# Design of an English Web-based Teaching Resource Sharing Platform based on Mobile Web Technology

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***Abstract*—Thanks to the booming technology of computers and multimedia, student-centered online teaching resource platforms have become an important way for students to learn. However, English teaching resource platforms at the present stage fail to effectively integrate the massive and scattered learning resources. Based on this, the study proposes an English online teaching resource sharing platform based on mobile Web technology, using the SOAP protocol to deploy heterogeneous data resources as Web services to achieve interchangeability between heterogeneous resources. In addition, to enhance the efficient use of learning resources by students, the study proposes a hybrid algorithm based on collaborative filtering algorithm and sequential pattern mining algorithm to achieve personalized sequential recommendation for students. The results show that the platform created by the study exhibits excellent performance in terms of resource transfer capability, achieves efficient teaching resource sharing in a short response time and also shows that the proposed recommendation algorithm is highly accurate.**

***Keywords*—Web service; SOAP; English teaching resources; sharing platform; personalised recommendation***

## I INTRODUCTION

With the continuous promotion of education reform, the value of online education has begun to emerge, which has a positive impact on the development of education in all disciplines [1]. English, as a basic language discipline, in the process of combining with online education, in addition to its own development towards diversification and multidisciplinary integration, it also acts as the language carrier of other disciplines [2]. Therefore, English teaching research is particularly important. At present, many colleges and universities are organizing English teachers and educational technicians to integrate teaching resources, develop online courses, provide students with a good internal environment, and realize the sharing of teaching resources [3]. However, the current multimedia resource sharing platform has caused the problem of excessive platform resources due to insufficient recommendation accuracy and low efficiency [4]. In this way, teachers need to carry out a lot of repeated work, and students and teachers' information acquisition ability is insufficient to improve teachers' teaching efficiency and students' learning autonomy [5]. In order to effectively integrate heterogeneous and dispersed English teaching resources and improve the quality of online English education, the research is based on mobile Web technology and resource recommendation optimization, and an online English teaching resource sharing platform is constructed.

The education platform is constructed by means of resource replacement, access protocol, user information encryption and algorithmic assistance. The MD5 algorithm is designed based on SOAP to ensure the user's information login security. In order to provide personalized learning services for students at different levels, a hybrid optimization algorithm recommendation model is proposed based on collaborative filtering algorithm and sequential pattern mining algorithm. The algorithm model can effectively improve the efficiency of recommendation, improve the accuracy of recommendation of English teaching resources, and better adapt to the current English education environment.

The research innovatively applies the combination of Web technology and English education resource recommendation method to the optimization of English education, providing a reference for the selection of the optimization direction of multi-class online education. In addition, the sequence mining method is incorporated into the collaborative recommendation algorithm, and the comprehensive efficiency of the recommendation algorithm is proposed, which provides a reference for the development of educational resource recommendation.

The research content mainly includes four parts. The second part is a summary of the research status of the construction of educational resources platform at home and abroad; The third part puts forward the construction of the English shared resources platform based on web services, Part A establishes the framework of the education resources platform, describes the construction of the MD5 encryption module, Part B constructs the online learning resources recommendation framework based on web logs, and specifically analyzes the optimization of the recommendation algorithm; The fourth part verifies the application effect of the English online teaching resource sharing platform. The results show that the English online teaching resource sharing platform based on mobile Web technology and resource recommendation optimization has good application effect.

## II RELATED WORKS

In a web environment, resource allocation is a very important issue [6]. Yuan et al. proposed a new neural network path sorting algorithm based on path sorting after improving and analyzing the traditional algorithm, and used a path sorting based on random walk patterns and a neural network path sorting algorithm to solve the link prediction problem in online learning [7] Gu designed a recursive algorithm-led online training model using a web programming language as an example, and by testing the web programming language, it can

be seen that this training method has greatly helped students' learning effect [8]. To further improve the development of online courses, Zhang scholars developed a Moocwas-based mobile learning platform, and the experimental results showed that the platform can well meet the multiple teaching and learning needs of learners [9]. Fang scholars developed an online teaching assessment system based on machine learning, which can effectively assess the quality of teaching and learning in schools, which has good application prospects [10]. To address the problem of schools only being able to teach remotely during the epidemic, Christianson designed a remote web poll to improve students' immediate engagement in a virtual environment, which experimentally proved to be positively experienced by students [11]. Scholars such as Zhou used a WEB web-based teaching platform, using principal meta-analysis and clustering algorithm to classify students' performance and evaluate their learning effectiveness, and the experiment proved that this function can effectively help teachers improve their teaching [12]. Zhang's team attempted to use blockchain technology in the sharing of English teaching resources, and through the analysis of its algorithm, designed a representation layer, business layer and data layer as the core English teaching resources sharing platform, but the process of building the platform was tedious and consumed a lot of human and material resources [13]. Scholars such as Park S E proposed a resource sharing platform based on collaborative recommendation algorithm and introduced it to a hybrid recommendation-based system in recommending learning resources, but as the security of the platform was not taken into account, making the platform vulnerable to malicious attacks [14].

