Chapter 13
A Personalized Learning System Based on Semantic Web Technologies

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ABSTRACT
In this study, a personalized learning system framework that is KOULearn (Kocaeli University Learning System) has been proposed. It is based on learning object and produces a personalized learning content according to learning style and cognitive knowledge level of an individual. The proposed framework is situated in advanced learning technologies according to educational perspective and is a semantic web application according to development technologies. The proposed framework is aimed to form a personalized learning environment. Three models are included in this system: domain model, user model and adaptation model, respectively. Components of the system have been realized by ontology based knowledge modeling approach. Execution of the personalized learning content structure and learning environment of the system, related to electric education, has been examined by resonance learning module which is constituted considering personalization requirements of the system.

INTRODUCTION
Today’s Web is an important learning technology platform. Its’ underlying technologies that is named as e-learning technologies has made it a successful environment in particular for the creation and presentation of learning resources. Especially, today’s e-learning technologies are aimed at creation of searchable, reusable learning resources on the web. However, an e-learning application should recommend students learning resources that are easily understandable according to their level of the knowledge and interesting enough to keep the students’ attention. So, adaptivity or personalization is key characteristic of today’s learning applications and e-learning researches.

Currently, the Semantic Web can be exploited as a very suitable platform for implementing a personalized e-learning system. Semantic Web is based on ontology technology. Ontology is a
knowledge representation framework (Pahl & Holohan, 2004). It is a collection of formal explicit definition of some concepts about any domain to represent the knowledge of the domain (Oguejiofor et al, 2004). It provides more advantages and flexibility to develop e-learning system that is has personalization or adaptability. For example; learning ontology development, ontology-based annotation of learning resources, ontology-based composition in learning content and delivery of the learning resources through e-learning portals are some application and research areas of the ontology based personalized or adaptive e-learning.

The potential of ontology technology for the development personalized or adaptive e-learning system can assist developers, instructors and the learners to discover, generate and compose learning resources and also to organize and publish of knowledge both for learning content but also the metadata level on the e-learning system.

The personalized management of the learning content means the set of rules and mechanisms that are used to select learning resources based on the student’s characteristics, the educational objectives, the teaching model, and the available media (Wenying & Deren, 2006). Many e-learning communities have combined and integrated these three factors in e-learning systems, leading to some ontology based standardization projects. These projects have focused on determining the standard architecture and format for learning environments, such as IEEE Learning Technology Systems Architecture (LTSC), Instructional Management Systems (IMS), and Sharable Content Object Reference Model (SCORM). IMS and SCORM define and deliver XML-based interoperable specifications for exchanging and sequencing learning contents, i.e., learning objects, among many heterogeneous e-learning systems. They mainly focus on the standardization of learning and teaching methods as well as on the modeling of how the systems manage interoperating educational data relevant to the educational process (Bick, Adelsberger, & Pawlowski, 2000).

Besides, personalized or adaptive e-learning systems are a research area for AI-Education. Researchers work to improve instructional planning practices for presentation of learning objects by using course sequencing techniques of ITS and adaptation techniques of AHS (Hatzilygeroudis, Prentzas & Garofalakis, 2005). In recent years, researchers work to integrate between instructional design theories, learning objects and e-learning environments by using ontological design approaches (Mohan, Greer & McCalla, 2003).

The chapter is organized as follows. Section 2, gives an overview of ontology and semantic web technologies. E-learning specifications for metadata of learning objects and content models of learning objects and relations among the learning object specifications, the learning object content models and ontology technology are discussed. In addition, ontology based personalized e-learning systems are discussed on the most interesting projects in this field in the literature. Section 3, describes general architecture a personalized e-learning system that is named as Kou-Learn. Section 4, describes to implementation of important components of the proposed system and explains results of the application study of Kou-Learn. Section 5, gives an overall discussion and some conclusion remarks as well as guidelines for the future work.

BACKGROUND

This section gives an overview of Semantic Web technologies and current state of personalized e-learning. Relations among Semantic Web, e-learning, e-learning standards, learning objects, learning object content models and personalization issues in the literature are discussed. Some ontology based personalized e-learning researches in the literature are presented. This section focuses on presenting a set of visions for the Semantic Web and ontology technology and also application and development of personalized e-learning
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