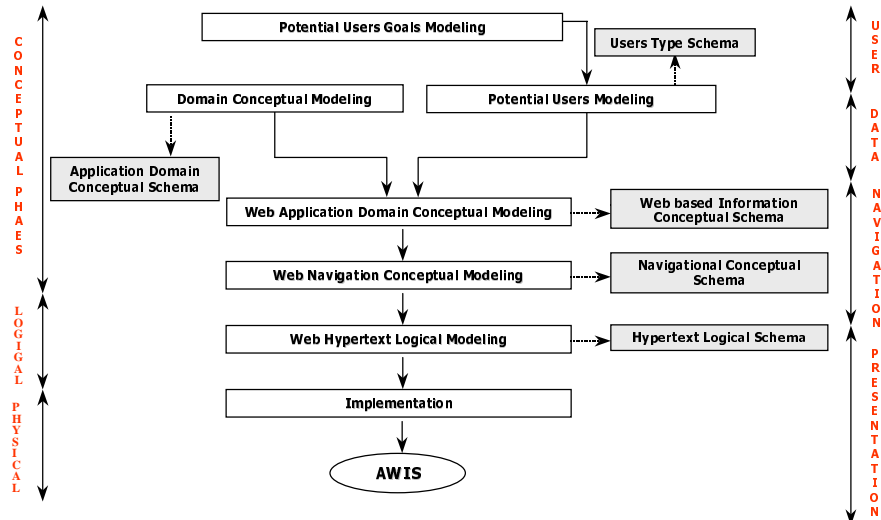


Figure 1: General overview of the method phases

Conclusion

We have presented in this short paper an overview of our ongoing research on Adaptive Web-based Information Systems engineering. We are currently validating this approach by a set of real cases, for example the well know Library Information System .

References

- [Atz95] A. Alzeni, G. Mecca, P. Merialdo, "To Weave the Web", Proc. 23rd Conference on Very Large Databases, Dec 11 - 14, 1995, Athens, Greece, pages 206-215.
- [Bru97] P. Bruisilovsky, "Efficient Techniques for Adaptive Hypermedia", Intelligent hypertext, Springer-Verlag, 1997.

- [Isa95] T. Isakowitz, E.A. Sthor, P. Balasubranian, "RMM : a methodology for Structured Hypermedia Design", Communication of the ACM, Vol., 38, N.8, pages 34-44, Aug. 1995.

- [Lee94] S.P. Lee, "Formalisation et aide outillée à la modélisation conceptuelle", Thèse de Doctorat de l'Université Paris1, juillet 1994

- [Rum95] J. Rumbaugh et. Al. , "OMT, Modélisation et Conception Orientés Objet", Masson, 1995

- [Sch95] D. Schwabe, G. Rossi, "The Object-Oriented Hypermedia Design Model", Communication of the ACM, Vol.38, N.8, Aug 1995.