Design and Implementation of C-iLearning: A Cloud-Based Intelligent Learning System

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ABSTRACT
The gradual development of intelligent learning (iLearning) systems has prompted the changes of teaching and learning. This paper presents the architecture of an intelligent learning (iLearning) system built upon the recursive iLearning model and the key technologies associated with this model. Based on this model and the technical structure of a cloud-based intelligent system, the authors developed an exemplary iLearning system—“Mobile Class,” accessible from the Shanghai Lifelong Learning Network, an online platform for the continuing education of Shanghai residents. This cloud-based intelligent learning (C-iLearning) system can adopt the cloud management model and synchronize users’ learning process in the clouds, so as to support users’ continuous learning with different devices. Formal testing with target users revealed the effectiveness of this system in supporting anytime anywhere learning.

Keywords: Cloud Learning, Intelligent Learning, Learning Management System, Mobile Class Usability Testing

INTRODUCTION
The rapid development and thorough application of new information technologies, such as the Internet, new mobile broadband networks, Next Generation Networks (NGNs), and cloud computing, is brewing major changes and new breakthroughs in computing and education. For instance, smart and intelligent movement has also become an inevitable trend. At present, more and more countries are embracing the concept of “Smart or intelligent City.” With a focus on intelligent learning, the Intelligent Campus (iCampus) initiative launched by Etisalat British Telecom Innovation Center (EBTIC) is a good example of such movement. EBTIC is a joint research and innovation center by ETISALAT, British Telecom and Khalifa University of Science, Technology and Research (KUSTAR). Guided by the intelligent learning theories...
advocated by EBTIC, we developed a Cloud-based intelligent learning (C-iLearning) system and studied its effectiveness in supporting teaching and learning. As a well-established distance education institution, Shanghai Open University established the Shanghai Lifelong Learning Network (SLLN), a learning management system that intelligently supports independent and collaborative learning of millions of online learners. This platform provides a wide array of learning resources, from lifelong learning to higher education, from vocational education to basic education. As one of the six pillars in the iCampus initiative, intelligent learning (iLearning) is considered the learning trend in the 21st century. Intelligent learning systems are learner-centered and can support individualized learning. These are accomplished through integrating a variety of learning terminals and instructional platforms, which provide teachers and learners with convenient and effective learning management, resources, assessment, and some other services, thereby creating an intelligent environment to meet diversified instructional and learning needs.

An Intelligent learning system has the following features:

- Highly user-friendly: break up the limitation of time, location, and devices
- Provides adaptive learning based on learners’ subjects, learning experiences, and an analysis of their learning behaviors.
- Create statistical data, which tutors can use to group learners and advise their learning.

Here, we conduct research on the design and development of a cloud-based intelligent learning system, which combines intelligent learning and cloud computing to effectively support individualized learning and mobile learning. Cloud-based learning system has the following three benefits: 1) Learning materials or courseware can be saved and accessed in a scalable and expandable way. 2) The cloud provides standardized interface (web services) so as to abstract and unify the call method regardless of the terminal devices and programming languages. 3) Unify the resources from different organizations (e.g. districts of Shanghai) to generate a distributed learning system.

Following we describe the architecture of this cloud-based intelligent learning system and also its implementation with target users.

THE ARCHITECTURE OF THE CLOUD-BASED INTELLIGENT LEARNING SYSTEM

Figure 1 shows the architecture of this cloud-based intelligent learning system. This C-iLearning system has three layers:

1. Visualization layer, which displays the interface of different devices when they share the same applications with same logic and data.
2. Learning application layer, which provides abstracted and unified logic of learning. This layer has the most important intelligent learning engine and the statistical and analytical engine.
3. Data and logic Layer, which unifies distributed data from different devices.

The three layers consist of several core components, such as platform, centers, data warehouse, intelligent recommendation engine, and multi-tenancy distributor, which all reflect the main characteristics of cloud computing: elasticity, resource pooling, abstraction, and virtualization. Elasticity (resource scaling up) and resource pooling are the core characteristics of cloud computing (Hirsch & Ng, 2011). The heart of cloud computing is abstraction and virtualization set on top of a dynamic distributed server architecture, which provides user with great flexibilities to create, share, save, and collaborate from anytime anywhere. Currently, there are three models of cloud computing: Infrastructure as a service (IaaS), Platform as a service (PaaS), and Software as a service (SaaS).

The network that provides resources is known as the “cloud”. From users’ perspective, resources in the cloud can expand infinitely and are accessible anytime, through on-demand
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