

Intelligent Mobile Agents in Personalized u-learning

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Abstract

e-learning and m-learning have some problems that data transmission frequently discontinuously, communication cost increases, the computation speed of mass data drops, battery limitation in the mobile learning environments.

In this paper, we propose the PULIMS for u-learning systems. The proposed system intellectualize the education environment using intelligent mobile agent, supports the customized education service, and helps that learners feasible access to the education information through mobile phone.

We can see the fact that the efficiency of proposed method is outperformed that of the conventional methods. The PULIMS is new technology that can be used to learn whenever and wherever learners want in Ubiquitous education environment.

Key Words : u-learning, Personalization, learning, MultiAgent

1. Introduction

Adaptable and convenient services in ubiquitous computing enable anytime and anywhere access to any equipment and information. Anytime, anywhere easy access to any device can be done in the environment that uses high quality information services[1]. Future technologies related to ubiquitous computing involve 3C, "Computing anywhere", "content everywhere", "connectivity everywhere". Computing anywhere refers to PDA, mobile devices, cars that have built-in processors; content everywhere refers to anytime and anywhere access to files and data over the network; connectivity everywhere refers to ability to connect to any device in order to access service [2][3]. The emergence ubiquitous computing that enables closer interaction between business and user in time and space is very important for any business successful future. Fusion of e-commerce and m-commerce concepts results in the introduction of u-concept that extends the range of methods and concepts existing in the commerce.

In a similar fashion, e-learning and m-learning produce concept of u-learning that provides new possibilities in learning process. The focus of this paper is to study the unique characteristics of u-learning effects in terms of educational efficiency.

e-learning has been recognized as the new wave in education. It allows learners to study with unlimited time and space as 24 x 7 which is cost-effective. Further, it is considered as a key strategy for increasing human capital in the knowledge society. It can be used in the organization for in-house training. Despite the advantages of e-Learning, this system has not been well designed to be customized for individual users. There are many comments about the "one-size-fits-all" philosophy, which results in too much information for users and lack of personalization[4][5].

2) m-learning

m-learning is often defined as e-learning through mobile devices[6]. In this context, mobile device is considered as small, autonomous, and obtrusive enough to accompany people in every moment of their daily life, and that can be used for some form of learning. These small tools can be seen as instruments for accessing contents, either stored locally on the device or reachable through interconnection. They can also be a tool for interacting with people, via voice and through the exchange of written messages, still and moving images.

An overview of advantage and disadvantage of Learning system is provided in Table 1.

Table 1. Advantages & Disadvantages of Learning system

Learning system	Advantages	Disadvantages
Conventional learning	-Group discussion, team projects, group presentations, individual assessment through quizzes and tutorials. -Good socialization among students and it allows them to learn	- poor interaction among students and lecturers during class - Lecturers do not know how a particular lesson went

2. Related Works

2.1 Learning system

1) e-learning

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	from each other.	
Computer based instruction	- System can log user's access to learning resources - movies and animation can improve students to recall information.	- Multimedia images and movies slow down the performance of the computer - Lecturers are needed for explanation on working problems in classrooms
Electronic Learning	Can be accessed at fixed location with internet connections such as computer labs, at home or cyber cafe	- Depend on a fixed location with internet access and does not support mobile learning - Students may be confused on actual submission of assignments.
Mobile Learning	- Learning can be done anytime and anywhere supports continuous learning.	- There are limited storage capacities for mobiles and PDAs. - PDA's and mobile phones are less robust than desktops.

An overview of classification of Learning system is provided in Table 2.

Table 2. Classification of Learning System

Classification	E-learning	M-learning	U-learning
Learning Space	Physical space	Physical+Cyber	Anywhere,anytime
Device	PC, Network	PDA,Tablet pc	Mebile phone, 3G
Main Technic	Internet,web	Wireless internet	Wireless internet
Learner	Membership	Membership	anyone
Learning time	Connective	Connective	anywhere

3) u-learning

ubiquitous learning is supported by ubiquitous computing, whose evolution has recently been accelerated by improved wireless telecomm unications capabilities, open networks, continuous increase in computing power, improved battery technology, and the emergence of flexible software architectures.