With the advent of the "Internet+" era, education informatics is placing increasing emphasis on the use of artificial intelligence technology to improve teaching effectiveness and quality. In intelligent teaching, intelligent recommendation is the key to realizing knowledge resources. After analyzing and comparing existing personalized recommendation technologies, Xu proposed a personalized recommendation algorithm based on content recommendation and collaborative screening, and the experimental results showed that the personalized recommendation algorithm has high correctness and effectiveness [15]. Based on the user interest model, Li et al. generated a user profile file by classifying the user's queries and generating a snapshot of the user's personal information through point-and-click, and the experimental results showed that the user profile was highly similar to the user's interests [16]. Chaabi's research group proposed a user interest model from a generalized to a specific hierarchy, which can effectively differentiate the interest characteristics of different classes [17]. Ohtomo et al. argue that users' interests when reading news can be divided into two categories, short term interests and long-term interests, with short term interests tending to be related to the timeliness of popular information and changing rapidly, while longer term interests tend to reflect users' real interests [18]. In contrast, Chen's team used a multi-strategy machine to build long-term and short-term interest patterns, and through an in-depth analysis of this system, a new content-based fusion algorithm was proposed and designed [19]. To improve the efficiency of the recommendation model, Wang combined the recommended content with a collaborative filtering algorithm to provide a specific model for the actual and potential hybrid algorithm, and experimental results showed that the knowledge resource-based recommendation system was effective in improving the usability of the collaborative filtering part [20].

From the research of many scholars, it can be seen that the current research of online English education platform is still in the stage of rapid development, and the development of educational resources and the efficiency of the promotion of educational recommendation ability still do not match. In order to further improve the efficiency of recommendation and the utilization of resources, a resource sharing platform based on Web technology is designed. The collaborative filtering algorithm and sequential pattern mining algorithm are organically combined to form a new hybrid recommendation model, which aims to contribute to the research of English education resource recommendation.

## III Web Technology Practice for English Online Teaching Resource Sharing Platform

### A. Design of a Web Service-based English Shared Resource Platform

The intelligent network mobile teaching platform can provide learners with rich teaching resources and a student-oriented teaching environment. However, due to the wide distribution of network teaching resources, the diverse and complex structure of network resources between different campuses and the inability of data resources to cross the restrictions of platforms and firewalls, the resources between campuses cannot be shared effectively, resulting in the waste of campus teaching resources [21]. In order to solve the above problems, the study combines both sides of the teaching body with the trial module and builds an English resource sharing platform, using resource replacement - access protocols - user information encryption and algorithmic assistance to optimize the design of the platform system.

Service Oriented Architecture (SOA) is a component model that connects different functional units of services in an application by defining clear interfaces and contracts. web services are an effective way to implement SOA by abstracting applications and resources in a unified form through a standardized approach to service usage and by supporting It supports the sharing and collaboration of teaching and learning resources in a distributed environment. Among the technologies related to web services, web services are often used to solve integration problems across web applications due to their loosely coupled nature. Compared to traditional technologies, it not only solves the problem of incompatibility between heterogeneous systems, but also allows any user to make changes to the mechanism without affecting the normal operation of the platform. SOAP uses hypertext transfer protocol as the carrier form to achieve the construction of SOAP message structure model under the construction of each SOAP sub-element to ensure the integrity of SOAP messages, and the XML model as the encoding method for the exchange of resources, and its specific exchange process is shown in Fig. 1. The specific exchange process is illustrated in Fig. 1.

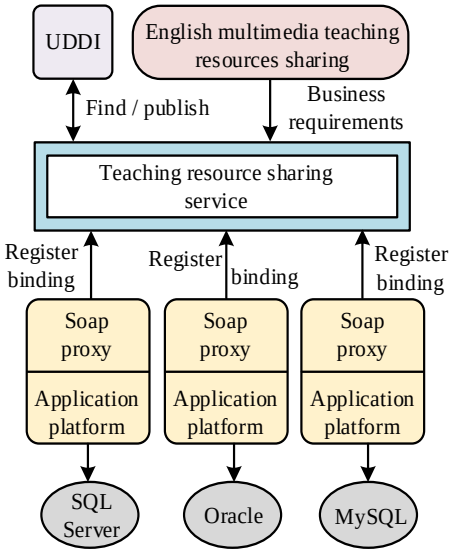



Fig.1. SOAP resource exchange process.

