COLMS:Components Oriented u-Learning Management Systems in Ubiquitous Environments

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ABSTRACT

In this paper, we propose u-Learning management systems which are designed and implemented based on learning activities oriented components. The proposed systems are composed of components which can process the functionalities for coming into actions of learning activities. Specially, each component is broken into class units by which learning activities of users can be performed on various devices. When users try to connect the proposed learning management system, the system explores devices of users and the corresponding connection program, and then selects components that are fitted to the activities and combines them in a real-time. Our system provides u-Learning environment so that users can use the learning activity services taking no influence on time, place, various devices and programs. That is different from traditional e-Learning system which cannot support various devices of users directly.

Keywords: *u-Learning management system, e-Learning system, component oriented LMS, learning activity*

1. INTRODUCTION

e-Learning is a strategy for planning some learning experiences that uses the media to deliver educational contents with the objective of the web-based learning [1], [2]. Graziadei[1] introduced three types of e-Learning, those are, synchronous learning, asynchronous learning, and combination of previous two types. Synchronous e-Learning is an environment where teachers and learners can execute learning together at the same time. In asynchronous e-Learning systems, learning can be executed on web environment according to the schedule of teachers and learners. Due to the characteristics, e-Learning does not have constraints of time and space when compared with off-line learning. The e-Learning, however, have restrictions on devices and networks they are using. The new u-Learning has appeared to overcome the drawbacks in the web-based ubiquitous learning environment [3], [13]. u-Learning is a synthetic word of ubiquitous and learning, and it takes a important role in on-line next generation learning systems which will become to appear as the expansion of e-Learning. In the u-Learning, it is possible for teachers/learners to learn using the u-Learning system anywhere at the anytime, specially, not tied to the place and time. That is, users, who are in home, school, office, moving out of work, can learn with various educational contents such as digital video, game, contents in digital library, and embedded training programs, over the Internet if they are using u-Learning systems.

There are several e-Learning systems including Moodle[4], [5] and LAMS[6], [7], and the systems have been serviced in educational training institutes including university and school. Currently the systems do not support ubiquitous learning environment so that users cannot use any device as well as they cannot study by using them anywhere at the anytime. In this paper, we propose u-Learning management systems which are working in ubiquitous environment. And with examples of the implementation results, we will show the possibility of u-Learning.

Section 2 describes the analysis of the existing learning system and its problems. In Section 3, the u-Learning

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Manuscript received Dec. 26, 2008 ; accepted Jan. 26, 2009

management system based on learning activity oriented components is proposed to cover the existing problems. Section 4 shows the implementation results of the proposed system, and finally, the results of this paper are summarized and future research directions will be presented.

2. RELATED WORK

In this section, we will describe the very meaningful learning management systems, Moodle and LAMS, related to our proposed systems, and then will introduce the problems with these systems.

2.1 Moodle

Moodle [4] is the abbreviation of modular object-oriented dynamic learning environment and is a open software package of the learning management systems so that users can do internet-based lessons as shown in Figure 1. By using the Moodle, teachers can easily open various courses in the on-line, and can operate them effectively, and learners also can study the courses which they want to do. Currently, Moodle has been used widely from a small scale educational institute to universities, and have abilities reflecting collaborative learning, learning evaluation, and web 2.0 such as blog, wiki, etc. There are forums, wikis, chat rooms, mutual evaluation and blogs as most representative functions of Moodle. More than 70 language packs for Moodle are available.

Users of Moodle are distinct into four groups, teachers, learners, managers and developers. Since Moodle has been developed by using PHP of open source types, it is possible for users to access databases in Moodle directly, and for developers to update Moodle systems to adopt for their requirements more easily.