Ubiquitous Learning focuses on the learning mission itself. In ubiquitous learning context, learning is a natural and spontaneous activity. What the learner pays attention to will not be peripheral tools or other environmental factors, but the learning mission itself. In other words, Ubiquitous Learning is human-centered, and learning task-focused. Technology can facilitate learning but should not disturb learning.

2.2 Agent

There exists no single definition for agents, but a lot of discussion (e.g. [8,9,10]).

Almost every author seems to propose own needs and ideas what leads to a variety of definitions depending on the targeted

problem area. The expressed spectrum determines reasonable application areas as for example user interfaces, tele communications, network management, electronic commerce and information gathering. Russel and Norvig described this multiplicity aspect in this way [11]. "The notion of an agent is meant to be a tool... " not an absolute characterization that divides the world into agents and non -agents." "

Mostly corresponding systems, architectures and points of view are based on using attributes as defining entities. For example Wooldridge and Jennings define agents as software-based computer systems with certain properties like autonomy, social ability, reactivity and pro-activeness.

3. PULIMS system architecture

3.1 Ubiquitous mobile learning Platform

Figure1 shows the Pulims(Personalized Ubiquitous Learning Intelligent Management System) features three collaborative agents in its architecture. These agents work together in order to control the content and appearance of the delivered courseware. These agents are Authentication Agent, Contents Management Agent and the Presentation Agent.

The Authentication Agent: The Authentication Agent is responsible for maintaining, updating and analysing the user profile. This profile is then used to generate personalised content based on the user' s abilities network capacity, device type and native language.

The Authentication Agent uses a set of rules to assess the user' s requirements, and transmits these requirements to the Content Management and Presentation Agent. These rules govern the behaviour of the entire system and ensure that any personalisation is intuitive and does not appear intrusive to the user. The ACK Agent : The Class level ACK Agent controls the content to be passed to the user.

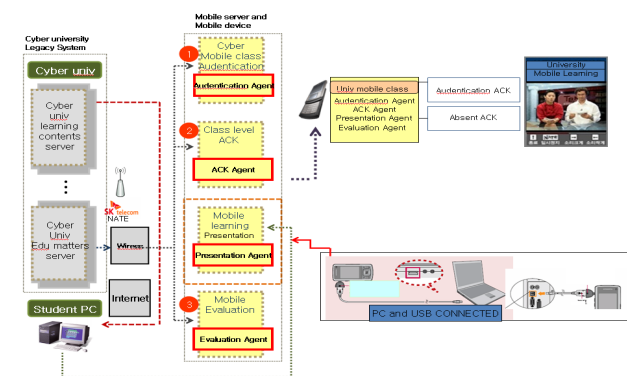


Fig. 1 Platform of Pulims system

Research on the cognitive information processing model of learning suggests that customizing learning materials based on the individual's preferred learning style or on personality can provide a measurable benefit to the learner.

ACK Agents can be used to create a personalized learning model and pathway tailored to individual learner knowledge and personality traits.

Learners begin courses or training sessions by taking knowledge surveys and/or answering questions related to their cognitive, affective, and social characteristics.

This allows ACK agents to customize the available learning objects to meet an individual learner's needs. ACK Agents should be able to select learning materials and optimize schedules for individual learners based on cognitive style, personal preferences, and accessibility needs in addition to prior knowledge and desired knowledge.

The Presentation Agent: The Presentation Agent is used to vary the content and interface to meet the requirements of particular devices. Interfaces designed for PCs do not fit very well on PDAs and should be adjusted to display correctly on the reduced screen size.

This is important in the field of u-learning as users should have the same learning experience irrespective of where and when they wish to learn. By adjusting the content so that only the most relevant information is displayed, and adjusting or possibly removing the peripheral interface components, such as calendars etc.,

Some types of agents located in a VB agent platform are as follows:

- A main mobile learning system, which stores default VB script agents:
- main server system and user client(PDA, mobile phone etc) system

Evaluation Agent : The Evaluation agent interface which included communication skills, valuation, comprehension faculty, ease of use, and relevance of the question answering system. A Likert scale ranging from 1 to 5 was used for responses to the questions: 1 represents the lowest score while 5 represents the highest score. Descriptive statistics was used in data analysis. The Evaluation agents system efficiency included smart content sequencing, analysis of solution, adaptive content, text presentation, provided questions, examples, system guidance, reasoning and saving output.

