

Python Learning Platform on the Web Service Side

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Abstract: In the dynamic and ever-evolving realm of computer technology, online learning has emerged as a prominent and transformative trend. This paper embarks on an exploration into the nuanced development of a sophisticated web service-side Python learning platform, with a pronounced focus on enriching the online facets of Python course studies. Proposed is a web service-side Python learning and sharing platform that prioritizes cost-effectiveness and user-friendliness. This platform not only addresses the real-time progress monitoring and tailored learning task needs but also facilitates diverse resource sharing, embracing images, audio, video, and animations. The platform encompasses a spectrum of innovative functionalities, ranging from seamless Python learning resource uploads to the streamlined downloading of courses, culminating in an interactive space for vibrant community discussions. These meticulously designed features are strategically positioned to not only elevate the efficiency of the learning process but also to adeptly navigate and alleviate administrative complexities. As the demand for flexible and accessible education continues to surge, this platform stands as a beacon, offering learners a comprehensive and user-friendly environment. It strives to empower individuals to seamlessly engage with intricate Python programming concepts, fostering collaborative learning experiences within a dynamic and supportive online community.

Keywords: Python Learning; Online Education; Website Development; Informatization Education; Foundational Platform Architecture; Cloud Computing

1. Introduction

1.1 Project Background

The web environment demands educators to adapt to new teaching paradigms, providing more avenues for information access and breaking free from spatial and temporal constraints. With the rapid development and widespread adoption of the Python programming language, its versatility has become even more apparent. Influential Python educational software such as MOOCs [1] and CSDN have gained widespread acceptance among learners, and almost every learner has such software on their mobile devices. However, these existing Python learning applications pose challenges in terms of the workload for developers and difficulties in content uploading.

In contrast, a Python learning and sharing platform developed on the web service side offers a cost-effective solution with easy maintenance and low development costs [2]. It is highly convenient to use, making it an attractive option for Python learners. Simultaneously, to alleviate the load on the local server, innovative utilization of Tencent Cloud storage services has been implemented. This approach significantly expands storage capacity, lightening the burden on the local server. Furthermore, it enhances the availability and reliability of resources [3].

2. System Analysis

2.1 Development Objectives

The development of the Python learning and sharing new media platform on the web service side aims to provide Python enthusiasts with an efficient and user-friendly method for acquiring knowledge. Learners can easily monitor their learning progress in real time and receive tailored learning tasks based on their individual learning patterns, thus

enhancing their learning efficiency. Leveraging the convenience of the internet, the platform promotes resource sharing through various formats such as images, audio, video, and animations, which empowers lifelong and self-directed learning for students. It facilitates opportunities for learning both inside and outside the classroom, thereby expanding students' autonomous learning capabilities.

2.2 Technical Requirements

The technologies employed by the website meet the development requirements effectively. The utilization of the B/S architecture and JSP technology enhances the user experience. The integration of the MySQL database ensures the system's data environment is more reliable. In terms of functionality, the maturity of the Python programming language is well-suited to meet the diverse development needs.

(1) Web-based Database System: The foundation of the website relies on a database, necessitating the use of web technologies for database management, which includes data storage, retrieval, and updates. And the database has been migrated to the cloud platform. In a cloud computing environment, there are typically cloud database services that enable the deployment of databases in the cloud. This implies that the storage, management, and maintenance of the database are handled by the cloud service provider rather than the local server, significantly alleviating the load on the local server.

(2) JAMstack(JavaScript 、 APIs 、 Markup)Website Architecture: The architecture of the website is its core, involving website layering, modules, interfaces, caching, and more. It requires the use of web technologies. JAMstack is highly suitable for microservices architecture, enhancing both performance and security.

(3) Web Programming: Web programming is at the heart of the website, encompassing aspects like webpage layout, images, text, forms, scripts, etc., and requires the use of web technologies such as HTML, CSS, JavaScript. Front-end interactions are handled using JavaScript to manage the website's interactivity and dynamism, without involving server-side rendering. Server-side functionalities are provided through third-party service APIs, and data is obtained from backend services via APIs, achieving

decoupling between the front and back ends. Static HTML files are pre-generated during the build process rather than dynamically generated upon request. Various Content Management Systems (CMS) are employed to manage website content, transforming content into static files.

