Design of an Online Vocational College Employment Guidance Course Teaching Platform Based on the Internet

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Abstract: This design focuses on employment guidance courses in vocational colleges and proposes a solution for an online teaching platform based on the internet. Firstly, it analyzes the employment development needs of vocational college students and presents functional requirements for online submission, review of employment plans, and teacher-student interviews. It then conducts system analysis, including user role definition, business modeling, and data modeling. Based on this, it completes the network architecture design, functional module design, database design, and interface prototype design. In terms of technology implementation, popular technologies such as Java, Spring Boot, Vue, etc., are selected. Specific solutions for authentication, plan review, and interview appointments are designed, and performance testing is conducted. Overall, this design provides a solution for improving the quality of teaching services in vocational college employment guidance courses through demand analysis and platform design, offering a valuable reference for further enhancements and applications.

Keywords: Online learning; Vocational colleges; Employment guidance

1 Introduction

The rapid development of vocational education in China has made it increasingly important to improve the quality of teaching and employment guidance in vocational colleges. The use of online and mobile technologies supports the development of blended learning models that combine online and offline elements. This design focuses on employment guidance courses in vocational colleges and explores how online learning platforms can enhance teaching methods and improve the learning experience. Firstly, functional requirements are proposed based on the employment development needs of vocational college graduates. Then, user roles and business processes are clarified through system modeling analysis. Based on this, network architecture, functional structure, database models, interface prototypes, and implementation using technologies such as Java, MySQL, Vue, etc., are designed. Performance testing validates the design's effectiveness. This design provides a solution for using online learning to enhance the quality of teaching services in vocational college employment guidance courses and has practical significance. Further enhancements and applications will be pursued in the future [1].

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2 Related Technology Analysis

2.1 Technology for Online Learning Platforms

Online learning platforms primarily adopt the B/S architecture, utilizing web and database technologies to create online learning environments. Common technologies include HTML5, CSS3, JavaScript, PHP, Python for server-side scripting, as well as databases like MySQL and MongoDB. The core of the platform is the Learning Management System (LMS), which handles functions such as course content management, user management, and progress tracking. Representative open-source systems include Moodle and Canvas. Deploying the online learning platform via cloud services provides flexible server resources and achieves high scalability [2].

2.2 Application of Data Mining Technology in Educational Analysis

Educational analysis involves using data mining techniques to analyze the learning behaviors of teachers and students and provide personalized teaching support. Key technologies include clustering analysis, association rules, text mining, and more. For example, analyzing student forum posts can reveal thematic keywords and identify the focus of student learning interactions. Association rules can analyze the correlations between students' video watching, practice, and discussion participation, providing learning recommendations. Additionally, text mining technology can analyze student-submitted assignments to understand their focus areas and knowledge states, enabling natural language processing [3].

2.3 Platform Information Security Technology

Online learning platforms store a significant amount of user data, making information security crucial. Key security protection technologies include identity authentication, access control, data encryption, vulnerability scanning, and more. Identity authentication ensures that legitimate users access the platform through usernames, passwords, or biometric features. Access control implements role-based permission control. Sensitive data is encrypted during storage and transmission to prevent leaks. Regular penetration testing and vulnerability scanning are conducted to identify potential security risks. Furthermore, limiting the permissions of backend administrators and monitoring log audits are important security measures [3].

3 System Requirements Analysis and Modeling

3.1 Business Process Analysis

The business process of employment guidance courses primarily includes students submitting employment plans, teachers reviewing and providing guidance, students improving their plans based on feedback, and teachers giving final approval. The online learning platform needs to implement an online submission and review process for employment plans [4]. The specific activity diagram is shown in Figure 1.

