

Higher Vocational Colleges' Intelligently Shared Professional Teaching Resource Library System Based on Mobile Agent

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Abstract : This paper attempts to integrate mobile agent with professional teaching resource library system. Based on analyzing the advantages of mobile agent technology in distributed computing, this paper designs a shared professional teaching resource library system based on mobile agent and discusses in detail the process of the realization of this professional teaching resource library system.

Keywords: mobile agent; higher vocational colleges; intelligently shared; professional teaching resource library system

1. Introduction

The document named "Some Opinions of the Ministry of Education on Promoting the Innovation of Higher Vocational Education Reform and the Scientific Development of Vocational Education" (Department of Vocational and Adult Education, No. [2011]12) clearly pointed out it is needed to vigorously develop digital teaching resources, promote the co-construction and sharing of high-quality teaching resources, expand students' learning space and promote students' self-learning^[1]. The document named "Some Suggestions of the Ministry of Education on Comprehensively Improving the Quality of Higher Education" (Department of Higher Education, No. [2012]4) put forward promoting the construction of higher vocational colleges' shared major teaching resource library, namely, joint construction of professional teaching resource library with industries and enterprises^[2]. At the same time, the diverse modes of training talents, the successful cases of teaching reform and the development of new and high technology, especially the technology of cloud computing and big data technology development have provided great opportunities for the construction of professional teaching resource library system.

At present, there exist some problems in the construction of higher vocational colleges' professional teaching resource library system. On the one hand, due to lack of intelligence, low efficiency and unsatisfying effect, the system construction cannot meet the requirements of sharing and immediacy of current higher vocational colleges' teaching resource library. On the other hand, the system construction has not combined the colleges' criteria with industries and enterprises' criteria, so the library system can neither meet the actual demand of industries and enterprises nor adapt to the need of mode reform of training talents in current higher vocational colleges. Therefore, constructing higher vocational colleges' intelligent shared professional teaching resource library system is an important measure to strengthen the connotation construction of higher vocational education, promote students' self-learning and improve the quality of personnel training.

2. Mobile agent and its technical advantages^{[3][4][5][6]}

Agent is a new programming after object-oriented programming, the technology of which derives from distributed artificial intelligence. Agent can independently plan complex operation in the

dynamically changeable information environment, which cannot be modeled in advance. In addition, without any intervention of users, it can provide services required by users. Mobile agent technology is a new computing means to achieve complex, dynamic and distributed intelligence application.

The mobility of mobile agent is that it can carry the related information and code from one node to another node of the network, with the purpose of reducing the network data flow and realizing asynchronous interaction. That is, according to certain rules, the related information and code are moved from one machine to another machine in a heterogeneous network to operate and interact with the nearest appropriate service resources of the same host or network, and accomplish specific tasks on behalf of the users, such as searching, filtering and collecting information. After the completion of the task, the information and code together with the results are transmitted back to the user terminal, which makes the agent technology have the characteristics of mobility and distribution calculation, further extends the function of handling affairs of the application system and better deals with the problems which traditional network computing model can not solve.

An application system based on mobile agent is usually made up of a group of mobile agents. According to its task and environment, each agent moves to the machine equipped with the resources required for computing. During the process of computing, the agent may need to collaborate with other agents, even cooperate with agents on other application system collaboration. After the completion of one computing, the mobile agent autonomously decides the next action.

With many outstanding advantages, mobile agent is fully utilized in many fields, such as distance education; information retrieval, e-commerce and so on. Its main outstanding advantages are as follows.

(1) It can reduce the network data flow, and overcome the delay of the network communication. Through the service request, the agent moves to the target host, processes data with direct access to the host resources and only transmits the final results. Therefore, it can decrease the interaction with the source host, avoid a lot of data transmission in the network, so as to reduce the reliance of the entire system on the network bandwidth, shorten the communication time delay, and improve the quality of service.

