Adaptable Web Teaching with KIWIS

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Abstract **-** *This paper presents the use of KIWIS as a Web tool for designing a multilingual course on databases adapted to different student's skills.*

KIWIS (which stands for Knowledge for Improving Web Information Systems) is an environment dedicated to the automatic generation of Web-based Information Systems (WIS), whatever the application domain. KIWIS users are provided with generic design guidelines to build adaptable WIS. Adaptability in KIWIS consists in giving to a group of users, or to an individual user, a progressive access to information and a personalized information presentation. The idea behind progressive access is to stratify the user's information space into different sub-spaces through which she/he can navigate. These sub-spaces correspond to ordered levels of detail that gradually give user access to information, from the more essential to the more detailed. Progressive access is established through two models, one which describes the different levels of detail available for a (or a group of) user(s), and one which describes the user's profile (rights on data and preferences concerning information presentation). When the user send a request to the WIS, these two models are consulted together in order to extract the corresponding data from the Data model that describes the application domain. If the user is authorized to formulate the query, the content of the reply is formatted to a level of detail, specified in the query or considered by default, and the results are displayed following the graphical charter associated with this user for this kind of query (i.e. for a same query, the WIS can deliver a reply, more or less detailed, with different presentations, depending on the user's profile).

We are currently using KIWIS to reformat a multilingual course on database we have written and made available on the Web. This work has been initiated through a French/Brazilian project, named STIMULI, between three Brazilian universities (UFRGS at Porto Alegre, UNESP at São Paulo and UFC at Fortaleza) and two French research laboratories (LSR-IMAG at Grenoble and INT at Evry). The STIMULI project focuses on Distributed Multimedia Information Systems for Teaching.

In its current version, this course presents, in French or in Portuguese, the general concepts of databases, the relational model, the SQL language, and the functionalities of a Data Base Management System. While reading the course, clicking on a link inserted in the text, a student can access more information concerning a notion she/he is interested in. The navigation was first implemented using standard HTML. We are currently translating this course into different KIWIS models to render it adapted to different students profiles (year of study, knowledge level, etc.). The expected advantage is that given (or a group of) student(s) profile and a stratification in different levels of detail, KIWIS will generate a presentation adapted to this (or this group of) student(s) skills, allowing a progressive access to the content of this course.

In this paper, we will present the different KIWIS models used in this application and we will stress on the relevance of progressive access for proposing adapted presentations of courses on the Web.

ADAPTABLE WEB TEACHING WITH KIWIS

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Abstract - *This paper presents the use of KIWIS as a Web tool for designing a multilingual course on databases adapted to different student's skills.*
KIWIS is a platform dedicated to the automatic generation of Web-based Information Systems (WIS), whatever the application domain. KIWIS users are provided with generic design guidelines in order to build adaptable WIS. Adaptability here consists in giving users both a personalized and progressive access to information. The idea behind progressive access is to stratify the user's information space into different sub-spaces through which she/he can navigate. This paper explains how the characteristics of KIWIS can be used in a e-learning context. We illustrate this idea by showing how different students are given access to different parts of a course depending on their profile (their level of knowledge, for instance).

Index Terms ¾ Adaptability, Distance Learning, E-learning, Web-based Information Systems.

INTRODUCTION

The Web becomes more and more widely used for diffusing or sharing information between distant users and this is specially true in the field of education where positive aspects of its use have been stressed [1]. In order to make possible the expansion of teaching through the Web, distance learning or e-learning environments have been designed. E-Learning can be classified, in a general way, as the teaching/training activity offered trough an electronic way. Using the Web in a teaching actibity has several advantages. The content of the courses can be presented in several formats (text, image, video, animation). If we compare the possibilities of access to contents between the electronic way and the traditional one, one of the obvious differences is the effort in locating a specific content. Besides, texts relatively long can be easily updated by the teacher when she/he has new information to enclose to the text, and they can also be endowed with crossed references.

