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## Abstract

E-learning, as an efficient education method, has been developed rapidly. Personalization in e-learning has also drawn more and more attention. Based on our agent-based e-learning system architecture, this paper proposes a learner profile design model to facilitate the development of personalized e-learning systems. The model extends the IEEE PAPI specification and focuses on critical personal information that facilitates intelligent learning objects discovery and assembling.



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# Learner Profile Design for Personalized E-learning Systems

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***Abstract*----E-learning, as an efficient education method, has been developed rapidly. Personalization in E-learning has also drawn more and more attention. Based on our agent-based E-learning system architecture, this paper proposes a learner profile design model to facilitate the development of personalized e-learning systems. The model extends the IEEE PAPI specification and focuses on critical personal information that facilitates intelligent learning objects discovery and assembling.**

***Keywords: learning object, personalized E-learning system, user profile***

## I. INTRODUCTION

With the boom of computers and the Internet, E-learning, as an efficient and effective education method, has drawn more and more attention from researchers and practitioners. It is now possible to provide customized learning styles for different learners to meet their personalized requirements. Many international organizations and standardization bodies are engaged in development of new approach to achieving personalization in today's distributed E-learning environment[8].

Most researchers focused on the issues of how to provide the intelligent function in the E-learning system and mainly considered how to construct E-learning systems and improve the technologies and learning tools. For example, in iWeaver project, a selection of learning strategies were transferred into an e-learning environment by using multimedia representations and specifically developed learning tools[1]. Some researchers were aware that learning materials could be a major factor in the E-learning world but gave little considerations on learner profile. For instance, [2] discussed how to build knowledge driven personalized E-learning system but gave no consideration about the user profile construction. In this paper we propose a learner profile design model to facilitate the development of personalized E-learning systems.

The rest of paper is structured as follows. Section 2 introduces the state of the art in E-learning. Our learner profile design approach is discussed in Section 3. Finally, Section 4 concludes the paper and outlines our future research directions.

## II. RELATD WORKS

In the E-learning world, learning resources and learners are the two most important key components. Learning resources can be made up of learning objects each of which is a self-contained chunk of learning that fulfills a single, affirmed learning goal [5]. Learning objects can be grouped into larger collections of content and be used in the multiple contexts for multiple purposes. These characteristics make the learning content changeable according to different customized requirements [7].

Learning objects make personalization of leaning content possible. The learner profile, which maintains learner information, plays a decisive role in building personalized learning content. Many organizations have proposed learner profile design models. Among them the most well known are IEEE PAPI [3] and IMS LIPS [4]. IEEE PAPI contains six categories which are personal, relations, security, preference, performance, and portfolio information. Similarly, IMS LIP provides a structure for storing identification, qualifications, accessibility, activities, competencies, goals, interests, transcripts, affiliations, security keys, and relationships. Both of them describe general learner information without considering how it affects the learning resources in form of learning objects.

We take advantage of the concept of the learning objects and extend the IEEE PAPI for development of personalized e-learning systems. The extended design model captures richer information that is able to facilitate intelligent discovery of learning objects. This will ultimately contribute to the development of personalized E-learning systems.

## III. LEARNER PROFILE DESIGN

### *A. Brief introduction of the system architecture*

In order to achieve personalization, we have proposed an agent-based E-learning system architecture in [6]

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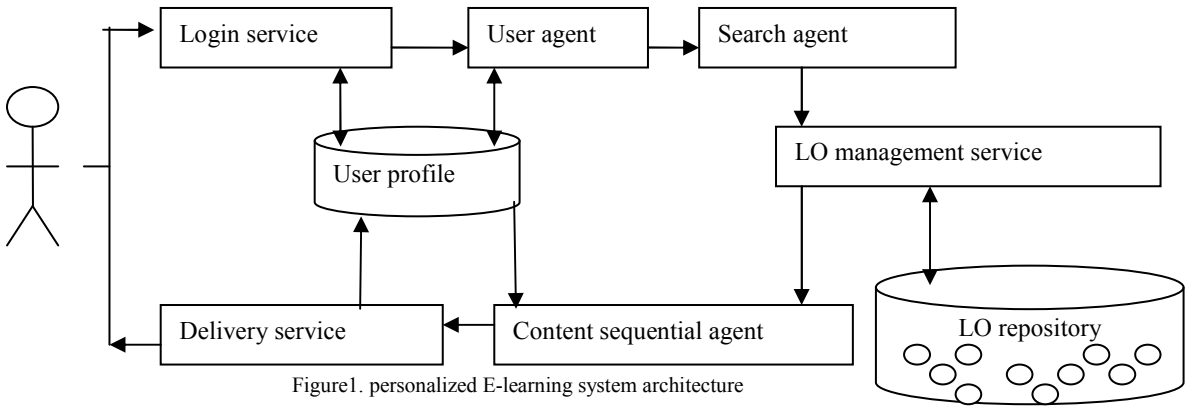