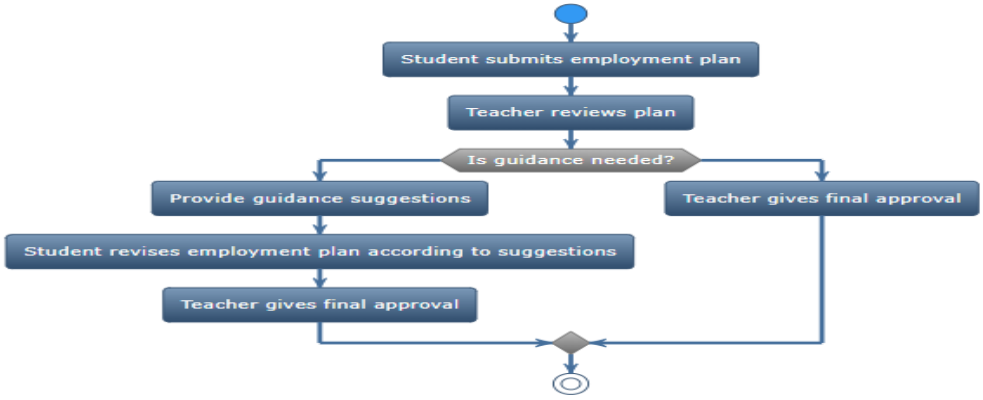

Figure 1: Business Process Activity Diagram

3.2 Functional Requirements Analysis

Based on surveys conducted with vocational college employment guidance teachers and students, we have identified the following functional requirements for the online learning platform. For students, the platform should provide the capability to submit and revise employment plans and schedule appointments with teachers. Teachers' functionalities should include reviewing students' employment plans, providing modification suggestions, and issuing interview notifications. Additionally, the system itself needs to incorporate features like plan version control, business process management, and interview calendar management to ensure the efficiency and organization of the entire employment guidance process. These functions collectively constitute a comprehensive online learning platform designed to assist students in better planning and preparing for their careers while facilitating the management and guidance work of teachers [5].

3.3 Non-Functional Requirements Analysis

Non-functional requirements for the online learning platform focus on performance, security, and availability aspects. Firstly, performance requirements specify that the platform should support a maximum of 2000 concurrent users while ensuring response times are less than 2 seconds to ensure a smooth and efficient user experience. Security requirements emphasize the use of account and password login mechanisms and SSL encryption during data transmission to ensure the security of user information and communication. Lastly, availability requirements mandate that the functional code coverage of the entire platform should exceed 90% to guarantee platform stability and reliability. These non-functional requirements are crucial for ensuring the high-quality operation of the online learning platform in all aspects, safeguarding user security and privacy, and providing an efficient and stable learning and working environment [6].

3.4 System Modeling

1.User Role Modeling

Define the set of user roles:

$$R = \{r_1, r_2, r_3\} \quad (1)$$

Where r_1 represents the "Student" role, r_2 represents the "Teacher" role, and r_3 represents the "Administrator" role.

Define the mapping between roles and permissions:

$$P = \{p_1, p_2, p_3, p_4\} \quad (2)$$

$perm(r_1) = \{p_1, p_2\}$, $perm(r_2) = \{p_2, p_3\}$, $perm(r_3) = \{p_1, p_2, p_3, p_4\}$

Where p_1 represents the "Submit Plan" permission, p_2 represents the "Review Plan" permission, p_3 represents the "Publish Notification" permission, and p_4 represents the "Account Management" permission.

2.Business Rule Modeling

Logic for Approval Decision:

Approval Decision = (Valid Plan Format) $\wedge$ (Complete Plan Content) $\wedge$ (Plan Quality Meets Standards)

Where "Valid Plan Format" refers to the document format meeting the requirements, "Complete Plan Content" means all content elements are present, and "Plan Quality Meets Standards" indicates compliance with quality rating criteria.

3.State Transition Modeling

Set of Employment Plan States:

State Set: $\{s_1, s_2, s_3\}$(3)

Where s_1 represents "Pending Submission" state, s_2 represents "Pending Review" state, and s_3 represents "Approved" state.

Event Set: $E = \{e_1, e_2, e_3\}$(4)

Where e_1 represents "Student Submission" event, e_2 represents "Teacher Review" event, and e_3 represents "Teacher Approval" event.

State Transition Function: State t+1 = Transition Function(State t, Event)

For example, if the state t is s_1 (Pending Submission) and the event is e_1 (Student Submission), then the state t+1 is s_2 (Pending Review).

4.Data Relationship Modeling

Relationship between Employment Plan Entity and Student Entity:

Employment Plan (Plan ID, Student ID, Plan Details)

Student (Student ID, Student Number, Name, Major)

Join Expression: Employment Plan $\bowtie$ Student = (Plan ID, Student Number, Name, Major, Plan Details)

5.Interface Constraint Modeling

Using the "Submit Plan" interface as an example:

Preconditions: The logged-in user must have the role of a student.

Postconditions: Add a new employment plan record with the status "Pending Review.

4 System Design

4.1 Network Topology Design

The network design adopts a three-tier C/S and B/S architecture for flexibility and scalability. The client layer consists of responsive web and mobile UIs using Vue and ElementUI. The application layer is built on Spring Boot, integrating authentication, business logic and RESTful APIs, deployed on Tomcat for efficiency. The storage layer utilizes a MySQL database with 10 core tables for complex data operations. A gigabit network card and TCP/IP protocol connect the application and database servers for high-speed, secure data transmission. Clients access the application server via HTTP/HTTPS, ensuring convenient and secure access. This comprehensive design meets system performance and security requirements while enhancing availability and maintainability [7].

4.2 Functional Structure Design

In the functional structure design, the identity authentication module uses Spring Security combined with JWT tokens to provide secure and flexible user authentication, including account/password login and support for third-party logins. The planning submission feature allows students to save their employment plans to the database by filling out forms and uploading files, with support for checking the format of uploaded documents. Plan reviews are conducted by teachers, who can query plans pending review, provide review comments, and upload review result documents. Interview management enables students to schedule interview times, and teachers can publish interview arrangements, integrating calendar management to optimize scheduling. Regarding permission control, the system manages access permissions to menus and buttons based on different user roles and provides a user-friendly permission configuration interface in the backend for intuitive and flexible permission management. These designs collectively create a comprehensive, user-friendly, and secure online learning platform that meets the needs of different user groups while improving overall system efficiency and usability [8-9].