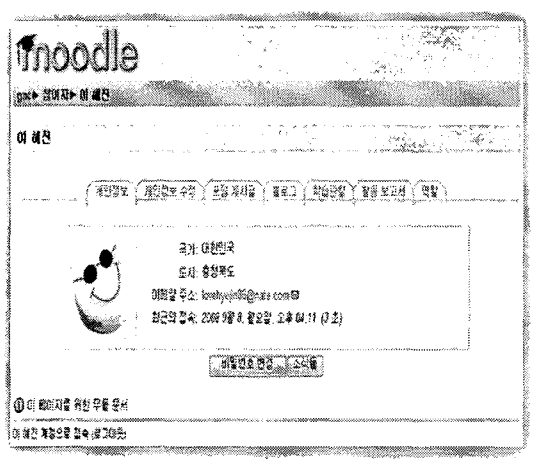


Fig. 1. Introduction of Moodle

2.2 LAMS

LAMS [6],[7] is the abbreviation of learning activity management systems which have been developed by Macquarie university of Australia, and is a freeware learning activity management system for designing and managing learning activities on the on-line environment as shown in Figure 2. Figure 2 shows a specific educational content made by using a variety of learning activities in LAMS. In LAMS, visual multimedia data construction environment is provided for reusing learning activities which can be created in a sequence or in a branch style, and can be stored into database in an interconnected type. The sequence of learning activities is designed through simply dragging and dropping the activity items by controlling the mouse. Each activity includes educational contents which will be learned within the activity stage. The working flow model is very important feature at viewpoints of teachers and learners. Due to the advantages of LAMS, various educational contents have been build for providing teachers and learners to obtain educational effectiveness under LAMS in various applications area such as medical education and collaborative educational contents in computer [8]-[12].

2.3 The problems of the existing systems

Currently, most of e-Learning systems, which have been used widely to manage the learning on the web, have two critical problems to be directly applicable to the ubiquitous environment. First, the educational supporting systems in existing e-Learning environment have a tendency to be operated on non movable PCs with Microsoft's Windows. Due to it, users including teachers and learners always have to be in front of their PC for learning the educational contents in the system. Clearly, PC will have to be connected over Internet. Users, who are moving into any place or cannot use any PC, cannot participate into the e-Learning systems. Therefore, when they have used a variety of devices including general PC, handheld PC, PDA, PMP and mobile phones in ubiquitous environment, they cannot connect to the e-Learning systems due to the limitations of the systems.

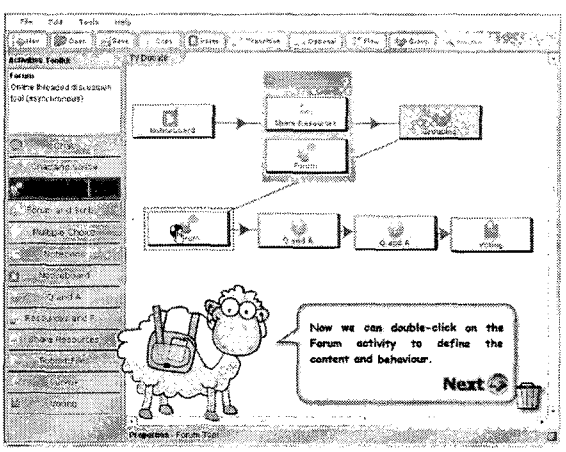


Fig. 2. Introduction of LAMS

Second, a variety of devices has been used in ubiquitous environments. Moreover, it is anticipated for us that more devices will be emerged. Therefore, several different versions of the same e-Learning systems will have to be remade to

support the different devices. In other words, whenever new devices are emerged, the existing systems must be changed to fit the devices as well as new systems have to be developed to support them. To maintain the work continuously, moreover, much more maintenance cost and development cost will be required.

In this paper, we propose component oriented u-Learning management systems which are possible to suit for a variety of existing devices and new devices, and introduce the result of the system implementation.

3. THE PROPOSED U-LEARNING MANAGEMENT SYSTEMS

3.1 Overview of the proposed system

The current e-Learning management systems have a tendency to be only operated in the fixed-access environment. Because of the reasons, they cannot be applied to ubiquitous environment where any device can be used without restraints of place and time. In order to solve the important problems, our proposed u-Learning management system is integrating learning contents creator module and learning contents viewer module base on UCC(user create contents), and web based system module, and is managing them to provide effectively various learning services for users. Moreover, we are making all functions of the proposed system into component units each of which can be combined dynamically according to characteristics of connection devices.

As shown in Figure 3, our proposed systems are composed of four components, those are, users connection component for managing users, component for supporting teachers, component for supporting learners, module for managing learning activities, and component for supporting administrators. By using the components, the system can manage login-check of teachers and learners, who want to connect the system through a variety of devices, can manage the list of courses, can record learning activities and results of users, and can provide the learning reports for users.

