Original Article

Basic Science

Adaptive User Model and Ubiquitous Hypermedia Learning System

Olayinka Olusegun LAWAL[1], Oluwaseun Gbenga FADARE[1], Gbemiga Seye AKINYEMI[2] , Dolapo Peter OLAGOKE[3], Anuoluwapo Eunice IBIRONKE[3]

ABSTRACT [ENGLISH/ANGLAIS]

This paper provides in one review article current trend in providing technologies that are capable of self-adapting in response to changing environments. There is need for, an efficient and satisfactory structured, computer based learning system which will be adapted to the user's needs. An adaptive hypermedia system is enumerated which offers pedagogical features of active-participation of student in learning and thereby reducing the problem of searching through the potentially large amounts of material that are irrelevant to users' needs. Its merits, demerits, its various models and implementations in classroom and distance learning environments are discussed.

Keywords: Adaptive, user, model, hypermedia, learning

RÉSUMÉ [FRANÇAIS/FRENCH]

Le présent document donne dans un article de revue tendance actuelle dans le domaine des technologies qui sont capables d'auto-adaptation en réponse à des environnements changeants. Il est nécessaire d', efficace et satisfaisante structuré, système d'apprentissage assisté par ordinateur qui sera adapté aux besoins de l'utilisateur. Un système hypermédia adaptatifs est énumérée qui offre des caractéristiques pédagogiques de l'actif participation de l'élève dans l'apprentissage et de réduire ainsi le problème de la recherche dans les montants potentiellement importants de matières qui ne sont pas pertinents aux besoins des utilisateurs. Ses mérites, ses inconvénients, différents modèles et mises en œuvre dans des environnements d'apprentissage en classe et à distance sont discutées.

Mots-clés: D'adaptation, l'utilisateur, le modèle, l'hypermédia, apprentissage

Affiliations:

[1] Department of Computer Science, Joseph Ayo Babalola Univeristy, Osun-State. Nigeria.

[2] Dept. of Statistics, School of Science and Communication Technology. Auchi Polytechnic. Edo-State. Nigeria.

[3] Information & Technology Unit, Joseph Ayo Babalola University, Ikeji-Arakeji. NIGERIA

*Address for Correspondence/ Adresse pour la Correspondance: fadareoluwaseun@yahoo.com

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INTRODUCTION

In contrast to traditional electronic learning and convention education systems, whereby all learners are offered or directed to standard series of hyperlinks, adaptive educational hypermedia tailors what the learner sees to his goals, abilities, needs, interests, and knowledge of the subject, by providing hyperlinks that are most relevant to the users essentially. The teaching tools of adaptive educational hypermedia adapts to the learners, of course, this requires the system to be able to effectively infer the learner's needs and desires. Adaptive hypermedia systems can be useful anywhere where hypertext and hypermedia is used. The most popular adaptive hypermedia systems are web-based systems. Web personalization is closely linked to the notion of Adaptive hypermedia. Hypertext browsers deal with the pointers in a transparent way - select the pointer and present the text that is pointed to therefore it stores, reads, searches, and edits. Hypermedia is a computer based information retrieval system that enables a user to gain or provide access to texts, audio and video recordings, photographs and computer graphics related to a particular subject. Images can be linked to sounds or documents. This means that browsers might not display a text file, but might display images or sound or animations. Hypermedia simply combines hypertext and multimedia. The term was first used in a 1965 article by Ted Nelson, [1]. Adaptive learning is an educational method which uses computers as interactive teaching devices. It is also known as adaptive educational hypermedia, and computer-

based pedagogical agents. Adaptive learning systems endeavor to transform the learner from passive receptor of information to collaborator in the educational process. An interesting aspect of adaptive hypermedia is that it makes distinction between adaptation (system-driven personalized and modifications) and adaptability (user-driven personalization and modifications).

PROPERTIES AND VARIOUS COMPONENTS OF ADAPTIVE HYPERMEDIA

One of the adaptive properties of hypermedia is the ability to navigate its materials in many ways. This is achieved and made possible by inserting nodes between different parts of the materials linking them together. Adaptive hypermedia systems combine and balance adaptation and adaptability. Links in hypermedia systems are typically associative; that is, they describe associations between the nodes they connect. While looking at a node, the user's attention may be drawn to a link (usually identified by buttons or hot spots on the screen). If the user activates the link by clicking on a button or hot spot with a mouse or other pointing device or pressing an associated keyboard key, the user will be linked to another node of information. Having arrived at the new node related to the previous link, the user may wish to return to the node from which he or she came or to go to yet another node. The links in hypermedia transport the user through the information space to the nodes that are selected, enabling the user to move through the knowledge base. The node structure and the link structure form a network of ideas in the knowledge base-structures and networks that may be very rich.