4.3 Database Design

Using PowerDesigner to draw an ER diagram, we have designed 10 core tables including users, plans, reviews, and more.

User Table: User ID, Name, Email, Password, Role

Plan Table: Plan ID, Student ID, Title, Document URL, Submission Time, Status

Review Table: Review ID, Plan ID, Teacher ID, Comments, Results, Time

Interview Table: Appointment ID, Student ID, Teacher ID, Time Slot, Status

5 System Implementation

5.1 Platform Framework Setup

We selected Spring Boot 2.2 + MySQL 8.0 + Redis 5.0 to build the backend of the system, using Maven for dependency management and building. The frontend is developed using Vue.js + Element UI. We used Docker Compose for one-click deployment in development, testing, and production environments.

5.2 Implementation of Functional Modules

Identity Authentication: Stateless authentication is implemented using JWT tokens, with tokens stored in Redis for validation.

```
// Java pseudo-code: Generate JWT token and store it in Redis
public String createJwtToken(UserDetails userDetails) {
    // Create JWT token
    String token = Jwts.builder()
            .setSubject(userDetails.getUsername())
            .setIssuedAt(new Date())
            .setExpiration(new Date(System.currentTimeMillis() + JWT_TOKEN_VALIDITY * 1000))
            .signWith(SignatureAlgorithm.HS512, secret)
            .compact();
        // Store the token in Redis
    redisTemplate.opsForValue().set(userDetails.getUsername(), token);
    return token;
}
```

Planning Submission: Implement the uploading and parsing of DOCX files, and verify the number of pages and words in the document.

```
// Java pseudo-code: Parse docx file and check page and word count
public boolean validateDocxFile(MultipartFile file) {
    // Parse docx file
    XWPFDocument document = new XWPFDocument(file.getInputStream());
    int pageCount = getPageCount(document); // Custom method to calculate page count
    int wordCount = getWordCount(document); // Custom method to calculate word count
    // Check if page and word count meet requirements
    return pageCount <= MAX_PAGE_COUNT && wordCount <= MAX_WORD_COUNT;
}
```

Plan Review: Integrate a workflow engine to enable teachers to review plans following a defined process.

```
// Java pseudo-code: Use workflow engine to handle plan review
public void processPlanReview(String planId) {
    // Start a workflow instance
    workflowEngine.startProcess("planReviewProcess", planId);
    // Additional workflow logic
}
```

Interview Appointment: Utilize task scheduling to check for any scheduling conflicts in the appointment times.

```
// Java pseudo-code: Check for appointment time conflicts
public boolean checkAppointmentConflict(Date desiredTime) {
    // Check if the desired time conflicts with existing appointments
    return appointmentRepository.findConflict(desiredTime) == null;
}
```

Permission Control: Generate dynamic menus based on role permissions and implement button-level permission control.

```
// Java pseudo-code: Generate dynamic menu based on user role
public List<Menu> generateMenuForRole(String role) {
    // Fetch the appropriate menu items based on role
    return menuRepository.findByRole(role);
}
```

5.3 Performance Testing

During the performance testing phase, the system underwent three key testing processes to ensure its stability and security. First, concurrent testing was conducted, simulating the scenario where 2000 users accessed the system simultaneously using specialized testing tools to ensure that the system maintained a response time of less than 2 seconds under such high-pressure conditions. Next, through load testing, the system's elasticity was tested by implementing application auto-scaling using Docker, ensuring high availability even during spikes in user traffic. Finally, security testing involved conducting penetration testing on the interfaces to identify and rectify potential security vulnerabilities, ensuring the overall security of the system. These comprehensive performance tests not only improved the system's stability and reliability but also enhanced its resilience against large-scale user access and potential security threats [10].

6 Conclusion

In response to the needs of vocational college graduates for employment guidance, we have designed an online vocational college employment guidance course teaching platform.

Through requirement analysis, we have proposed functional requirements that align with the practical circumstances of vocational colleges, and we have carried out system modeling work, including user role definition and business process design. Based on this, we have designed the platform's network topology, functional structure, database model, and interface prototype. In terms of implementation, we have utilized mainstream web technologies such as Java and Vue to build a microservices-based system architecture. The functionality includes identity authentication, plan submission and review, interview appointment management, and more. Performance testing has been conducted to ensure the system's stability and reliability. In summary, the employment guidance course teaching platform designed in this paper is well-suited to serving vocational college students' online learning and communication needs, improving the quality and efficiency of employment guidance, and holds promising application prospects. Future work will involve further expanding functionality and deployment.

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