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DEVELOPING A SCORM-BASED U-LEARNING LMS SYSTEM

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ABSTRACT

An integrated content and learning management system (LMSs) which has the characteristic of being ubiquitous is the most essential component of U-Learning. However, most modern learning management systems have different architectures, which makes it's difficult to integrate the numerous learning resources, and reusability is hard to achieve. Otherwise, most learning resources read on mobile platforms are still restricted to electric books or digital learning materials. So, it's not easy to manage the learning progress and immediately information providing or interactions between learners and instructors are impossible. A research is proposed in this paper to develop a SCORM compliant blended U-Learning LMS system, which emphasizes the content compilation, content packaging and the implement of SCORM run-time environment to have learning materials being reusable and interoperable.

Keywords: U-Learning 、 E-Learning 、 SCORM 、 LMS 、 PDA

INTRODUCTION

With the growth of wireless LAN and the development of 3G telecommunication technology, Internet access is no more being restricted in wired networking [3], so as to provides a ubiquitous environment for E-Learning. Computer-assisted instruction which integrates with wireless LAN and learning theories has becoming indispensable recently.

The concept of ubiquitous campus (u-campus) [7] [8] was placed importance on followed the gradually development of handheld learning assistants, such as tablet PC, pocket PC or smart phone. Using the handheld appliances ubiquitously is possible due to the smaller volume with higher operating capability of them. In recent years, u-campus is becoming the critical technique of national information technology development in many countries. Take an example of Asia Pacific Zone, Japan is improving a plain named "U-Japan" to achieve Ubiquitous Japan in 2010. Also Korea stared "IT839" integrating related technologies on the way to achieve U-Korea in 2007[4].

In traditional learning condition in the classroom, learning activities were usually restricted, and it was easily tended to passive learning attitudes with low-level learning motivation. Due to the convenience of the information access and transaction through Internet, E-Learning has become a popular learning ladder. World Wide Web (WWW) communication technology in general, offers education institutions opportunities to improve learning, the campus community and the complete learning experience. The recent evolution of u-campus infrastructure further enhances the educational technologies by integrating instruction, learning theories, and information technologies seamlessly, and it's also increases the amount and the categories of resources that are available to instructors and learners.

This paper proposes a research to develop a blended ubiquitous learning management system (LMS) based on SCORM (Shareable Content Object Reference Model) standard. Its ambit covered the principles of the learning contents design, the construction of content packaging and the implement of the SCORM LMS run-time environment to enhance the reusability and interoperability. Learning theories and real time communication software on handheld devices are also applied in the system to achieve the high-level requirements of U-Learning. The implicates are as follows :

1. Recording learning progress to analysis learners' capability to straighten out learning disorders and this also serviceable to result a personal learning plan and situated learning activities in real world.
2. Providing a learning environment integrating virtuality and reality to help instructors to fully utilize the advantage of U-Learning in practice teaching to promote students' capability to investigate, analyze and address problems.
3. Providing strategies to manage learning materials and learning progress in the blended LMS system. Learning activities would become more complex in the past and recording learning progress was not easy as a result of the integration of virtuality and reality. It's considered deriving SCORM as the standard to achieve the goal to have the learning materials being reusable and interoperable.

The methodology used in this research including learning theories, system framework and leaning situation are described in section 2. Section 3 presents system flow and construction. Section 4 summarizes conclusions of this paper and the feature works.

METHODOLOGY

The system framework proposed in this paper was developed based on the social learning theory, the inquiry-based learning theory [5][6] and the situated learning theory. Learning environment is also blended in this system to practice outdoor situated learning. Finally, we define the relationship between the learning environment and the LMS system.

The social learning theory of Bandura emphasizes the importance of observing and modeling the behaviors, attitudes, and emotional reactions of others [1]. And it explains human behavior in terms of continuous reciprocal interaction between personal, behavioral, an environmental influences. The system was designed based on the simulation of practicing an inquiry-based learning activity on vegetation. During the learning of different inquiries, diversified learning styles are accomplished across the interaction between the three important elements in social learning theory. The element, people, is defined as the learners, whereas behavior and environment presents the communication and the learning situation in this research, respectively. Fig. 1 figures the conception of inquiry-based learning theory and social learning theory applied on U-Learning.