For the development of distance courses, an instructor has several tools at her/his disposal. These tools implement environments of distance teaching, and can generate virtual educational environments of high quality, when they are well used. Many of e-learning tools provide teachers to create a course according to some characteristics and preferences. We havee studied some tools used in the academic environment and they will be quickly presented in the section 2.

The main contribution of this paper is to present the development of a distance learning environnement using KIWIS, a tool for the generation of Web-based Information Systems. We present, in section 3, the different KIWIS models used in this application and we put the emphasis on the relevance of a progressive access for proposing adapted presentations of courses on the Web.

Finally, we describe a little example of use of our tool, concluding with the presentation of general considerations on the developed work and also with some perspectives.

ADAPTABILITY IN E-LEARNING

According to Keegan [3], we talk about presential education (conventional learning), when we have regular courses with teachers and students always meeting in the class room. The semi-presential education is characterized by the accomplishment of a part of the work in class room and other part at distance, through the use of new technologies and distance education (or virtual). Distance education can include some presential moments, but most of the time it happens with teachers and students separated physically in the space and/or in the time and interconnected through communication technologies.

Systems of e-learning are technological systems of bi-directional communication, that substitute in the class room, the personal interaction teacher/student by the systematic and united action of several didactic resources, under the control of an organization or of tutors. In other words, the orientation are chosen by qualified professionals (teachers) who give students tools promoting a learning autonomy [2].

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The main actor of e-learning systems is the tutor who has, among other things, the responsibility of guiding students, to minimize their doubts, to help them to solve problems or to make some investigations. According to Keegan [3], the principal characteristics an e-learning system should present are:

- Physical separation between teacher and student, that differentiates from presential learning;
- Influence of the educational organization (planning, systematizing, projecting, driven organization, etc.), that differentiates from the individual education;
- Use of technical means of communication that allow both the teacher and the student to transmit their educational contents;
- Possibility of occasional meetings with didactic purposes and socialization.

In the next sections we introduce some of the most popular tools of e-Learning:

- WebCT - WebCT [4] is developed at the University of British Columbia, in Canada. WebCT can be used to create a group of "classes virtual" where the teacher and the student have their own work area [5].
- LearningSpace - Developed by Lotus Education and IBM Learning Space [6] is an environment for development of support services dedicated to distance education. Concerning adapatability to user, this tools offers homepages created by the students and teachers with information mentionning contact, experience and interests.
- TopClass - TopClass [7] is developed by WBT Systems. Pages of individual courses are offered and adapted to students. This allows to the instructor to add and to remove each student's material individually. TopClass makes it possible to control access to content. For instance, some courses can be used but not modified.
- Virtual-U – The Virtual-U [8] is an environment developed at the Simon Fraser University. It consists in a personal workspace which offers an individualized starting point for all the tools and features provided. Within this space, users can view their own course syllabi, assignments and online resources, save their personal book marks and create their own portfolios [9].
- Future Learning Environment (FLE) - FLE has two basic tools: Knowledge Building Tool and Web Tops. With Knowledge Building, the study groups can promote discussions for knowledge construction in several areas and promote debates, storing the results in databases [12].

Through this study, we can notice that many e-learning environments offer a service of adaptability according to the user's profile, but this mainly means that the user can choose the schedule of work, the format of her/his home page, etc.

None of the studied tools gives students a progressive access to the course and proposes a personalization or adaptation of the content to the student's profile.

We present in the next section, the platform KIWIS that contains those expected characteristics and which we intend to use as an environment for distance learning.

THE DEVELOPED TOOL: KIWIS

In this section, we present the KIWIS project that was initiated in the team SIGMA of the laboratory LSR (Sotware, Systems and Networks) of IMAG (Computer Science and Applied Mathematics Institute of Grenoble) in september of 1999.

KIWIS – Knowledge for Improving Web Information Systems – [15] is a platform for the conception and the generation of Web-based Information Systems (WIS). Typically, users of KIWIS are designers WIS which are given the opportunity to adapt the content (in terms of quantity of visible information) of the WIS to a particular user or group of users.

