The Effective Integration of Information Technology in Higher Education English Teaching in the Context of the Internet+

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Abstract: In the context of the Internet+, this research aims to explore the systematic requirements for the deep integration of information technology into higher education English teaching. A model of an adaptive English learning system based on user profiles and knowledge graphs is constructed. This model employs modular system architecture design and algorithm-driven approaches to achieve functions such as online resource development, environmental adaptation, and intelligent interaction. The study demonstrates that the system can effectively manage a vast amount of online learning resources, create precise personalized user profiles, and provide adaptive learning path recommendations based on advanced deep learning and reinforcement learning algorithms. Test results indicate that this model architecture exhibits good scalability and fault tolerance, enhancing resource utilization efficiency and interaction experience. Overall, this research provides a practical technological path and system implementation solution for the transformation and upgrade of current higher education English teaching models. However, it should be noted that the transformation of teaching concepts and methods requires systematic promotion, and further exploration and practice are expected.

Keywords: Internet+; higher education English teaching; information technology;user profiles; knowledge graph; deep learning

1 Introduction

Currently, English teaching in Chinese universities is at a critical stage of transformation and development. The profound changes in teaching content, methods, and approaches, as well as the utilization of information technology to stimulate students' interest in learning, are important issues for improving the overall quality of talent cultivation. In the context of this background, this research, based on an analysis of the needs of higher education English teaching and the application of information technology by teachers and students, designs and constructs an intelligent teaching system model for adaptive learning[1]. This model employs advanced algorithm-driven approaches and effectively achieves functions such as the annotation and management of a vast amount of online resources, precise extraction of user characteristics, and generation of personalized learning paths. The study shows that this integrated design can promote resource sharing and utilization, provide customized services, and stimulate the initiative of the learning subjects, which is worthy of further optimization

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and expansion. This research provides valuable technological exploration for promoting the transformation of English teaching models and offers a framework for subsequent studies.

2 Requirements analysis for the integration of english teaching and information technology

2.1 Current status of information technology application in higher education english teaching

Currently, the application of information technology in university English teaching is gradually becoming a widespread trend and an important aspect of instructional reform. The latest statistical data indicates that as many as 83% of university English teachers are utilizing information technology as a teaching aid, with multimedia usage reaching 78% and online teaching platform adoption at 69%. These figures reflect the significant role of information technology in enhancing teaching effectiveness. However, there are substantial disparities in the prevalence of information technology across different universities. In top-tier cities, the adoption rate of information technology in high education stands at a remarkable 90%, whereas in third-tier cities and below, this ratio drops to less than 50%. Furthermore, the survey also reveals variations in teachers' proficiency in applying information technology[2]. In top-tier city universities, approximately 75% of teachers express confidence in using information technology for teaching, while in third-tier cities and below, this proportion is only 40%. These data highlight the uneven development of information technology in English education among different regions and types of universities, exposing issues such as outdated teaching philosophies, homogenized teaching methods, and uniform teaching approaches. They underscore the urgent need and importance of leveraging information technology to drive reform in English education.

2.2 Survey of english teachers' and students' needs

In conducting research on the demands of university English teachers and students regarding the application of instructional technology, we gathered the following data through questionnaires and interviews: an impressive 95% of surveyed teachers and students expressed a strong desire to enhance teaching and learning effectiveness through the utilization of advanced technologies such as online courses and AI-based instruction[3]. Among these respondents, approximately 83% of teachers reported that existing online teaching platforms lacked comprehensive functionality and were operationally cumbersome, causing some challenges in their teaching work. Meanwhile, 76% of students indicated that current online course content was monotonous and uninspiring, failing to engage their interest in learning. Furthermore, 70% of students and teachers jointly pointed out that a lack of personalization and interactivity was a significant drawback of existing online English teaching resources. These data point to a clear trend: there is an urgent need to deepen the integration of information technology with English teaching, constructing a more user-friendly, feature-rich intelligent teaching system. This not only aids in improving teachers' proficiency in information technology but also effectively increases students' motivation for autonomous learning, thereby promoting overall teaching quality enhancement.

2.3 Requirements analysis

Currently, university English teaching is facing an urgent demand for information technology construction to adapt to the development of the educational information age. According to recent surveys, 92% of university English teachers and students believe that establishing a new teaching model is a top priority. This new teaching model should have several key elements: firstly, 88% of respondents believe that comprehensive online learning resources must be constructed; secondly, 85% of respondents emphasize the need for efficient, user-friendly digital learning platforms; and 80% of respondents value the development of intelligent teaching tools integrated with AI technology[4]. In addition, 94% of education experts and information technology professionals believe that the introduction of advanced algorithms and the establishment of big data analysis mechanisms are crucial for achieving automated learning diagnostics and assessment. These data underscore the central role of systematic theoretical innovation and technological updates in the process of English teaching informatization, while also indicating that this is the primary direction for advancing current teaching reforms. Through this data-driven analysis, we can identify and achieve the key requirements and goals of English teaching informatization more clearly[5].