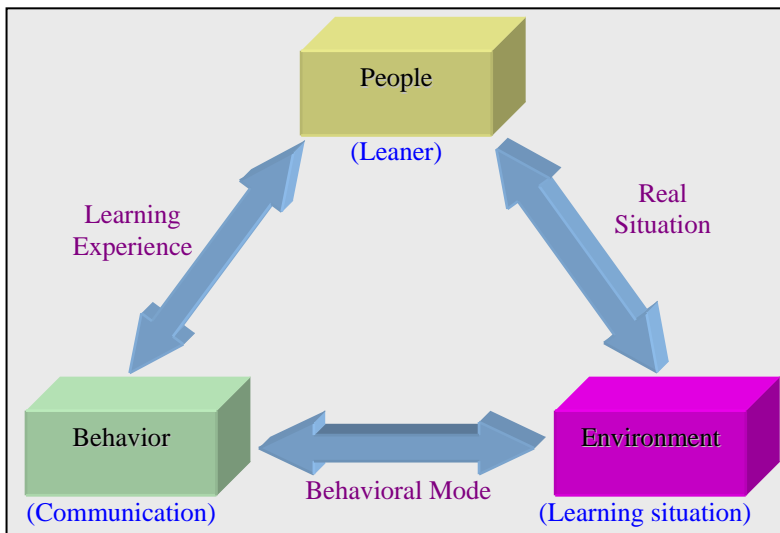


Fig.1 U-Learning based on inquiry-based learning theory and social learning theory

Situated learning theory and knowledge acquirement are outcome across interaction between the learners and the learning situation, which is necessarily provided to meet the real world to have students taking participate in learning activities. This system is designed for outdoor learning activities, and the learning materials are instructed according to the learning objects to provide simulate learning situation.[2][9]

System Framework

Students can learn ubiquitously via connecting with LMS server through 3G broadband transmission or wireless LAN with handheld devices. The learning situation will be aware by delivering the subjects to LMS server to have the appropriate learning contents being accessible. Take an example of paying a visit in the botanical garden, appropriate learning contents are accessible by submitting the scientific name of the plant on the handheld appliances. Its serveable to merge learning activities into life through wireless communication technology and learners could attain to real time learning environment in the circumstance that all the appropriate and any other related learning contents are acquirable.

Learning contents are designed according to international code of botanical nomenclature (ICBN) to construct domain knowledge and destructed the learning materials base on SCORM standard. JSP and Java Servlet are used to develop a web-based U-Learning LMS system in this paper to address the arduous problem of un-interoperability due to the specific system design built for different platforms. Related learning contents will present on the browser on handheld devices at right time with learning progress and behaviors recorded and transmitted to LMS server to enhance the situated learning. System framework represents as Fig. 2.

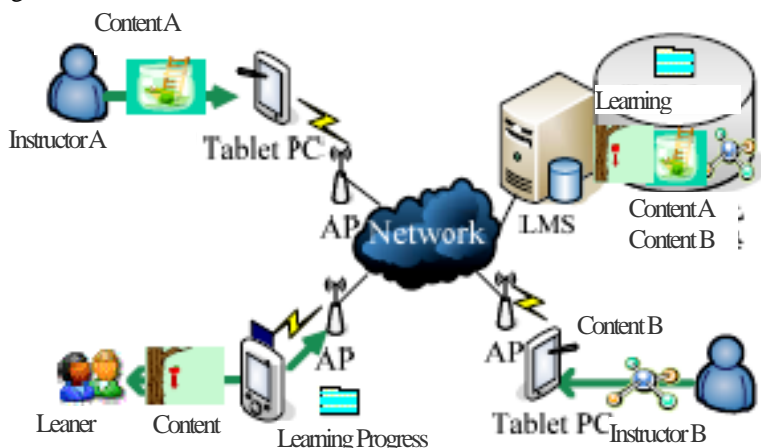


Fig.2 LMS system framework

Learning Situation

It was not easy to completely record learning progress in outdoor situated learning activities so as to analyze learning efficiency and advance the pedagogies in the past. In this system, learning progress of a learner is recorded as learner profile in the learner database during his course to provide personal learning environment to improve learning efficiency. And a recommendation list of learning content could also be generated to a learner in the feature system development. Fig. 3 signifies learning environment.



Fig. 3 Learning environment

Give an instance of taking a ubiquitous learning activity in the botanical garden on a PDA (personal digital assistants) with Pocket PC 2002, 3G telecommunication and wireless LAN. Situated learning can be accomplished by delivering learning environment related learning contents to learners when making requests to LMS server. U-Learning, which operates in coordination with situated learning and inquiry-based learning, can transfer the characteristics of E-Learning, any time, any place and any information to right time, right place and right information respectively.

SYSTEM DESIGN AND IMPLEMENTATION

The system design and implementation of U-Learning are based on handheld devices such as PDA and smart phone which are usually small and portable. Using these kinds of mobile appliances as learning assistants, appropriate learning contents in content server which meet learning environment can present on browser at right time through wireless LAN.

The characteristics of this system are as follow; situation related learning contents can be delivered to learners' handheld appliances at right time to achieve situated learning when making requests to LMS server. Learners can also sign up what they want to learn according to their interests and learning efficiency. Learning progress, moreover, can be transferred as data model and recorded in LMS server through wireless LAN on the go to provide personal learning environment. This system, which implicates database and XML parsing design, contains content presentation and learning progress management module, content management module and authority management module. System flow is showed in Fig. 4.