3.2 u-learning Platform

For the servers, the MS-2003 server, MS-SQL database server and the IIS web servers were used while the client was the mobile OS Wipi and the VM when the application software was being developed. Within the mobile device's system software, a mobile operating system for the driver of the mobile terminal and the mobile device's learning platform, the virtual machine were classified to operate the various kinds of applications for the wireless internet. Figure 2 shows the classified structures of the softwares being ran on the mobile terminal.

There were 3 classifications for the user's application software within the mobile device which can all be explained. The learning, advertisement and download application programs can be downloaded at the mobile VM platform which

lets users operate various kinds of contents which can be games, bell sounds, videos, camera phone features and etc.

Like the web browser, the wireless internet browser has the role in supplying various kinds of information from its server.

The mobile operating system has been developed so that it's the most suitable for a small-sized mobile device which has the features of phone conversation, wireless internet, multimedia services and etc.

The mobile VM platform is located in between the mobile device's operating system and the application which creates an environment where the application can be operated solely by the hardware. After the application or the contents are downloaded in the wireless internet server by the user's request, it is operated at the mobile VM platform. The strong point of a mobile platform is that after an application is downloaded, it can be solely operated without needing to connect to a wireless internet, shown in Fig. 2

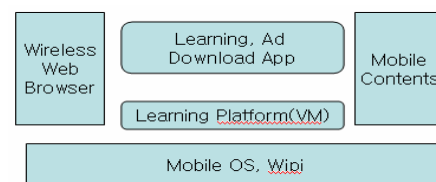


Fig. 2 u-learning Platform

4. Experiments and Results

4.1 u-learning study method

To study through the u-learning system, it can be easily used when following the orders of this figure. Through the agent within the server that is personalized, the user can download the needed studying material or see the progress and by operating the client agent, the download program will start.

- [Step1] Installation study phone agent build
- [Step2] Double click login icon
- [Step3] Acquisition of Authentication number from user Authentication agent
- [Step4] Select contents list
- [Step5] Downloads contents
- [Step6] Study
- [Step7] Exit u-learning

4.2 u-learning player

Explanations on how to transplant the mobile application program is as below.

Through the wireless mobile system, press [1472#1] [rate or] and the call button to get online. When connected, choose to download the learning player program and when download starts, the player has started to get downloaded on the mobile phone.

See Fig. 3 choose the needed learning contents, load it in the mobile system and now, the user is ready to study.

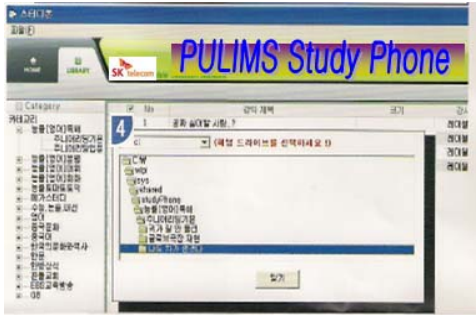


Fig. 3 learning contents

The mobile system controls are much simpler compared to the other systems which makes the efficiency more higher.



Fig. 4 select contents

Fig. 4 is stored in the mobile phone screen, select the contents you want from the learning contents and selected contents in Fig. 5 shows the execution of the screen.



Fig. 5 start a lecture

4.3 Results

The operation results gives out a utilized studying method and not like the fixed method where paper textbooks are used, it is more efficient to users that want to search for information and receive studying effects through the utilization of education

by contents and the wireless internet. Since the structure has it so communication fees are decreased and the usage of battery power is also reduced, it can be said the u-learning is a very effective tool within the intentions of the new paradigm.

5. Conclusion

The impact of Ubiquitous Computing on Learning is not confined within technical dimension. Besides its technical facilitation, this new computing paradigm also challenges human's belief on learning, and compels us to rethink on the design of learning resources and environments. Based on the recognition of Ubiquitous Learning, this paper proposed a conceptual model of Ubiquitous Learning Community and presented a design framework for the construction of ULC. Some sample learning systems based on currently affordable technologies and devices were also provided. More practices and evaluations in ULC development will be strengthened in our future studies.

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