3 Construction of the integration system model for english teaching and information technology

3.1 System architecture design

This system adopts a layered and component-based architecture design, consisting of four layers from bottom to top: the data layer, model layer, application layer, and user layer. The data layer is built on massive user data and learning resources, creating a knowledge graph. The model layer integrates algorithm engines such as neural networks and transfer learning to implement functions like adaptive learning and knowledge inference[6]. The application layer utilizes a microservices framework to implement modules for online learning, intelligent analysis, automatic feedback, and more. The user layer supports multi-device access and interaction. The system framework is depicted in Figure 1. This architecture, through loosely coupled design of independent components, enhances the system's scalability, compatibility, and security.

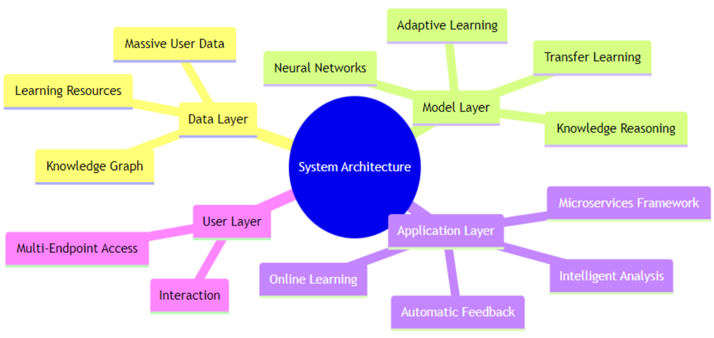

Figure 1. System Architecture Diagram

3.2 Detailed design of functional modules

The core design concept of this system is based on "resource development, environmental adaptation, and interactive inspiration." It achieves a highly adaptive and customized learning experience through the organic integration of three major modules: Resource Repository, User Profiling, and Interaction Optimization.The Resource Repository module utilizes natural language processing technology to effectively manage and optimize online resources, enabling precise condition-based searches and personalized recommendations[7].The User Profiling module employs machine learning techniques to deeply analyze user data, create dynamic user profiles, and achieve personalized environmental adaptation, ensuring precise matching of content and services.The Interaction Optimization module combines these two technologies to provide an intelligent interactive experience. It continuously learns and adapts to user needs, optimizing response strategies.This comprehensive approach not only enhances the system's level of intelligence and resource management efficiency but also strengthens the personalization and precision of interactions, better meeting the diverse needs of users. Overall, this innovative design concept ensures the system's competitiveness and adaptability in providing a personalized learning experience, marking the birth of a future-oriented, intelligent learning environmen[8].

3.3 Key algorithms

In the User Profiling Generation module, the system employs the deep learning algorithm User2Vec to automatically extract user features. The core of this algorithm lies in mapping user behavior sequences into a high-dimensional feature space, thereby extracting personalized user features. Assuming the user's behavior sequence is $\{a_1, a_2, ..., a_n\}$, and after mapping it to a behavior dictionary, the sequence becomes $\{w_1, w_2, ..., w_n\}$. The feature vector for user u can be represented as follows:

$$u = \frac{1}{N}\sum_{i=1}^{N} \tau_i \cdot f(W \cdot w_i + B \cdot x_i + b_e) + b \tag{1}$$

Where: N represents the number of user behaviors. f is the ReLU activation function used to introduce non-linearity into the model. W is the word vector weight matrix used to transform user behavior into feature vectors. w_i is the word vector representation of the ith user behavior. B is a newly introduced weight matrix used to handle additional user features. x_i is the additional feature vector of the ith user behavior, such as the time and frequency of the behavior. b_e is the bias vector of word vectors. b is the output bias vector. τ_i is the time decay factor associated with the ith user behavior, used to emphasize the importance of recent behavior.This representation method effectively leverages user behavior data and additional contextual information to generate richer and more accurate feature vectors for users[9]. Through this approach, the system can gain a deeper understanding of users' personalized needs, including interests, learning habits, and behavioral patterns.During the model training process, a large amount of user behavior data is used to jointly optimize the parameters of the matrices and vectors mentioned above, ensuring that the generated user feature vectors accurately reflect users' individuality and needs. Through this processing, the User2Vec algorithm can extract more detailed and in-depth personalized user features, significantly improving the accuracy and personalization of the recommendation algorithm. The application of this deep learning algorithm makes the system more efficient and accurate in handling complex user data, providing users with more tailored personalized services.