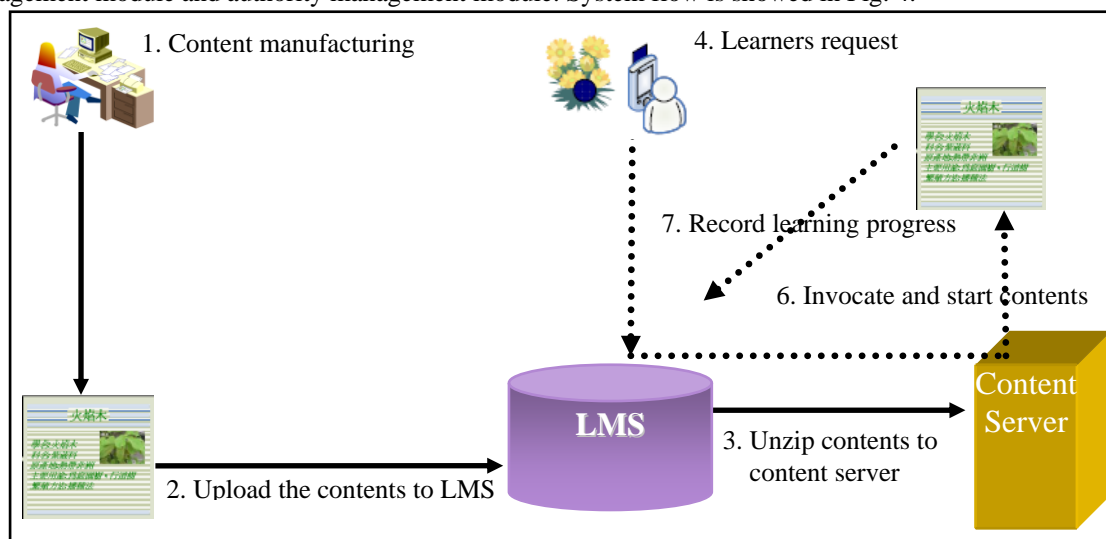


Fig. 4 System flow

Content Presentation And Learning Progress Management

The content presentation and learning progress management module is the core of this U-Learning LMS system. Learning progress is set as data model, being defined in the white book of SCORM run-time environment, to record the interaction between learners and learning contents present on browser. Database design is the most critical task during this phase of

system development. Microsoft® Access 2003 is adopted as the database management system in our system, with the object oriented compiling language, JAVA, we can track learning behaviors and store related patterns into database by object access. Fig. 5 represents the flow of this module.

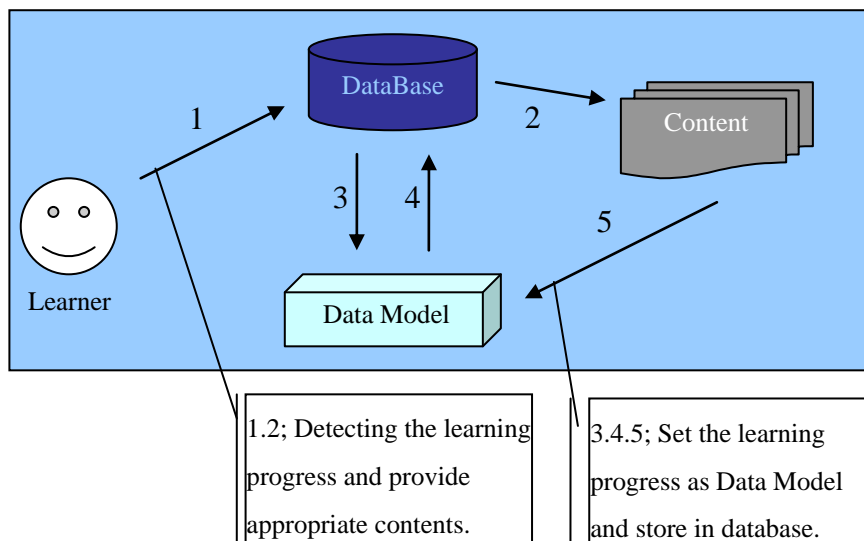


Fig.5 Contents presentation and learning progress management

Learning Contents Management

The learning contents management module includes three important functions described as follows:

1. Course submission : Instructors can submit new instructed learning contents with related information, such as the subject and instructor of the course, which are compressed into a .zip file and upload to the LMS server.
2. Course permission : The ZIP file of a new submitted course will be stored in a temporary database, and the checkers can publish the course being examined and approved. The published learning contents will be extracted into the database.
3. Course import : The published course will be imported into the content server and present on the web pages in user interface.