DESIGN

A hypermedia tool usually comprises of an editor and a programming language; high level for creating hypermedia systems. NoteCards, Hyper-Card, and ToolBook, are examples of tools for creating hypermedia systems. Figure 1 shows a hypermedia metadata file of adaptive hypermedia systems. Hypermedia may be developed in a number of ways. Any programming tool can be used to write programs that link data from internal variables and nodes for external data files. Multimedia development software such as Adobe Flash, Adobe Director, Macromedia Author ware, and Match Ware Mediator may be used to create stand-alone hypermedia applications, with emphasis on entertainment content. Hypermedia applications may be developed on embedded devices for the mobile and the Digital Signage industries using the Scalable Vector Graphics (SVG) specification from W3C (World Wide Web Consortium), [3]. Hyperlinks may also be added to data files using most business software via the limited scripting and hyperlinking features built in. Documentation software such as the Microsoft Office Suite allows for hypertext links to other content within the same file, other external files, and URL links to files on external file servers. Requirements for a hypermedia design environment.

a. Fast feedback loop spanning across methodological stages, to facilitate evaluation and re-design activities.
b. Accessible and unconstrained cloning tools at the instance level, to facilitate the generation of material application instances that lend themselves to evaluation by designers, developers and users.
c. Abstraction and instantiation mechanisms that enable developers to alternate between bottom-up and top-down approaches.

In hypermedia languages, corresponding between different information items are called links, and the respective items are called nodes. A node can contain one or more links to other nodes, forming a network of nodes and links where hypermedia network is also called hypermedia structure.

IMPLEMENTATION

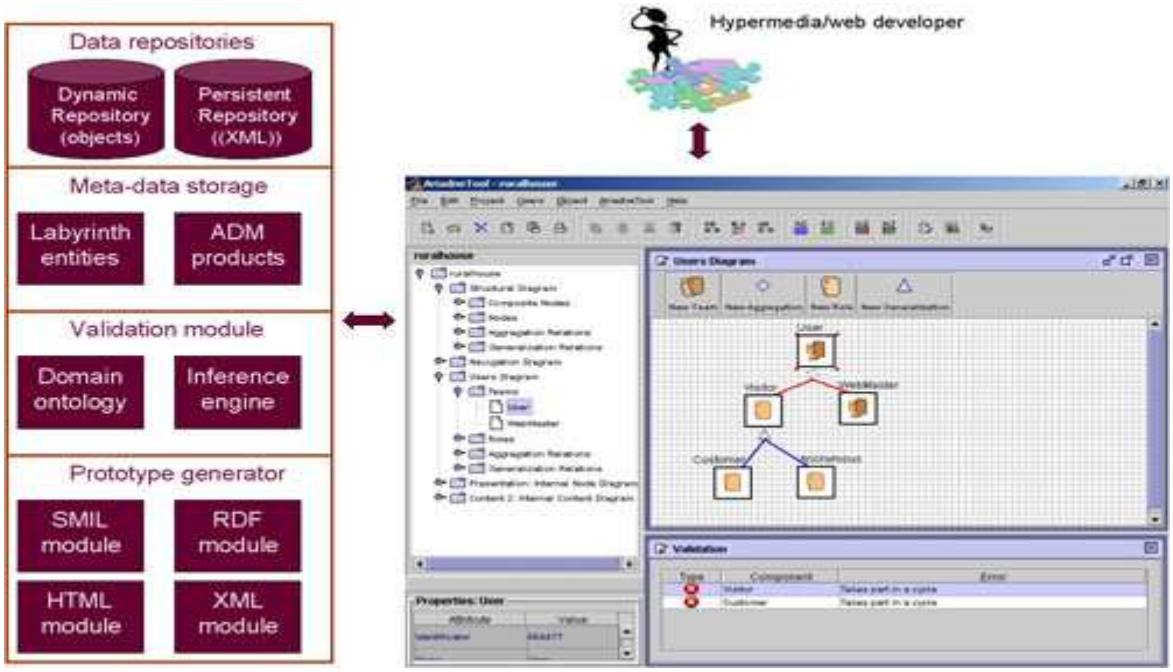
Adaptive learning can be implemented in the classroom environment using IT called an Adaptive Learning System which is otherwise known as Intelligent Tutoring Systems, which operates upon three basic principles, [4]

a) Systems need to be able to dynamically adapt to the skills and abilities of a student.
b) Systems must have the ability to be flexible and allow for easy addition of new content.
c) Systems need to also adapt to the skill level of the educators.