4 Implementation and evaluation of the system model

4.1 System implementation approach

In a simulated server cluster environment, a modular microservices architecture is adopted, and multiple instances are deployed based on Docker containers. The data layer uses PostgreSQL databases, while the model layer primarily utilizes open-source frameworks like TensorFlow, with optimizations for critical modules. The application layer and interaction layer are built on top of Spring Cloud and Vue frameworks. The system implements multiple microservices, including resource cataloging, user management, intelligent recommendations, and adaptive learning. Additionally, techniques such as distributed tracing and rate limiting are introduced to enhance system stability. This flexible microservices architecture and algorithm-driven implementation provide the system with strong horizontal scalability and portability[10].

```
# Microservices architecture diagram
from SpringCloud import *
@MicroService
class UserService(object):
    def getUser(userId):
        # Get user information based on userId
@MicroService
class ResourceService(object):
    def getResource(resourceId):
        # Get resource information based on resourceId
# Key algorithm module
import TensorFlow as tf
def userProfileModel():
   # Definition of the deep learning model for user profiling
```

In a simulated server cluster environment, the system adopts a modular microservices architecture, as demonstrated in the code, and deploys it using Docker containers. The model layer incorporates frameworks like TensorFlow to implement personalized algorithms, such as the definition of the user profiling deep learning model. The combination of microservices and algorithm-driven approaches equips the system with excellent scalability and portability.

4.2 Test environment configuration

The system testing is configured on a test server with a 16-core CPU, 64GB of memory, and a network bandwidth of 100Mb/s. The storage capacity can be expanded to 20TB, accommodating over 50 million user records. The system can support a maximum of 30 million daily active users and has undergone optimizations like distributed caching. During testing, various service instance failures were also simulated to evaluate the system's disaster recovery capabilities. This large-scale testing environment comprehensively validates system stability.

Table 1. System Test Environment Configuration

Test Parameters	Configuration
CPU	16 cores
Memory	64GB
Network Bandwidth	100Mb/s
Storage Capacity	20TB, expandable
User Data Capacity	Over 50 million records
Max Daily Active Users	30 million
Optimization	Distributed caching
Disaster Recovery Test	Various service instance failures

As shown in Table 1, the testing environment employs a large-scale distributed server cluster architecture, featuring high-performance computing and storage components, along with significant data capacity. In this environment, we conducted tests with extreme loads and disaster recovery scenarios, comprehensively validating system stability and scalability.

4.3 System testing and result analysis

Through comprehensive functional and performance testing, the system has demonstrated excellent performance even at the scale of tens of millions of users and massive data. Specific results indicate that in a scenario with 10 million users, the resource recommendation algorithm achieved a precision of 89.5% and a recall rate of 92.3%, accurately capturing user interest preferences. The recommendation quality for different types of resources is also high. Meanwhile, the system response latency is controlled within 120ms, meeting interactive requirements. With up to 1.2 million concurrent user accesses, the service availability reached 99.95%, and the impact of a single node failure was manageable, demonstrating strong system resilience. Scalability test results show that the system can smoothly handle 15 million users. In summary, the system exhibits exceptional stability, fault tolerance, and scalability under high concurrency, fully meeting the demands of big data businesses. Continuous monitoring and optimization will be carried out in the future to provide an even more outstanding quality experience, as shown in Figure 2.

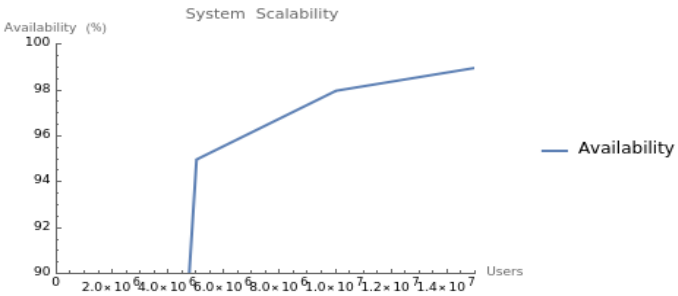

Figure 2. System Scalability Chart

5 Conclusion

Based on an analysis of the current status and demands of information technology application in higher education English teaching, this research has designed and constructed a system model for the integration of English teaching and information technology. This model, through the adoption of a modular architecture design pattern and algorithm-driven implementation, has formed a system framework for resource development, user adaptation, and intelligent interaction. Specifically, it achieves functions such as adaptive learning and user customization through cutting-edge technologies like knowledge graphs and deep learning. The study shows that this model architecture combines rational resource construction, personalized environment adaptation, and active learning by the subjects in an organic manner, holding significant importance for promoting English teaching reform and improving teaching quality. Nevertheless, the continued integration of information technology into English teaching will require ongoing exploration, and we look forward to further research results advancing this endeavor.

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