Once the WIS has been designed, KIWIS deploys it so that it can consequently be used (consultation, query, modification) through a navigator. The generated WIS can contain data of different media types (video, image, audio, text).

Based on Java Servlets and XML technologies, KIWIS proposes a group of models and methods that help the XIS designer in the analysis and design phases.

KIWIS handles the creation of an adaptable WIS in agreement with the four following aspects:

- Content management;
- definition of the navigation structure;
- definition of the user's interface;
- identification and the user's preferences and needs.

The different models embedded in KIWIS are:

The data model

This model corresponds to the informational content of the IS. The informational domain can be analysed and model according to methods and traditional languages (OMT, UML, etc.). The model of data in KIWIS is mainly based on two concepts: the classes, that gather entities whose structure, behavior and semantics are common and the associations that describe the links between classes. In a traditional design process using UML, users are considered as members of users categories (*i.e. actors*).

The Progressive Adaptable Model

The Progressive Access Model (PAM) is dedicated to the stratification of the data model of the application domain addressed by the WIS in order to introduce different levels of detail in information

A particularity of WIS generated with KIWIS is to provide users with the possibility to structure their information space in different levels. This is achieved thanks to a PAM [10]. The PAM is centred around the two notions of masks and multiple formats. Masks are ordered and more or less complete representations of information which allow users to access data at different levels of detail. For instance, one class of the data model can be structured in different representations or masks. From one mask to another, the number of variables which are visible when accessing objects of this class, increases (or decreases). The same gradual visibility can be obtained on the whole schema. Classes and associations visible at each level are defined.

Multiple formats give multiple representations of a multimedia information (a text, image, audio or video), providing users with a more or less detailed content of this information. For instance, a video can be substituted by an excerpt or an abstract of it. Then, when users do *not* have enough time to entirely see the video, they can still access parts of it.

Mask and multiple formats play a central role in the adaptability of the content of information to users. The PAM establishes links between the Generic User and Data models. The design task consists in defining for each group, the appropriate mask and multiple format structuring. By default, individual users are initially provided with the same progressive access as their group. They will define their own structuring using a specific interface of the WIS, if needed and if they are allowed.

The Generic User Model

This model represent the preferences and rights of two classes of users: individual users and groups of users

The concept of profile is based mainly on the notion of preference in term of presentation of the informational content (personalization of the navigator, format of presentation) on the one hand, and in term of content on the other hand (expected level of detail, etc.).

A user is identified by a connection login and a password. The designer can personalise a user's profile by specifying a presentation model as her/his presentation by default. Also the designer can specify for a user the way of activating the links (in the same window or in a new window) and the automatic indexation or not of the images and videos. At level of interface of the navigator, the appearance of the windows can be personalised (presence or not of the tool bars of the menu). Finally, the designer can associate a level of detail by default starting from which the information will be presented.

The designer can give the user a certain number of rights, including those of specifying her/his presentation and level of detail by default.

The Hypermedia Model

In KIWIS, the hypermedia model is in charge of describing any hypermedia element (a Web page or a component of a Web page) that will be published on the Web. The hypermedia model allows to associate a graphical charter for each component and to specify a navigation model that describe which page can be accessed from the current page.

Although KIWIS has some interesting characteristics (the possibility for the user to define/modify her/his profile, a progressive access to information, the definition of a graphical charter and the implementation for a prototype of automatic generation of WIS), it has not been developed originally for the creation of WIS able to configure environment of distance learning. We believed that yours application in that context allows to organise the content of a didactic material in agreement with the user's characteristics, what configures with your point of view, a quite interesting flexibility in the use of pedagogic documents.

DEVELOPES APPLICATION

The application that we present is based on a course multilingual on the database topic. That course is used as didactic material for virtual classes. This work has been initiated through a French/Brazilian project, named STIMULI, between three Brazilian universities (UFRGS at Porto Alegre, UNESP at São Paulo and UFC at Fortaleza) and two French research laboratories (LSR-IMAG at Grenoble and INT at Evry). The STIMULI project focuses on Distributed Multimedia Information Systems for Teaching.