(4) Website Server and Security: The website server is the core of the website, involving deployment, maintenance, and security aspects. Deploying the database in the cloud platform allows the cloud database to easily scale based on demand, adapting to changes in scale and load. Additionally, cloud databases typically have multiple data centers and backup mechanisms to ensure high availability and redundancy of data. Cloud platform providers often offer automatic backup and disaster recovery features, ensuring data security and reliability. Cloud database services also provide a user-friendly management interface, streamlining the configuration and monitoring processes of the database.

2.3 System Functions

(1) Curriculum System: Offering a range of Python courses including basic Python, advanced Python, and Python project development.

(2) Learning Resources: Providing learning materials for various levels, such as basic Python learning materials, advanced Python learning materials, and Python project development materials.

(3) Online Coding: Supplying a Python online coding environment that enables learners to engage in real-time coding practice [4].

(4) Online Discussions: Establishing a Python learning discussion forum for learners to share experiences and solve learning issues.

(5) Community Interaction: Creating a Python learning community, allowing learners to form exclusive Python learning exchange communities.

(6) Technical Support: Offering professional Python technical support to help learners resolve any technical issues encountered during their studies.

3. System Design

3.1 System Function Module Design

Based on the requirements analysis, the functional structure diagram of the system can

be obtained as shown in Figure 1. The platform primarily serves the needs of users, including teachers, students, guests, and administrators. The platform management module includes specific functionalities like path configuration, data upload settings, and data permission management settings. The course module encompasses course addition, deletion, modification, management of course materials, and resource downloads. The assignment module involves teacher online assignment creation, modification, and assignment management, as well as a notification publication module, notification modification module, message replies, privacy settings, and permission settings.

(1) Python Material and Courseware Upload Function: The transmission of information and resources is fundamental to the teaching process, and the construction of a resource repository is of utmost importance. High-quality resources are essential to ensure the quality of online education.

(2) Python Video and Courseware Download Function: Rich teaching resources are an effective means of enhancing students' information literacy. Students can not only engage in online communication and learning but also download resources for real-time and on-site study, significantly improving the effectiveness of teaching [5].

(3) Student User Management Function: Teachers or administrators can use the platform to publish notifications, update teaching information, monitor students' activities, and manage users. They can also set permissions, delete records, and add or remove records in the platform's database [6].

(4) Community Q&A and Communication Function: This serves as a bridge for communication between teachers and students. It allows individuals to log in and communicate, either under their real identities or as guests, to seek answers to questions, provide feedback on the platform, and address any concerns. This function promotes the sharing of implicit knowledge, and teachers can facilitate discussions through the platform's backend.

(5) Routine Maintenance Function of the System Platform: Administrators can perform data maintenance and security tasks, including adding, deleting, and modifying modules, managing users, resources, and logs, among

other administrative duties.

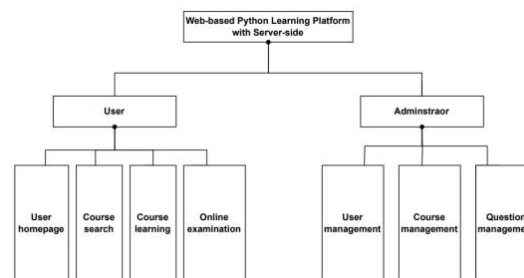


Figure 1. System Functional Structure Diagram

3.2 Database Design

The educational system holds a substantial amount of user information, making it essential to ensure the security of the database. Considering both economic and security factors, we have chosen MySQL as the database for the current system development to mitigate the risk of personal information leakage. In summary, MySQL database aligns perfectly with our system requirements, offering exceptional adaptability and can serve as the database engine for the system [7].

(1) User Registration Table

The user registration table is used to store and manage user information, with different permissions assigned to administrators, teachers, students, and guests. Different registration levels are set, where "level" represents the authority, with 0 for administrators, 1 for guests, 2 for teachers, and 3 for students. Administrators have the authority to select user roles and perform filtering, while teachers have the ability to remove users [8].

(2) Resource and Courseware Management Table

The resource and courseware management table is primarily used for resource management, including functions such as adding, uploading, modifying, setting review permissions, and deleting. Specific data fields include name, size, notes, course, author, and other related information.

