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Designing an Adaptive LO Search System Model Based on the Learner Information Profile

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Abstract: Aiming at the efficient settlement of e-learning, this study purposed to propose an effective LO (Learning Object) search system model for enhancing learners' convenience and providing services customized to learners' level by reflecting the learner information profile. For this purpose, we propose a system model based on the LIP standard specification proposed by IMS and suggest a learning object search system model based on learner information profile using UML diagrams.

Key words: Learner information profile, adaptive LO search system

INTRODUCTION

The social concern with e-learning has been growing for the last several years. Thus, in response to the recent popularization of e-learning, school education is making efforts to develop students' abilities to search necessary information by themselves and solve given problems creatively. However, the popularization and necessity of e-learning are accompanied with several problems (Adriana and Fransisco, 2005).

One of the problems is that although many learning materials(LO; Learning Object) are provided in e-learning environment it is hard for learners to find optimal learning objects effectively (Biletskiy *et al*., 2004). In other words, it takes too much time and effort for learners to get necessary materials, for educational contents designers or teachers to build up e-learning materials. Therefore, we need to design a search system model that can supply appropriate learning objects to learners. Through the system, education services should be individualized and customized to learners' level and demand.

As a part of solutions to the problem, the present study proposes a LO search system model based on learner information profile. Currently a number of institutions have proposed standards for learner information profile including LIP (Learner Information Package) of IMS, Learner Profile of UK and PAPI (Personal and Private Information) of IEEE.

Existing search systems, such as Yahoo, Google, show the results of simple search but the volume of search results is too large. Then, the learner has to search the results again in order to find necessary information. If learner information profile developed by ontology is applied, what is stored is not learner tendency but learner preference, search results are filtered based on the learner's information and only those matching the user's tendency are provided selectively and consequently the user can get search results in a much easier and faster way.

Related works and adaptation: e-learning has been brought to public attention in recent years, but little is known about the learner information profile. Lgor *et al*. (2006) created ontology but is not a specific system model. It simply created OWL ontology without any specific form of system (Igor *et al*., 2006).

Duk-Hoon and Young-Ran (2006) have extracted learner information elements to be standardized and classified them into essential information and optional information.

In this research, we propose a specific system model that applies a learner model to an actual e-learning system.

RESULTS AND DISCUSSION

The learner information profile: Standards for learner information are provided by a number of institutions

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Table 1: LIP components (Duk-Hoon and Young-Ran, 2006), (IMS, 2001)

Components	Explanation
Identification	Biographic and demographic data relevant to learning
Goal	Learning, career and other objectives and aspirations
QCL	Qualifications, certifications and licenses granted by recognized authorities
Activity	Any learning-related activity in any state of completion. Includes formal and informal education, training, work experience and military or civic service.
Transcript	A record that is used to provide an institutionally-based summary of academic achievement.
Interest	Information describing hobbies and recreational activities.
Competency	Skills, knowledge and abilities acquired in the cognitive, affective and/or psychomotor domains.
Affiliation	Membership of professional organizations, etc.
Accessibility	General accessibility to the learner information as defined through language capabilities, disabilities, eligibilities and learning preferences including cognitive preferences, physical preferences and technological preferences.
Security key	The set of passwords and security keys assigned to the learner for transactions with learner information systems and services.
Relationship	The set of relationships between the core components.