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Following the characteristics of KIWIS, we divided the users' profile in three groups that allows user accessing the information in agreement with the group which he belongs. Like this, the user belonging to the first group has the permission of accessing a number of information limited, or be the basic information of a course. The user belonging to the second group, is capable to access the same information that the user of the first group, but however he will have the possibility to access larger details on the information, as the

result of the exercises proposed during the course. The user of the third group is capable to access all the available information to the first and the second group and still the additional information of the course, as for instance the
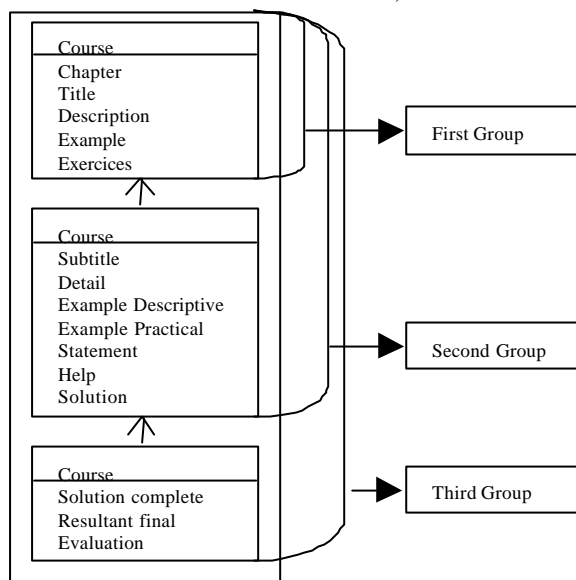
students' evaluation.

Such groups were divided taking in consideration the gradual increase of information that the student will obtain in agreement with elapsing of the course, for instance, when a student belongs to the first group, he will receive the enunciation of an exercise and, however, he can obtain larger information and helps on this exercise when belongs to the second group. The same case happens with relationship to the definitive result that will only be able to be visualized when the same is part of the third group. The structure of this model is presented to proceed, in the figure 1.

FIGURE 1:
The levels of detail for class Course

In agreement with the disposition of the presented model, each chapter of our example was subdivided in Title, Description, Example and Exercises, in other words, those will be the basic information presented obligatorily in the page of the course.

The user that belongs to the second group can expand the sections in order to obtain larger information. The sections that he has access is: Descriptions, Examples and Exercises. Like this, the user of the second group is capable to read the subtitles and the details of the description of the content, the descriptive and practical examples in agreement with your preference and the proposition, helps and solutions of the presented exercises.

In relation to the preparation of the didactic material, the use of KIWIS will owe in relation to the teacher to allow an

facility in the means found in the preparation of the didactic material. So, a teacher be able to develop a course in agreement with a specific content and with the profile of the group. In other words, the teacher can use the content of various courses for the creation of a different and adaptable course according to students' profile, using multimedia information database.

CONSIDERATIONS AND PERSPECTIVES

The capacity that the Web propitiates of change of experiences, doubts and materials, independent of the geographical distance besides the possibility given to the teachers to prepare best your class, enlarging the forms of teaching and modifying the evaluation process and of communication with the students and with the other teachers it integrates information of hypertext of the net with tools of collaboration and communication and it presents two innovative aspects for the denominated systems WBI (Web-Base Instruction). A first point is that she supplies specific tools to manipulate the content of information existent multimedia in the pages Web. An additional characteristic is that authorized users can modify the information of the net in the system.

With the models of KIWIS presented in this article, we saw the possibility to create a environment of distance learning capable to allow to the user to access a course accordingly your adaptability.

Our work consists of the improvement of KIWIS so that it can be used as an instrument of development of courses at the distance, with an adaptable content in agreement with the user's profile, allowing the employment of medias different. This means that intended to extend the platform KIWIS in order to obtain the basic characteristics of a environment of the distance learning, or then to use one of the environment studied with the platform KIWIS to obtain the desirable result.

The objective is to obtain a course that can be adapted to a student, or a group of students where an user can have a progressive access adapted at your knowledge level.

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