Adaptive Learning systems can be implemented on the Internet for use in distance learning and group collaboration applications. The field of distance

learning now incorporating aspects of adaptive learning. Initial systems without adaptive learning were able to provide automated feedback to students who are presented questions from a preselected question bank. That approach however lacks the guidance which teachers in the classroom can provide. Current trends in distant learning call for the use of adaptive learning to implement an environment with intelligent dynamic behavior in the learning environment. During the time a student spends learning a new concept they are tested on their abilities and databases track their progress using one of the models. The latest generation of distance learning systems take into account the students' answers and adapt themselves to the student's cognitive abilities using a concept called 'cognitive scaffolding'. Cognitive scaffolding is the ability of an automated learning system to create a cognitive path of assessment from lowest to highest based on the demonstrated cognitive abilities, [5]. An instance of successful implementation of adaptive learning in web-based distance learning is called the Maple engine of WebLearn by RMIT University, [6]. WebLearn is IT system that can provide assessment of questions posed to students even if those questions have no unique answer like those in the Mathematics field. Group collaboration is also a hot field in the adaptive learning research area. Group collaboration is a key field in Web 2.0 which extends the functionality and adaptability of distance learning, [7]. Adaptive learning can be incorporated to facilitate collaboration within distance learning environments like forums or resource sharing services.

Figure 1: This figure shows hypermedia metadata file system of adaptive hypermedia systems



DISCUSSION

The expert model stores information about the material which is being taught. This can be as simple as the solutions for the question set but it can also include lessons and tutorials and, in more sophisticated systems, even expert methodologies to illustrate approaches to the questions. Student model algorithms have been a rich research area over the past twenty years. The simplest means of determining a student's skill level is the method employed in CAT (Computer Adaptive Testing). In CAT, the subject is presented with questions which are selected based on their level of difficulty in relation to the presumed skill level of the subject. As the test proceeds, the computer adjusts the subject's score based on their answers, continuously fine-tuning the score by selecting questions from a narrower range of difficulty. The instructional model generally looks to incorporate the best educational tools that technology has to offer (such

as multimedia presentations) with expert teacher advice for presentation methods. The level of sophistication of the instructional model depends greatly on the level of sophistication of the student model. In a CAT-style student model, the instructional model will simply rank lessons in correspondence with the ranks for the question pool. When the student's level has been satisfactorily determined, the instructional model provides the appropriate lesson. The more advanced student models which assess based on concepts need an instructional model which organizes its lessons by concept as well. The instructional model can be designed to analyze the collection of weaknesses and tailor a lesson plan accordingly.

CONCLUSION

Diverse information systems are designed to serve different purposes. However, Hypermedia has a strong potential for learning applications because it permit learning by exploration, though the systems are basically complex and requires tools, methods and techniques which must be provided to guide the process for successful implementation

REFERENCES

[1] Ted Nelson. Vassar College Miscellany News: Article written by Laurie Wedeles; 1965 available online at: http://faculty.vassar.edu/mijoyce/Ted_sed.html and http://www.mrg.english.ucsb.edu/conference/CNCSC/multimedia/documents/wardrip-fruin.pdf..

[2] Bra PD and Calvi. L. Aha! an open adaptive hypermedia architecture: *The New Review of Hypermedia and Multimedia 1998;* 1(4):115-39.

[3] Garzotto F, Paolini P, Schwabe D. "*HDM - A Model for the Design of Hypertext applications*", ACM Trans. Info. Syst 1993; 11, 1: 1-26.

[4] Boticario JP, Gaudioso E, and Hernndez F. Adaptive navigation support and adaptive collaboration support inWebDL : In *Proceedings of the International Conference on Adaptive Hypermedia and AdaptiveWeb-based Systems:* Trento, Italia, Agosto 2000: 51-60.

[5] Fernandez George. Cognitive scaffolding for a web-based adaptive learning environment: Advances in web-based learning, international confererence on web-based learning, Melbourne, AUSTRALIE. 2003; 2783: 12-20

[6] Aguilera Nestor. Addressing diff cognitive Levels for on-line learning. A conference Procedding. Ascilite ; 2002. Avaliable online at : http://www.ascilite.org.au/conferences/auckland02/proceedings/papers/216.pdf

[7] Gaudioso E, Boticario J.G. Towards web-based adaptive learning communities Artificial Intelligence Department; 2001. Avaliable online at http://www.ia.uned.es/~elena/papers/gb-aied03preprint.pdf