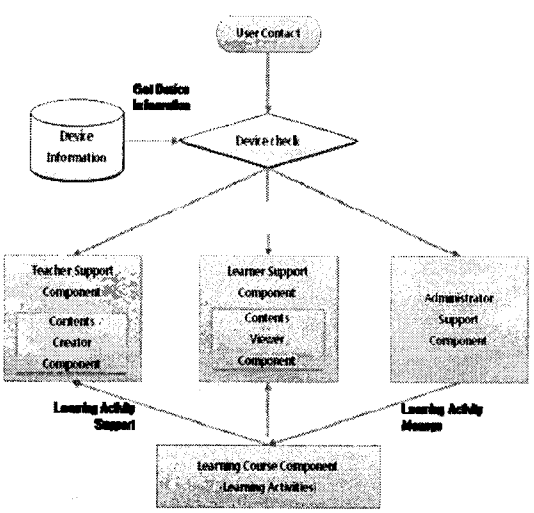


Fig. 3. The configuration of our proposed systems

When users want to connect the proposed learning system, user connection component catches type of the device and program, and then decides its limitations, roles and functions for teachers and learners according to the grasped types. Even if our proposed system does not distinguish teachers and learners, it may divide their role into teachers and learners with respect to their functionalities and scopes. The teacher support component provides teachers for creating regular courses and deleting them, and can provide learners for opened lessons. And also, learning status such as participation, learning effectiveness can be monitored for the processing lessons over on-line in Web environment. By using the learner support component, learners can search the opened lessons, the entire progress of their attending lectures, their homework and their grade, and can manage their overall learning status. Specially, learners can make lectures by themselves, and share the lectures with other learners.

The administrator support component can manage the following items: users including teachers and learners, system, contents, learning activities, courses, the logical flows of the courses, and connectable devices. Finally, by using learning courses support component, users can create the learning activities such as board, notebook, question and answer, resources sharing, mail, UMS(unified messaging service), survey, video, video conference, chatting, forum, vote, file uploading, 3D computer graphics, multi-working, single choice(multiple choices) questions, and diary.

3.2 Reconstruction method of components

Not only can users using various devices connect to our proposed system, but also can they create educational contents composed of structured learning activities and learning curriculum, which can be adopted to different environments, and display them on their device. However, traditional e-Learning systems do not offer the functions to users in ubiquitous environment due to limitation of devices and services.

In order to support the functions in our system, we design all functions into components so that they can be reconstructed for adapting to the device and service users want to use. Figure 4 is an example of reconfiguration of component units according to the wanted device. The example shows the process for making new features such as inheritance and recombination, depending on the properties of a device by using the components supported for various devices. Some components are also composed of by combining their parent classes with common features and children classes with proper functions for each device. When users want to connect the system by using cell phones, PDAs and PCs, the system consists of components for the devices dynamically with children classes adequate to the devices based on their parent classes, and are providing educational contents, which the users want to for the device.

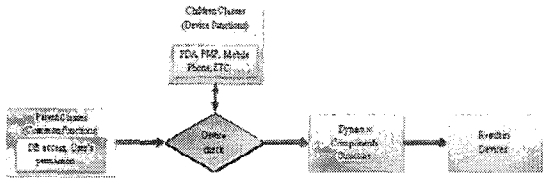


Fig. 4. The reconstruction procedure of components

3.3 Connection method for external devices

As illustrated in Section 3.1, Figure 5 shows procedure for processing the services, which are required by users, through the reconstructed components dynamically after determining the correspondence external device information. Our component oriented learning management system. In our proposed systems, the information on connectable devices is previously stored into database, and then might be used to check the feasibility of the device usage. If the checking result is positive, users can create and view educational contents by using the device.

Whenever the connection is executed, the problems about security and interoperability are very important to do services required by users. As shown Figure 6, SOAP(simple object access protocol), which has been serviced as a type of SOA(service-oriented application) using XML data for communicating to external devices, is applied to guarantee the problems. Since SOAP transmits the processing data according to HTTP formats such as HTTP-GET/HTTP-POST/HTTP-SOAP based on XML, the standard specification on transaction and security has clearly been included into the processing data. Therefore the problems can be implementable over the development environment of our system. In other words, whenever users using various devices request the wanted services to our system according to HTTP based on the techniques, our system provides the corresponding service for users as a type of XML data.