SOAP can effectively ensure that network service providers can realize the query of resource data, information update and sharing of different data types of each database. In order to further ensure the normal operation of the English multimedia resource platform and the confidentiality and security of user information data, the study is based on the MD5 information abstraction algorithm to accelerate the security of the platform information while ensuring high-quality services for users and realizing the optimal design of the platform security. The MD5 algorithm can effectively extend the length of the data and achieve a continuous distribution of bits at intervals of 512 times, thus forming a combination with regularity. Under the assumptions of the four MD5 $F(a,b,c)$, $G(a,b,c)$, $H(a,b,c)$, $I(a,b,c)$ basis by bit can be expressed as eq. (1).

$$\begin{cases} F(a,b,c)=(a\&b)\left|((\square a)\&c\right. \\ G(a,b,c)=(a\&c)\left|(b\&(\square c))\right. \\ H(a,b,c)=a\wedge b\wedge c \\ I(a,b,c)=b\wedge(a\left|(\square a)\right.) \end{cases} \tag{1}$$

$Y_j$ $j$ The conversion of the grouping of $(a,b,c)$ can be achieved in the form shown in eq. (2).

$$a_j=b+((a+X(b,c,d)+Y_j+t_i)<<<s) \tag{2}$$

In the study the buffer corresponding to the MD5 algorithm is used as the link variable and the derivation of the message digest is implemented with the help of the buffer, which is represented as shown in equation (3). And after defining the four link variables, the weights corresponding to the variables are transformed with the help of equation (1) to realize the message data in order to achieve the confidentiality of the user information.

$$\begin{cases} A=0X01234567 \\ B=0X89abcdef \\ C=0Xfecba98 \\ D=0X76543210 \end{cases} \tag{3}$$

When the MD5 algorithm is used to verify user information on the resource sharing platform, it uses Ra random values to achieve circular encryption processing of the scheme, and increases the types and combinations of verification information data to reduce malicious attacks by illegal users and avoid leakage of user data, thus strengthening the overlay encryption of data, and its verification process is shown in Fig. 2.

When the information scheme is encrypted, in order to avoid the loss of resources under the platform due to the increased number of calibration repetitions, the server adds random values with immediate time characteristics to the string generation process by forming a completely new string from the random value R, the user password PW, the current time TIME and the address of the SIP connection protocol, as shown in eq. (4).

$$RA=R\left|TIME\right|SIP \tag{4}$$

The client also encrypts the plain text of the received password, as shown in eq. (5).

$$PW'=K(PW) \tag{5}$$

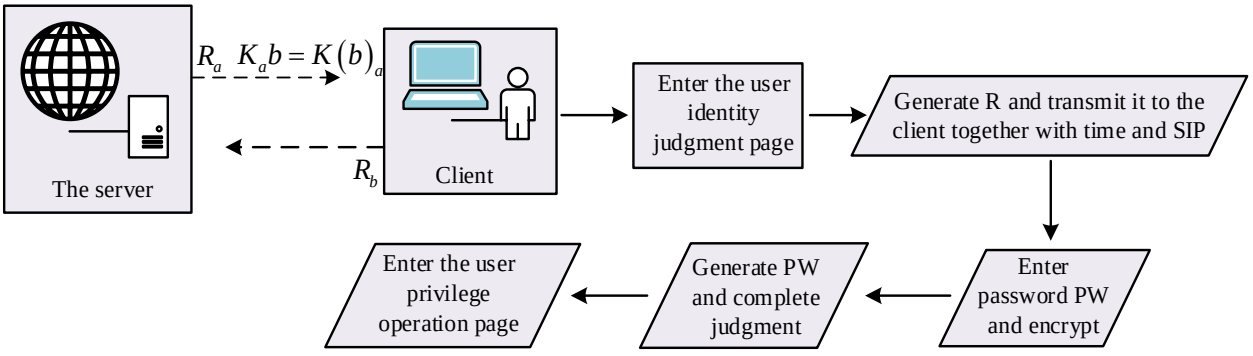



Fig.2. User identity verification process.

The server processes the generated sequence in depth using the MD5 algorithm to obtain the end-user's credentials and sends the MD data to the server, a process defined by eq. (6).

$$MD = MD5\left(R_a \left| PW'\right.\right) \tag{6}$$

The server application uses the MD5 algorithm to verify the encrypted text of the user's password and sends a confirmation message; the encrypted text is sent to the client and the passage of the user's credential information is used as a signal to achieve login. The research proposes a teaching resource platform that can effectively introduce SOAP into the construction of the platform to meet the demand characteristics of different users, on the basis of including the teaching sides module and the auditor module, and build a resource platform based on the cloud computing environment, whose overall structure as shown in Fig. 3.