Figure1. personalized E-learning system architecture

As shown in Figure 1, the system uses intelligent agents to dynamically discover learning objects that fits a user's learning requirements. A registered user is able to create a user profile capturing all his personal information including preference, actions, goals etc. When the user requests learning content, a user agent will access this user profile and attach some constraints to the original request to help the system produce personalized learning content by selecting and assembling the most relevant learning objects. During the study procedure, the system can update the user profile continuously. From the above description, we can see that building a proper user profile is very critical to achieve the personalization of the system.

*B. Learner profile design*

The learner profile, as a key component of any E-learning systems, has been heavily studied. In this paper, we extend the IEEE PAPI standard which is the most well know user profile model. Our user profile design model is shown in figure 2 and consists of nine categories as follows:

- Personal information describes the user natural feature and is represented as <name, telephone, address, reference, e-mail, post address>.
- Security information is about the user's authority to use the system and is represented as <user name. password>.
- Relation information describes the relationship between the user and the other users and is represented as <is teacher, is student, is administrator>. The system can provide different functions for different users.
- Preference information describes the user preference as <language, region, age level, input/output device preference, content preference, prefer time on each study>. This category is a very important factor to build condition constraints for learning object searching. Considering that users own different biology characteristics, we include the preference time on each study value in the IEEE PAPI preference category, which allows users to select the prefer time that best suits their biology time. This value will provide a criterion to determine how many learning objects should be contained in the learning session. The language factor will decide what kind of language in which a learning object is to be shown. The input/output device will help the system to select the learning objects which are suitable for the device that the learner is using. The content preference will determine the learning object representation such as text, graphic, table and so on.
- Performance information records the user performances as <learner ID, content ID, recoding-date-time(time begin, time end), complete percentage, total time accumulate, score>. This category is used to record the user's actions. When the user uses the system, the user actions and his/her study history will be recorded, so the system can get the necessary data to decide his/her next learning content. For example, if the record shows that the user already completed all the learning units but the score is very low, the system may find those knowledge points that the user did not grasp and assemble relevant learning objects to form a new learning unit for the user. In this category we add the complete percentage value to tell the system the study status which not be mentioned in IEEE PAPI category.
- Portfolio information is for accessing previous experience of a user and is represented as <degree, transcription, qualifications, certificates, licenses>. This category provides a general level for searching and assembling the learning objects. For example, if the user has a high school diploma, the system may put the focus on learning objects that are suitable for undergraduate study. The difficulty level of the knowledge will vary according to the reasoning result of this category.
- Goal information is an important category which can reflect the user's subjective sensation and is a key factor during the process of constructing personal learning materials. The goal information is represented as <new start(complete a knowledge point, complete a unit, complete a course, complete a subject), continue last study>. In this category, we pre-define two values. User selection will determine the system procedure. If the user selects 'continue last study', the system will call the previous record and build the learning material