(2) It possesses dynamic adaptability, capable of asynchronous and autonomous execution. Mobile agent can sense the operating environment, and according to the internal state make appropriate responses to the environment change independently in the absence of external control, in order to enable the whole system to maintain its optimal state all the time. It can also determine the mobile target based on the server and network load. The traditional network communication mechanism requires the requesting user end must always wait for network service on line. Through mobile agent technology, users can assign a plurality of mobile agents to

perform the whole task rather than a single request in the network with the asynchronous, autonomous collaboration. After accomplishing the task, through the switching mechanism the agent monitors whether the user is online, if online it transmits data results back to the user.

(3) It supports heterogeneous platform environment and possesses robustness and the strong ability to tolerate faults. Distributed network computing platform is often heterogeneous, while mobile agent is usually independent of specific software and hardware environment. Its operation is related only to the running environment related rather than specific network structure, network protocol and operating system. As long as the network node is provided with a mobile agent runtime environment, mobile agent can move and operate across platform. Mobile agent supports off-line computing, which greatly reduces the requirement of network reliability. At the same time, its adaptability to non-expected situations makes it relatively easy to build robust distributed system with good tolerance of faults.

3. Function Design of Higher Vocational Colleges' Teaching Resource Library based on Mobile Agent

The design of intelligent shared professional teaching resource library is divided into six function modules: navigation system, resources management system, user management system, interactive space system, incentive and evaluation system, mobile agent system, the overall function framework is shown in figure 1.

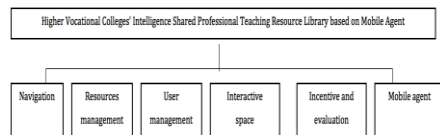


Fig. 1: The overall function framework of Professional Teaching Resource Library

3.1. Navigation system

Resources navigation system is based on traditional classification method and Tag technology, whose function is mainly reflected in two aspects, namely, resource classification and resource search, equivalent to the resources catalogue of resource library. Through this system, users can learn the scope, type, and form of resources, recommended resources and newest resources, etc.

I. The Resource Classification

Resource classification is to create a list of resources classification. Resources of teaching resource library is first classified according to profession, and further divided based on professional construction standards, teaching materials, excellent courses, network courses, and certificate examinations. In the classification of resources, profession classification is in line with the standards of "management measures for profession classification in general higher education and higher vocational education" issued by the Ministry of Education and teaching materials are classified on the basis of "technical specification of education resource construction", combined with the teaching resources storehouse construction in Higher Vocational Colleges content classification. Excellent courses, network courses mainly integrate the links to existing high-quality courses and network courses. Certificate examinations include relevant learning resources or videos for professional certification exams.

II. Resource Search

The user can search teaching resources by classification or keyword and the retrieved teaching resources can be browsed or downloaded.

III. Resource Statistics

Real-time statistics about the total number of all kinds of resources are automatically generated and displayed after each classification label.

IV. Resource Recommendation and Update

Resource recommendation includes recommended excellent courses, and excellent teaching information, while resource renewal refers to the real-time display of the latest resources.

3.2. Resource Management System

Resource management system includes: resource upload, resource download, resource query, resource statistics, resource customization, resource deletion, resource collection and other functions.

Resource upload: to allow teachers and teaching staff to upload single or multiple resources after login.

Resource download: registered users can download free teaching resources.

Resource audit: audit manager is mainly responsible for reviewing the resources uploaded by teachers to determine whether to release the resources.

Resource query: resource library provides multiple queries according to profession, curriculum, media type, tag, title and so on. The user can search by setting the corresponding keyword.

Resource customization: on the basis of their own interests and knowledge focuses, users can use the RSS subscription system to subscribe relevant channels and keywords, so as to keep up-to-date on the resources they are concerned about even without logging in resource platform.

Resources deletion: resources auditor or system administrator can delete non-standard and overdue resources.

Resource statistics: automatically generate real-time statistics of browsing and downloading various resources, to determine the degree of demand of various resources, so as to show the usage of resources.

Resources collection: Summaries of profiles enable users to collect resources they need and are interested.

3.3. User Management System

There are three main types of users of professional teaching resource library: system administrators, teachers, students. Users of different types have different requirements on the function, efficiency, security of the system.