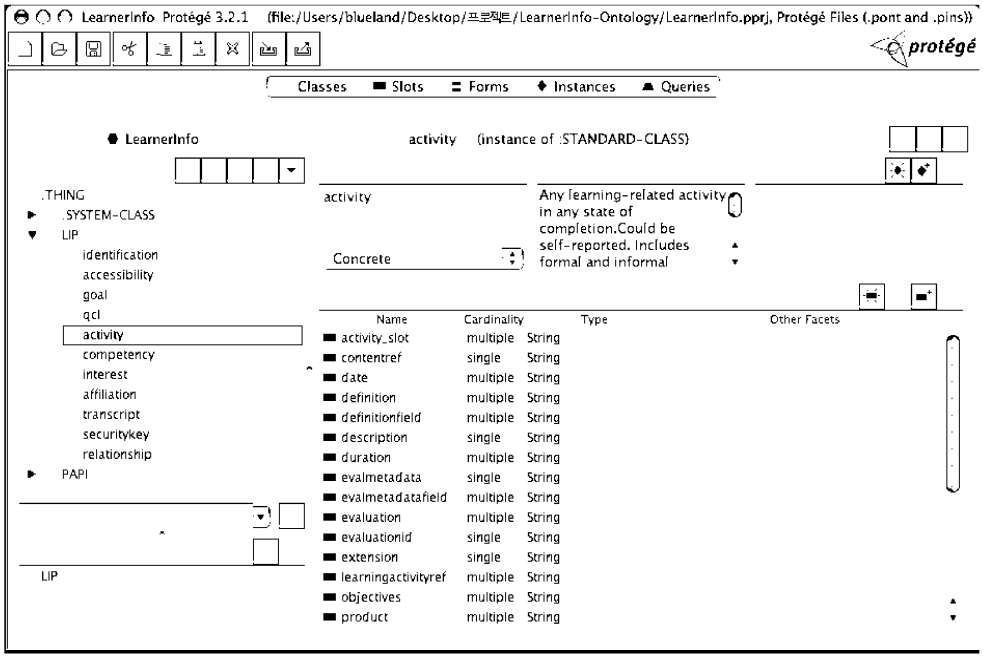

Fig. 1: Learner information profile ontology developed by Protégé

including LIP of IMS and PAPI of IEEE. Discussion in the present study will be focused on LIP of IMS that provides binding at an XML level and the standard will be applied to the model of our system. LIP of IMS is as in Table 1.

As we describe in the Table 1, LIP specification has a variety of information about learners. Learner information profile is implemented in the form of XML. If it is implemented in ontology, we can apply the information effectively using the advantages of ontology in building and reusing knowledge. Therefore, we designed with the ontology based on the LIP standard specification proposed by IMS.

Figure 1 shows ontology for LIP of IMS, a learner profile standard, created using ontology authoring tool Protégé. Protégé is the most commonly used ontology authoring tool developed as free software by Stanford University. Using the authoring tool, we can create ontology in different forms ranging from RDF to OWL, the most popular ontology language. Figure 1 shows the attributes of the 'activity' class(component) among various components in learner profile. The attributes of the activity component define the learner's learning activities and they include duration, which is the definition of a learning activity, evaluation related to assessment and objectives related to learning goals. Like this, if various attributes related to learning activities are defined as ontology, the search system can get information on a specific learner's learning activities and perform search customized to the learner.

Adaptive LO search system model based on the learner information profile: We will be focused on the IEEE Learning Technology Systems Architecture (LTSA) because this model is general enough to symbolize a wide