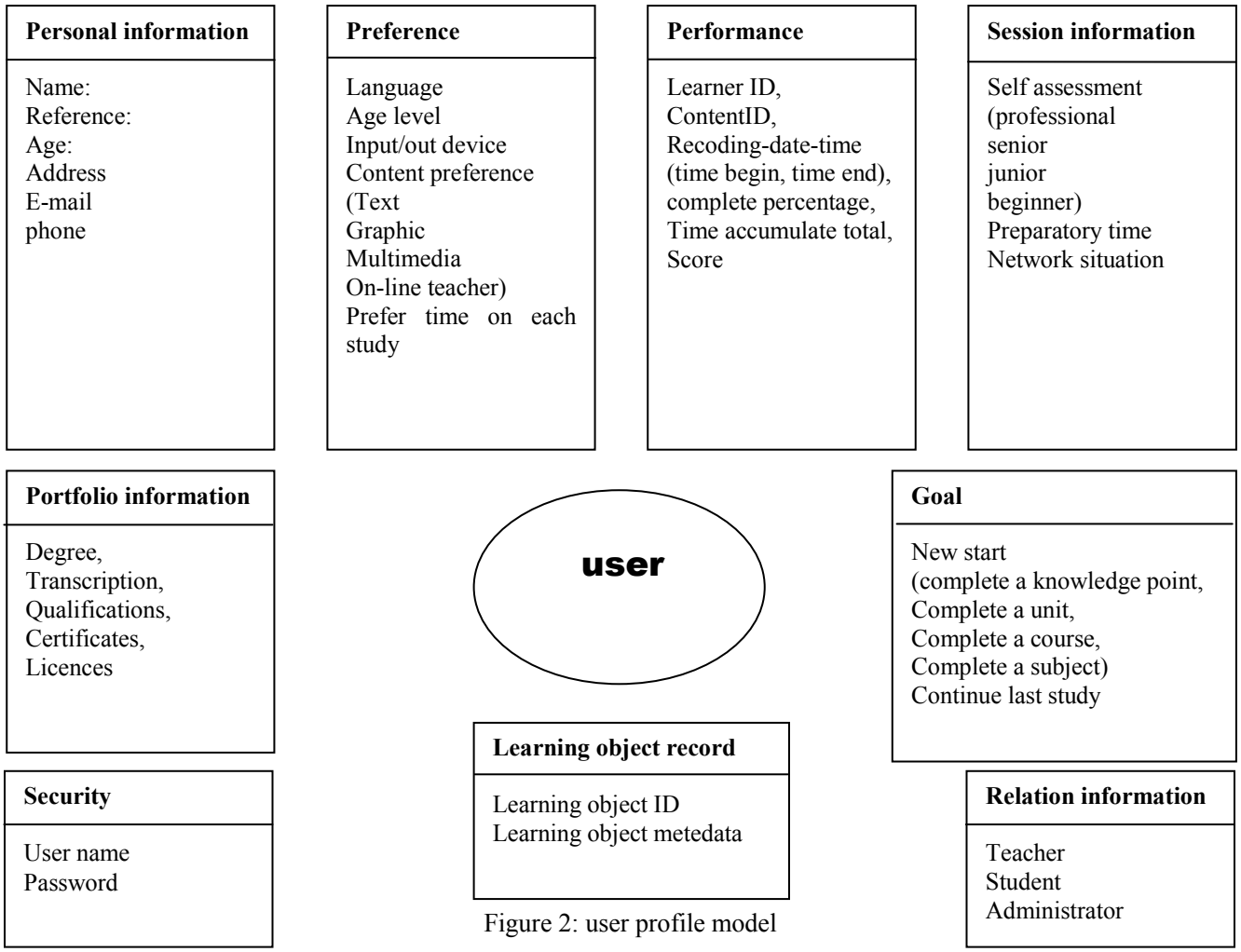


Figure 2: user profile model

- based on it. If the user selects 'new start', the system will not consider the user action history and will continuously ask the user's goal. If the user wants to study a knowledge point, for example pointer in C language, the system just gives the definition and maybe an example. Otherwise if the user selects 'study a unit' for pointer in C language, the system will assemble the relevant learning objects into one unit and provide it to the user. Obviously this category plays an important role in our personalized E-learning system and should be added to the original IEEE PAPI model.
- Session information could be inputted by the user each time when the user uses the system. There exist some sessional factors which can affect the system to build customized learning content. The session information is represented as <preparatory time, knowledge level (beginner, junior, senior, professional), network situation>. The user may use the E-learning system in different situations each time. Thus we need a category to save these session information. As the change is unforeseeable, the user should input session information to inform the system. For example, if the user can only get ten minutes to study, he/she should prescribe preparatory time as ten minutes and the system can select proper learning objects according to this sessional time constraint. Knowledge level represents a user's familiarity with the intended learning content. It is another factor that may vary according to the user's learning content. The network situation can help system select the quantity and the type of the learning material.
- Learning objects record can help the system get the learning information quickly and can provide a gist for the user to understand his/her individual study situation. Because we adopt the learning objects as the basic learning material unit, it is reasonable to save the learning objects that the user has already studied into the learner profile. This category is represented as <learning object ID, learning object metadata>.

The learner profile design model developed in this paper covers important characteristics to facilitate the learning personalization. Based on this design model, our next step is to design detailed learning objects discovery and assembling mechanisms.

## IV. CONCLUSION

The research work is engaged to facilitate the development of personalized E-learning systems since it has drawn more and more attention. User profile as a decisive component of the E-learning system is the emphasis of this article. This paper has introduced the art of the E-learning world and discussed how to design the user profile to facilitate the personalized E-learning system. The detailed user profile structure based on IEEE PAPI has been presented.

A mature learner profile data and a corresponding algorithm are the key points to build a personalized E-learning system. In the future, how to exploit the user profile data to achieve personalization will be explored.

## ACKNOWLEDGEMENT

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