(3) Discussion and Announcement Table

The discussion and announcement table is used to store news and message posts, containing data such as titles, comments, authors, and related information.

4. System Implementation

4.1 Technical Requirements

4.1.1 User homepage implementation

When users access the system, they will see an introduction to Python courses. The course homepage primarily displays various courses, allowing users to select and watch videos based on factors such as video view count or likes.

4.1.2 Course search implementation

In configuring the database connection within the application, utilizing cloud database services involves obtaining connection details such as connection strings or host addresses, port numbers, usernames, passwords, etc. These details are used to configure the application to connect to the cloud database. Create the necessary databases and table structures within the cloud database. Ensure that the database structure meets query requirements and, if necessary, create indexes to enhance query performance.

4.1.3 Course learning implementation

After logging into the system, users can click on a course and choose to start learning. In the course learning interface, users can access Python course materials through the web browser's video player. Additionally, they can use the built-in virtual machine system on the website for Python coding practice. During the learning process, users can engage in communication and discussions with other learners using the community Q&A and communication features [9].

4.1.4 Online exam implementation

After completing a course, users can evaluate their learning outcomes through a theoretical and programming exam. In the online exam interface, users can input their answers based on the knowledge they've acquired. When they submit their answers, the system will automatically score their responses according to the predefined correct answers and display the results [10].

4.2 Administrator Function Module

4.2.1 User management

The User Management module implements two functions: firstly, viewing all users, and secondly, adding and viewing users. As depicted in the sequence diagram of the user management module in Figure 2 to view all users, a request is sent to the backend AdminController using the "allUser" method.

This method in turn calls the "selectAllUser" method in "userBiz" to make a request to the UserBiz interface. The UserBiz interface queries the database based on the specified conditions and returns the final results [11].

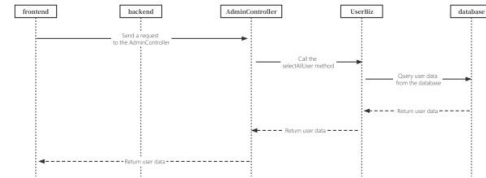


Figure 2. Sequence Diagram for User Management Module

4.2.2 Course management

In the course management page, the administrator can view all the courses in the system and perform operations such as listing, viewing detailed information, and deleting courses. The course management sequence show in Figure 3. When the administrator clicks on "View All Courses," the system sends a request to the AdminController, which then uses the courseBiz service layer to call the selectAllCourse method in the CourseMapper to retrieve all course information from the database. The retrieved results are stored in the Session scope with the name "courses" and sent to the "View All Courses" page. In the course viewing page, the <c:forEach> tag from the JSP tag library is used to iterate through each course's information and display it on the page. Course management sequence diagram

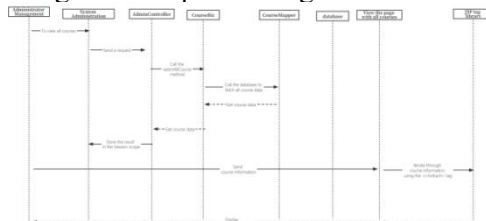


Figure 3. Course Management Sequence Diagram

4.2.3 Question management

Administrators can perform various operations on related questions, such as adding, deleting, modifying, and querying questions through the question management interface.

5. Conclusion

This paper primarily focuses on the construction of a web service-side Python course learning system. It accomplishes the overall functional design of the system and demonstrates the implementation of system

functionalities through test writing. This ensures the practical fulfillment of personalized learning needs for different students. By deploying the local database to the cloud platform, the system effectively alleviates the burden on the local server. Additionally, deploying a static website on the platform significantly enhances security. While static websites have relatively limited interactivity, the use of JavaScript frameworks can achieve a certain level of interaction, allowing client-side processing of user input, page updates, and state management. Simultaneously, communication with backend services through API calls enables data retrieval or transmission. This enables static websites to dynamically obtain data at runtime and exhibit dynamic behavior. Using JavaScript libraries like jQuery can simplify DOM operations, event handling, and dynamic content updates, thereby enhancing interactivity and elevating security and operability.

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