Database Design

Fig. 6 shows the E-R model of the database in our system. The entities in SCORM are defined as learner and instructor, content, SCO, item, which includes the related information about SCO and interaction. We establish 13 tables, including the intermediary tables, which are designed to take the responsible for communication between entities to provide the common information in the database.

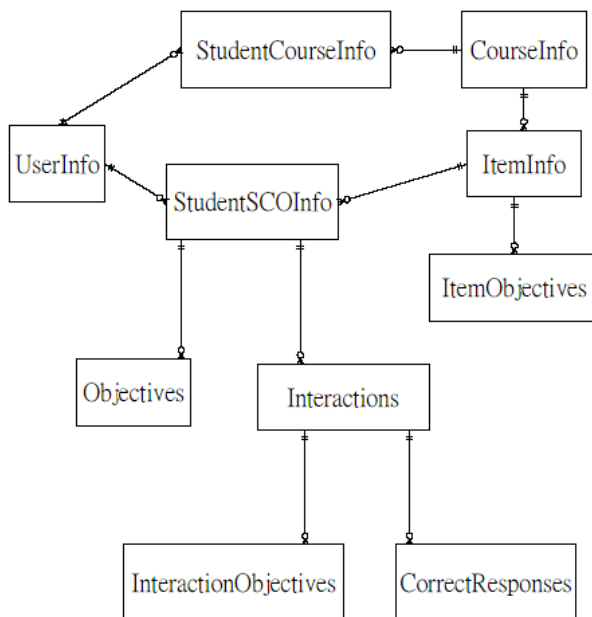


Fig. 6 E-R Model

XML Parsing

The LMS system have to provide a function to obtain the related information about a learning content and to identify the

resources included, which is defined as XML parsing. A XML file will be generated to record the status, usage and the related information while manufacturing a learning content. The two kinds of the related information are as follows :

1. Meta-data : To record and describe the assets, SCO and content aggregation included in SCORM content model. The segment represents the context independent.
2. Content Packaging : This segment describes the context specific.

For example, if a learning content contains 7 chapters, the chapter specific related information is represented in the Meta-data segment and the learning sequence of these chapters is defined in the content packaging section. The XML structure of content packaging shows in Fig. 7.

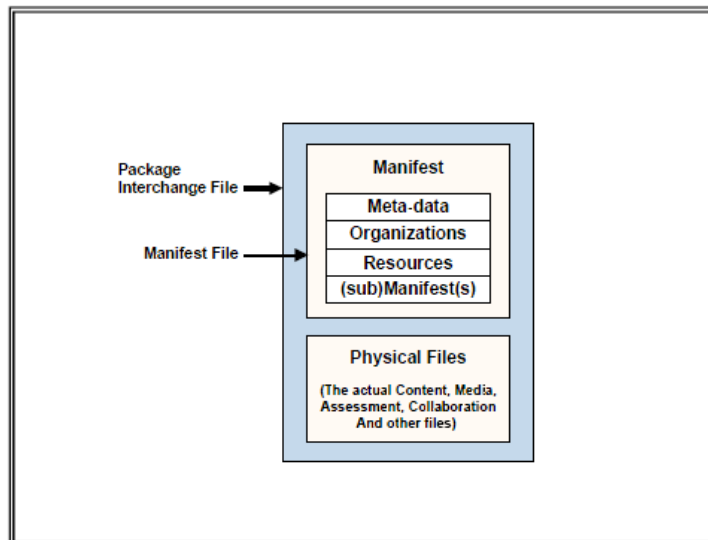


Fig.7 XML Content packaging

The purpose of content structure is to provide the content developer with the means to author collections of learning resources into a cohesive unit of instruction, apply structure and associate specific behaviors that can be uniformly reproduced across LMS environment.

Finally, the user interface design must obey the principles of being friendly and convenient to provide an inviting learning environment to user.

CONCLUSIONS AND FUTURE WORKS

This research proposes a SCORM compliant Web-based U-Learning LMS system to address the problem of being interoperable in different platforms and provide a ubiquitous learning environment on handheld devices at right time and right place. This system, moreover, is design to take on-line learning activities on handheld appliances, and it's possible to provide a more flexible, personal and self-determining learning way to improve teaching effects and learning efficiency in contrast with traditional off-line reading.

Learners can not only interact with LMS system but also integrate learning situation to acquire related learning contents base on social learning theory and situated learning theory. For example, transferring the learning situation from classroom to the foot of an aged banyan outdoor during the course of botany to have learners to observe, to touch and to feel the objects in real world, with the learning contents present on the handheld appliances, which are conceptualized can be changed into the reserve of concrete knowledge to achieve situated learning. In the future, the learners' preference, usage and learning progress can be attached on our system to improve the adaptive capability and flexibility.

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