Teachers and students are the main users of the system. After registration, they can log in and use the system such as browsing, retrieving, uploading, downloading, and commenting on resources and so on.

Mainly through the backstage library operation, the system administrator examines user registration, grasp the basic information of the user, give different permissions for the teacher and the student respectively, and give them permissions of maintaining system data such as adding, deleting, and modifying records.

3.4. Interactive Space System

The interactive space is similar to the forum, which collects users' common questions and offers corresponding solutions. When the resource library user encounters a problem, he can search the answer from questions library. If there is no related solution, he can ask either ordinary people or experts for help.

3.5. Evaluation and Incentive System

The evaluation and incentive system mainly uses the Digg mechanism in Web2.0 to stimulate the enthusiasm of resource library users for "everyone can construction resources", enhance the quality of resources and realize the sustainable development of re-

sources. Library resources mainly use the score, comment and vote to evaluate the resources in the library resources.

3.6. Mobile Agent System

Mobile agent system is an important part which displays intelligent behaviors of professional teaching resource library system. In this system, according to the needs, a computational entity encapsulates the related information and the statement to enable the agent to automatically transfer to a remote computer or cloud server repeatedly, perform the task and return to the user machine, thus reducing the network congestion. In the whole process of the task execution, user machine is unnecessary on the web. Only when the agent returns, the client machine needs to be hooked up on the network. This allows the interruption of network connection, so it can overcome the network delay, reduce the time of network occupancy, improve network utilization, fast respond to users' interactive requests and realize the intelligence and interaction of the teaching resources sharing.

Professional teaching resource library designed by the author consists of five agent modules.

I. User Agent

The user agent is the only interface between the user and the system. After completing the tasks in the different place, it will offload the user's request information, returning the needed information or providing follow-up communication service in the process of non-terminating communication. The user agent can carry the user's request information for retrieval and interact with the system. In addition, it can provide the user with friendly and personalized usage interface. In the interactive process, the user agent receives the user feedback on the satisfaction with teaching resources retrieval, monitors the user's retrieval and browsing behaviors and analyzes implicit feedback information of the user's behaviors. As a result, it can obtain the relevant resources the user is interested in and the degree of his interest, and provide that information for the learning agent.

II. Analysis agent

While the system retrieves teaching resources, analysis agent is generated, whose main function is to analyze the retrieved data, extract the features of the document and present the structuralized feature attributes of the document. The analysis is conducted mainly through calculating the frequency of the retrieved keyword in resources and the membership between the unit document and the keyword. Then the agent deposits the attributes of the membership and keyword frequency in the reasoning machine of the analysis agent.

III. Learning agent

The learning agent uses machine learning techniques to study the relevant feedback of the user, dynamically adjust the user model and the dictionary to achieve higher precision of search. User model shows the user's interest and intention, for the purpose of expressing and stimulating the user's interest. The machine learning technology of learning agent mainly uses the genetic algorithm. The learning process is both the process of both the user's relevant feedback and cultivating the user's interest.

IV. Evaluation Agent

Evaluation agent is the combination of industry evaluation and school evaluation. According to server configuration, the client terminal generates industry evaluation agent and school assessment criteria agent. These two agents work collaboratively, instantaneously sharing industry and school evaluation standards, adjusting dynamically and achieving high intelligence, high sharing of assessment criteria module in the professional teaching resource library.

V. Process Agent

The process agent is the combination of enterprise production flow and student's learning process. According to server configuration, the client terminal generates the enterprise production flow agent and the student's learning process agent. These two agents work collaboratively, instantaneously sharing production flow and learning process, adjusting dynamically and achieving high intelligence, high sharing of flow module in the professional teaching resource library.

4. Implementation of Higher Vocational Colleges' Professional Teaching Resource Library Based on Mobile Agent

4.1. Analysis of the overall framework of software development

Teaching resource library platform adopts the browser / server (Browser/Server, referred to as B/S) model. The technology used in the development is ASP.NET, which separates the HTML language from the source, to make the front Webpage designers and developers perform their own tasks respectively. The advantages, such as low coupling making the system more efficient and reusable codes, greatly improve the efficiency of system development.