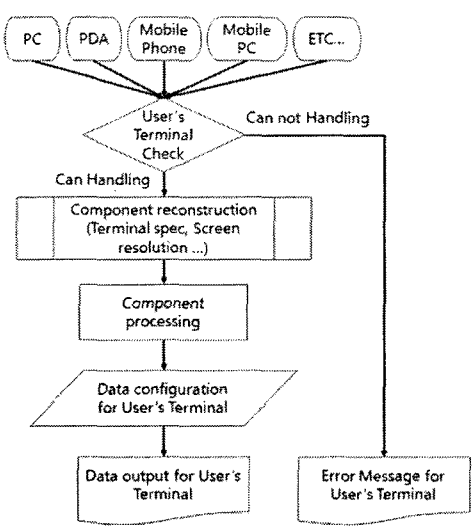


Fig. 5. The method to decide the user device

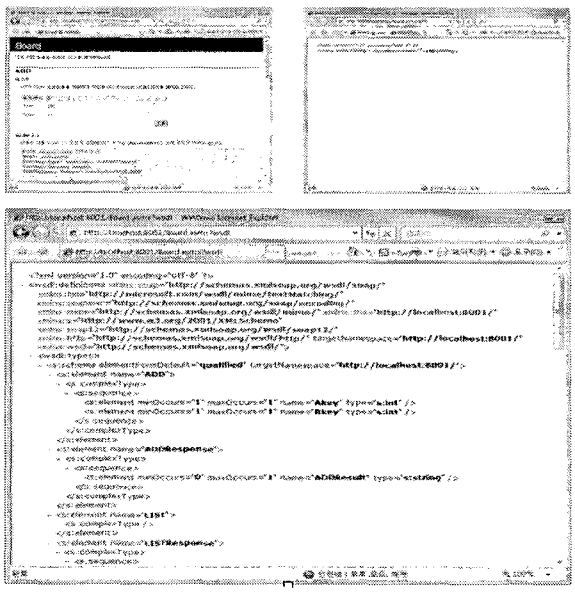


Fig. 6. An example of a SOAP call

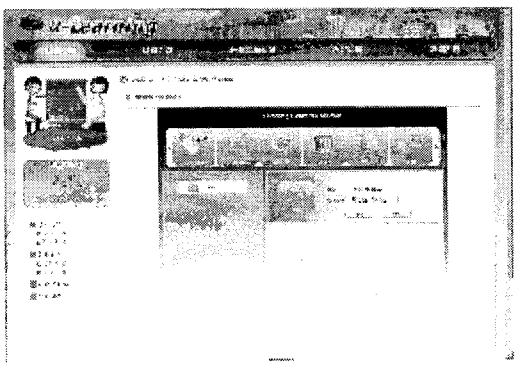
4. IMPLEMENTATION

In this section, we describe implementation details of our proposed systems. Our system has been implemented on Window 2008 server by using ASP.net, silver light 2.5, MS SQL 2.5 and Visual Studio .NET 2003. Specially, we implement the proposed system as a type of RIA(rich internet application) to handle easily experiences of users aspect to contents creation and learning activities. The overall system development environment is like as the following table.

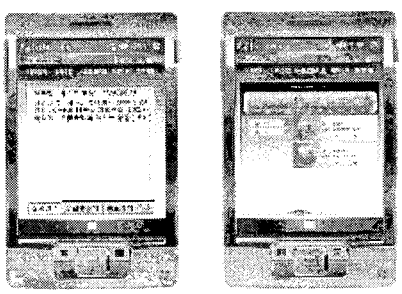
Table 1. System devlopment environment

items	Specification
Operating Systems	Windows XP
CPU	Intel Core2 Duo 2.4Ghz
RAM	2 GBytes
HDD	300 GBytes
Web browsers	MS Explorer 7.0

Figure 7(a) shows the main screen of the proposed u-Learning management system, in which there are menus for supporting the teachers and learners, and also those for e-portfolio and communities for processing the subjects with specific purposes. Additionally, there is another menu for supporting customers. Teachers in our u-Learning systems can open and manage some courses, and they also can manage learners who are participating in their courses. Learners can manage the list of their courses which they took, and can monitor their scores and learning activities. Figure 7 (b) shows one screen appearing in PDA devices connected to our u-Learning management systems. By convergence methods described in this paper, the educational contents are reconstructed according to characteristics of the PDA device such as their resolution and functional constraints, and then are visualized on the device.



(a) The main screen of our system



(b) PDA viewing screen of our system

Fig. 7. Implementation examples of our proposed systems

5. CONCLUDING REMARKS

Our proposed u-Learning management systems support a variety of devices by which users connect the system and then can process their adapted learning in the system. The system has the ability for collecting information of the connected devices, and for identifying their types. Moreover, it provides users for making the educational contents based on the components. To do it effectively, it is possible to reorganize the educational contents dynamically in the proposed system based on the features of the connected devices, and then the contents will be displayed on the corresponding devices. The dynamic reorganization of contents can be very performed efficiently because that the contents can be made by combining the components. Therefore, whenever users want to use our u-Learning system using any new devices, they can learn through combination of the educational components without making new contents suited for them.

The current u-Learning management systems have been updated so that can accommodate useful functions for applying learning-teaching techniques.

ACKNOWLEDGEMENT

This research was financially supported by the Ministry of Education, Science Technology (MEST) and Korea Industrial Technology Foundation (KOTEF) through the Human Resource Training Project for Regional Innovation, and by the Korea Research Foundation Grant funded by the Korean Government(MOEHRD) (The Regional Research Universities Program/Chungbuk BIT Research-Oriented University Consortium).

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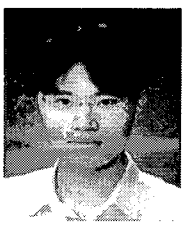

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