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Research and Design of Digital Learning Resource Management System in Meteorological Adult Training Based on Cloud Computing

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Abstract: In this paper, we describe the design of digital learning resource management system based on cloud computing in meteorological adult training. This paper mainly introduces the overall structure and design strategy, function design, structure design and database design of the learning resource management system. It is to provide teachers and students convenient access to resources. The design concept of the system is unified function, cooperative development, centralized sharing, distributed storage. It realizes the integration of all kinds of multimedia data, unifies data construction specifications and classification standards, and provides standard interface management.

Keywords: Learning resource management system, cloud computing, system design

1. Introduction

Based on the design concept of unified functions, collaborative development, centralized sharing and distributed storage, Digital Learning Resource Management System based on Cloud Computing in Meteorological Adult Training (LMS-CC-MAT) integrates various multimedia data, unifies data construction norms and classification standards, and provides a standard interface management multimedia data construction environment on the basis of existing teaching platforms and teaching resources. It facilitates the branch and provincial training to actively participate in the construction of resources. It realizes the multimedia data construction environment with convenient data update, perfect system function and good application performance.

2. Function Design

The system takes media data digital storage, multimedia teaching resource management, search and recommendation resources as the core. It collects teaching materials from books, Internet, industries, work and life, and establishes a logical relationship with documents, images, audio, video, animation and other types of materials. The core functions of the system include uploading, cataloging, retrieval, storage management; download output, transcoding transmission, copyright management, in addition to user management, system management and other functions.

2.1 Upload module

The main function of upload module is to collect compressed or uncompressed digital file materials stored on traditional media and uploaded on the network, generate digital media data objects, and generate corresponding original cataloging information. With the function

of automatic key frame extraction, it provides the necessary basis for fast retrieval. The system can compress the material digitally with broadcast quality and convert it into streaming media, network video and other formats for data exchange.

2.2 Cataloging module

All kinds of learning resources and materials must be cataloged into the library. The cataloging system classifies the archived materials in a unified, scientific and standardized way, so as to turn the unordered information into orderly resources. This module provides structured processing and labeling of teaching materials, and supports the realization of shot segmentation, key frame extraction, content feature extraction, automatic extraction of labels and manual labeling labels, etc., which provides the basis for fast and efficient search of materials in comprehensive utilization.

Due to the wide range of online courseware resources, it is necessary to support a powerful cataloging system, which is suitable for large-scale cataloging production and management of pipeline, and is suitable for different cataloging needs of various types of resources such as high-definition audio and video, three-split screen streaming courseware, SCORM courseware, etc.

2.3 Query and retrieval module

Learning resources information query is the result of the catalog and data storage.The system supports a variety of compound retrieval methods, and the retrieval method based on media content is added to the traditional retrieval method.It supports to query according to various subject headings, keywords, speakers and other elements to achieve retrieval efficiency and accuracy of retrieval results. Based on the multimedia collection and cataloging of the material, the query terminal can not only use the original retrieval system to query the text and picture information of the material, but also browse the low bit stream material through the network.

Retrieval can be divided into the following categories, including full-text retrieval based on annotated content, retrieval based on visual content, retrieval based on examples, retrieval based on images, etc.The retrieval module should be independent and meet the combination of users' needs. At the client side, the structure of the whole system can be obtained through a retrieval interface. Data search lists can be automatically formed for the retrieved data.The system allows users to submit a download application, and the download application status is visible.

2.4 Catalog review module

The cataloging review module is to complete the final review of all cataloged and submitted teaching materials and learning resources from the state of "cataloging to be reviewed". Catalog review should contain different functions such as review, call back, and cancel review. All cataloged information, after being reviewed by professional cataloging and archiving staff, is formally stored in the archived learning resource database for easy retrieval, download and reuse.

2.5 Download module

LMS-CC-MAT can save the digital media data, then download or transfer to other systems to achieve browsing, viewing, editing and other needs. It supports fast positioning playback that is accurate to the frame, and supports downloading of program lists.It supports data conversion. It can convert digital files into DVD, streaming media and other formats, and makes intelligent code stream adjustment according to network conditions.

2.6 Transcoding module

The system fully supports the interconversion between various video and audio formats, and is committed to applying to mainstream video and audio formats to ensure the efficiency of format conversion, the success rate of conversion and the quality of transcoding. The system supports all kinds of video and audio equipment and collecting, editing and broadcasting systems for meteorological distance education, aiming to improve the efficiency and quality of video and audio production, management and broadcasting. This module can quickly transcode video and audio files of various formats, transcode courseware resources of various formats. It is compatible with all domestic non-editing software, courseware editing software, with the most flexible scalability and good usability and it is convenient for users to edit and use data.

2.7 Statistics and analysis module

Statistics and analysis module can timely understand more system information, including visitors, visit rate, teaching resource utilization rate and so on. It can understand the changing trend of teaching resources in real time, understand the scale of effective coverage of users and other important information. For example, through the statistical analysis of the target user characteristics of the use of teaching resources, it can provide an important basis for the collection and construction of teaching resources.