Based on C/A/S (client / mobile agent / server) mode, a main agent on the server is responsible for generating the mobile agent sent to the client, packing data information needed for professional teaching resource library and then loading the information to the mobile agent. After the mobile agent enters the client, it generates the agent on the client. The framework of the system development is shown in figure 2.

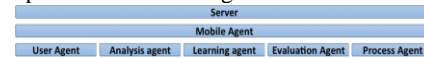


Fig.2: framework of developing the professional teaching resource system

4.2. The platform and tool for the system development

Professional teaching resource library should be simple and convenient, with unified user interface, so the teaching resource library system adopts the B/S pattern based on Web. Taken into account many factors, such as leading technology, security and stability, speed, operating efficiency etc., Microsoft Visual Studio.NET is chosen as development tool. The ASPX Webpage developed by Visual Studio.NET has the advantages that once compiled it can be used repeatedly, which is superior to the Webpage program developed by traditional ASP technology. In the process of connecting the library, the latest ADO.NET technology in Visual Studio.NET is used to connect the remote SQL Server2005 library, by using the three-layer architecture, to insert, update, delete data or perform other maintenance operations.

4.3. System Storage and Security Analysis

I. Storage type

Professional teaching resource library is a platform for storing, managing and sharing resources. Resources contain many types of media and a large quantity of data. If the design scheme of the resource storage is not reasonable, the management and usage will be more complex, resulting in the confusion in the management and usage and affecting the whole system performance. Therefore in the system design, the storage structure of the system resources should be studied in detail to form a reasonable storage scheme.

The professional teaching resource library system designed by the author mainly stores teaching resources of one college, so there are not too many data. In addition, in the storage type, the system stores all the related resources in a specific server which serves all usages of the resources. As a result, this system possesses high

degree of integration, managerial convenience, while its drawback is high requirement for the physical properties of the server.

II. Security Strategy

First of all, security of the server should be ensured, which includes installing the latest system patches, making up for the known system vulnerabilities etc. Secondly, in devising the virtual path for resource module operation, defining reasonable rules is required to ensure the safety of the virtual path.

Secondly, in the process of the program operation, the scope of resources the user can use is determined according to the login information of the user. Constructed middleware uses a variety of information defined within the system library to determine the scope of available resources.

Finally, as for the library security design, because a large amount of information stored related to security and resource metadata is stored in the library, the leak or loss of the information can cause huge losses to the whole system. In order to prevent leakage of information in the library, we can use encryption to protect the library.

4.4. Analysis and Design of the System Library

The standardized library design is an important indicator in measuring whether a library application system is perfect or not. Library is the basis of the teaching resource library system and the operation of the system. Rationality, integrality and maintainability of the library structure are the basis of the normal operation of the system. Constructing the library is the first step and one of the most important steps in system development. The standardized design of the library makes the library have high logic and physical performance. Standardization is to simplify the complex links between the attributes, generating a set of more simple relationships as each step forwards. Finally the attributes of these relationships functionally depend on the keyword interdependently and completely, and there only exists the form of functional dependency. An optimal library design can surely improve the efficiency of the system. In order to improve the operation efficiency of teaching resource library, the system uses the effective library design technology. What's more, it uses the E-R data model in data modeling, abstracts and extracts all the entities and their relationships, and thus deriving relationship tables between professional teaching resource libraries.

5. Conclusion

This paper analyzes the technical advantages of mobile agent technology in distributed computing, devises an intelligently shared professional teaching resource library system in Higher Vocational Colleges based on mobile agent. To solve the problems existing in current vocational colleges' professional teaching resource libraries, such as lack of intelligence and sharing, low integration with industry, etc., this system adopts the mobile agent technology in resource library system, makes full use of the fea-

tures of mobility and intelligence of mobile agent, to effectively improve the intelligence as well as sharing of resource library system.

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