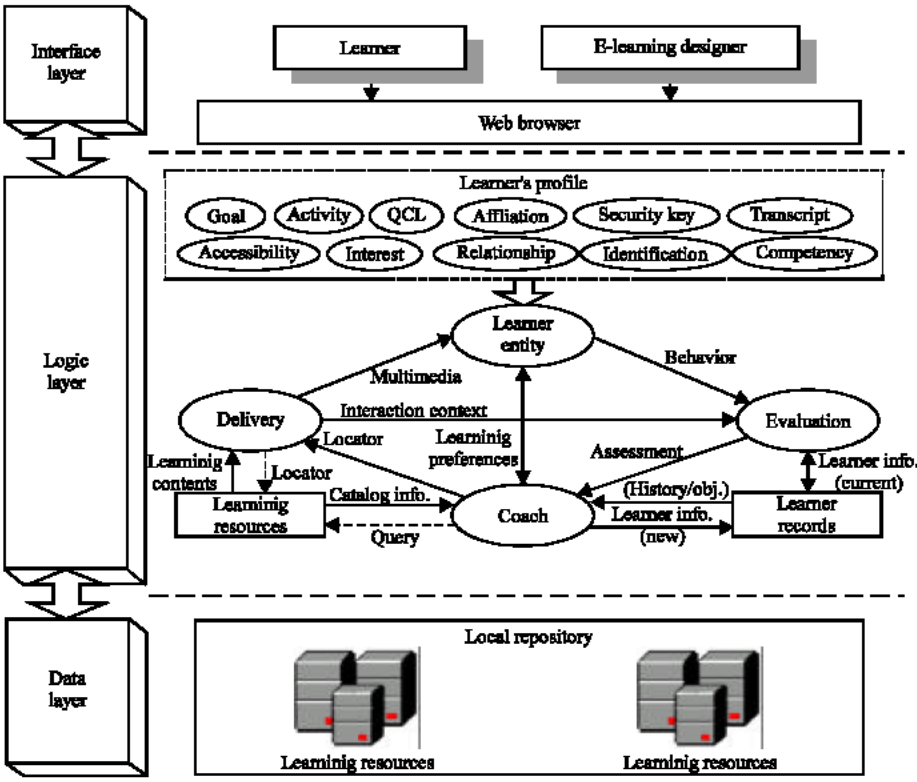

Fig. 2: E-learning system with learner's information profile using ontology

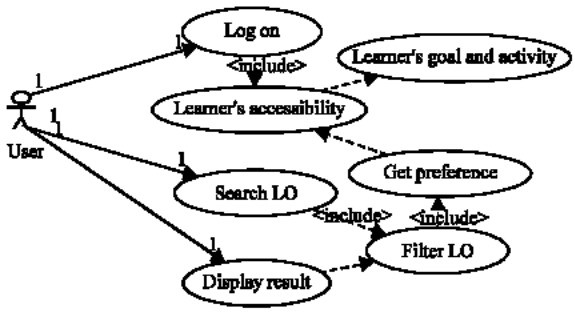

Fig. 3: UML use case diagram

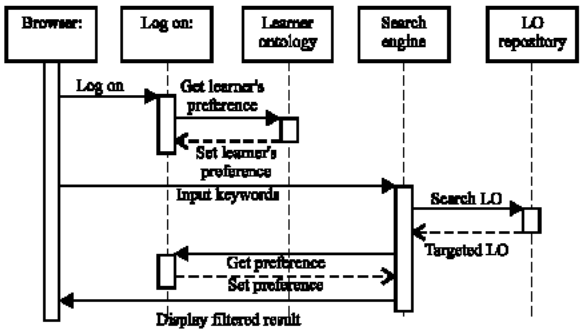

Fig. 4: UML sequencial diagram

variety of learning search systems from different area. Figure 2 shows the model used by IEEE LTSA along with our ontology-based learner's information profile (Hyunjong, 2005).

Figure 2 diagramed the adaptive e-learning search system model based on learner profile proposed in this study. The search system is composed of three layers-data layer that stores learning materials, logic layer that executes search using learner profile implemented in ontology and interface layer that system users or e-learning designers access using a Web browser. Individualized search, the key role of this model, is performed by the logic layer. For this, learner profile ontology developed as in Fig. 1 is stored in the learner entity area. The delivery entity in Fig. 2 uses the learner profile to produce individualized search results. More detailed explanations are given using the UML diagrams in Fig. 3 and 4.

Figure 3 diagramed the UML use case model that a learner uses the search system proposed in this study. If the learner logs on the system, the system retrieves the learner's information, namely, LIP and store temporarily the information of the learner's activity component and accessibility component into the user's session. As the

two components have attributes related to the learner's learning activities and tendencies, they can individualize search results for the learner. For example, a learner may prefer the use of videos in learning and another user may prefer texts or figures. Then, the user's preference for media is stored in the preference attribute of LIP and the attribute information is used to filter and show the learner's favorite media only.

Figure 4 is an UML sequence diagram for the proposed system model. In the series of processes, a learner logs on the system, learner profile ontology is stored in session information and using the learner information containing the session information the search engine filters and shows learning media fit for the learner's tendency among learning materials in the learning object repository where learning materials are stored.

CONCLUSION

We applied ontology-based learner's information profile at e-learning search system. This model has advantages to find LO customized to learner's tendency because of searching by learner's profile in comparison with existing E-learning search systems. Furthermore, learner information profile can be shared and reused in E-learning system due to ontology-based learner's information profile. Through this model, we can know how to use learner information profile in E-learning search system and we will apply it in e-learning search system which will be developed. In future research, we will implement the system and apply it to actual learning and refine the use of learner information profile. E-learning system with learner's information profile using ontology will be implemented into a system and its effectiveness will be studied. A further direction of this study will be to provide more evidence for this result.

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