2.8 Statistics and analysis module

This module mainly includes parameter setting, log management, backup management, user management, permission management and security management. It has a three-level account management mode of "person-role-permission". It supports logging and query functions and supports automatic backup and recovery management of databases. The system sets secret levels for teaching resources, from low to high, and requires users with corresponding permissions to access operations to ensure the confidentiality of teaching resources. In addition, according to different users for storage space, departments, permissions, processes and other aspects, the system will carry out a comprehensive personalized settings and management.

2.9 Statistics and analysis module

The system provides a user account for each operator, and the user account is unique for each operator. Only after the user name and password have been verified, you can use the system. The system has detailed log records for each operation of each user and network administrator. The system administrator can add and delete personnel, departments and columns; establish the login password of the personnel, the setting of personnel permissions, system log management and so on.

3. Structure Design

LMS-CC-MAT is developed by B/S model. Based on the distributed network environment, this system constructs a platform to share multimedia resources and various materials for digital teaching and learning. This structure can improve the security of the system, effectively reduce the cost of system development and maintenance, and adapt to the changing needs of the business. It can effectively improve the concurrent processing ability of the system.

No specific software is required to be installed on the client, and the client can access the server simply by using an Internet browser. With a simple click of the mouse, you can access information in databases such as text, images, audio, video and animation by

browsing the web. The system is relatively simple to maintain. There's almost no development work to do on the client side. However, most of the work is focused on the intermediate transaction logic layer and the back-end database layer. The three-layer B/S mode prevents users from waiting for the processing results when they query a large amount of data and cannot process other tasks, and also solves the time delay caused by the system processing complex logic. The advantages of using the three-layer structure include: the programmer can care about a certain layer of the overall system structure; the interdependence between layers is reduced; it is conducive to the standardization of modules, but also is conducive to the reuse of logic at each layer.

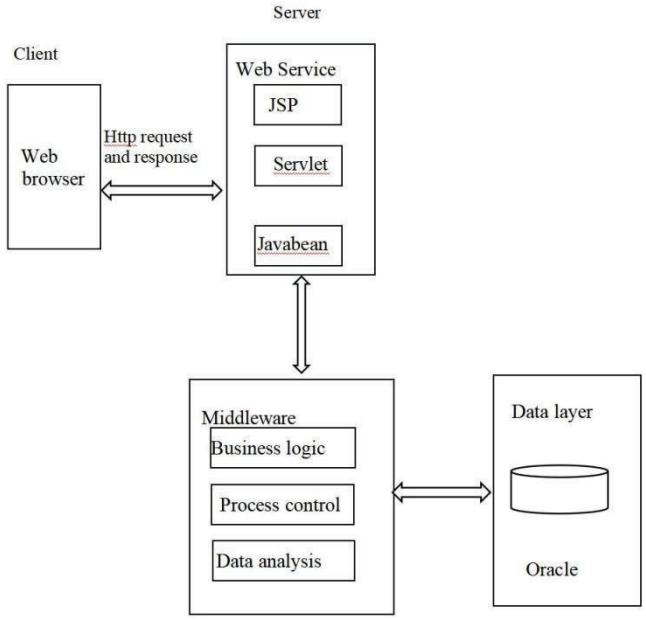

Figure 1. Three-layer application system architecture diagram.

4. Overall Architecture and Design Strategy

The overall architecture includes application layer, data logic layer and database layer.

4.1 Application layer

The application layer includes teaching resource management subsystem, teaching resource browsing and retrieval subsystem, teaching resource statistical analysis subsystem.

4.2 Data logic layer

The data logic layer establishes the information flow between each system and database, and the external data interface includes the teaching resource management system interface, the training file management system interface, and the Single Sign On (SSO) interface.

4.3 Database layer

The following four logical databases will be built in the database layer: basic information database, courseware database, teaching case database and tutoring database.

LMS-CC-MAT adopts B/S model, based on open source J2EE architecture design, integration of Web2.0, Spring, Strusts, Hibernate, Ajax and other frameworks, to achieve advanced and complete enterprise application environment. The design concept of SOA is applied to realize data exchange through interfaces. The SSO mechanism is used to implement authentication and trust access. Based on WebLogic application middleware and Oracle RAC enterprise-class database cluster, the application system is stable. Link Load Balance and P2P technologies are used to ensure efficient network utilization. CDN technology is used to distribute and share data.

A network storage System based on the Internet Small Computer System Interface (ISCSI) technology provides massive storage. Digital Watermark technology is used to embed hidden marks in digital multimedia data by means of signal processing to achieve copyright protection of multimedia data. Using SVN (SubVersion) technology, the version management of multimedia data is realized.

In the program implementation, using the advantages of B/S structure design, we use JSP+Ajax+XML+Xhtml+css+div technology and Oracle database to achieve the data platform.

5. Conclusion

In this study, we propose a cloud-based digital learning resource management system design model for online training, that allows learners and teachers to explore a variety of real open learning resource data.Online learning resource management system allows learners to explore the content they want to learn through other means than the content designed by the researcher. This actually shows that shows the learners' commitment to the exploration of the topic, and online guided query mode can increase students' learning motivation.

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