As can be seen in Fig. 3, the software structure of the cloud computing environment as a platform for carrying content is divided into three layers: a data access layer, a business logic layer and a user performance layer. The data access layer enables the upload, audit and publication of learning materials and the download of matching resources with a list of completed learning materials, i.e. the resource download interface allows the setting of resource download links and binding them to the key values of the corresponding source files, providing users with an efficient resource download function. Finally, the audit resource fields and page call methods are retrieved by the teaching audit module to ensure that the resource platform can achieve good audit and coverage of all learning resources and thus continuously enrich the types of teaching resources to meet the learning needs of students.

### B. *Web Log-Based Online Learning Resource Recommendation Framework Design*

As the amount of information carried on the Internet continues to grow, information referral methods have also flourished. In the vast amount of learning resources, it is difficult for learners to quickly find the information that meets their needs [22]. Therefore, the study proposes a hybrid recommendation algorithm based on the web-based learning platform logs by analyzing the logs of the above-mentioned web-based shared English learning platforms to uncover the characteristics of the resources and the preferences of users in the web environment. The hybrid recommendation algorithm combines a collaborative filtering algorithm and a sequential pattern mining algorithm in order to achieve a personalized recommendation model with real-time adaptability to the learning platform. The goal of collaborative filtering is to filter out data with similar characteristics from the database to form a single dataset, making the data as differentiated as possible between datasets based on different points of interest, while data belonging to the same dataset are as similar as possible. Assuming that each user in the learning platform for online educational resources $x$ corresponds to a set of learning resources $I_x$, where the resource $i \in I_x$, which represents that the user has studied this resource $i$, has also been rated by the user, the user's scoring matrix for the resource is shown in Fig. 4(a).

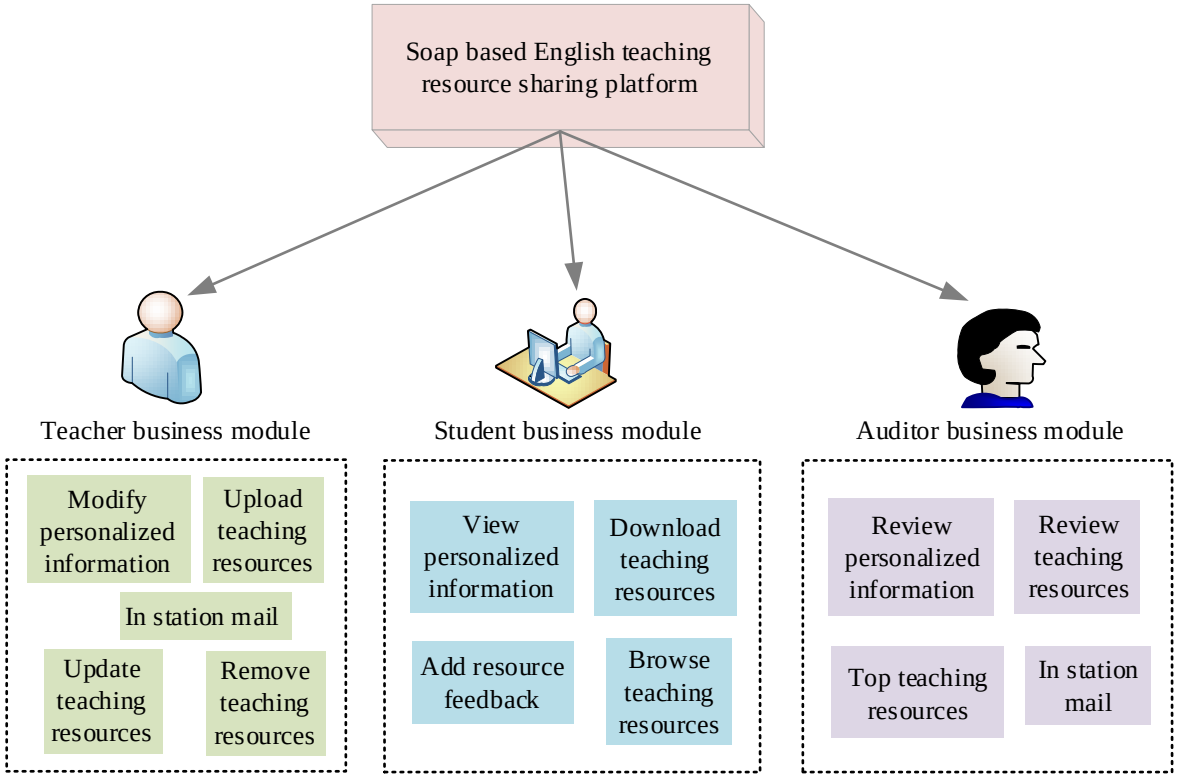
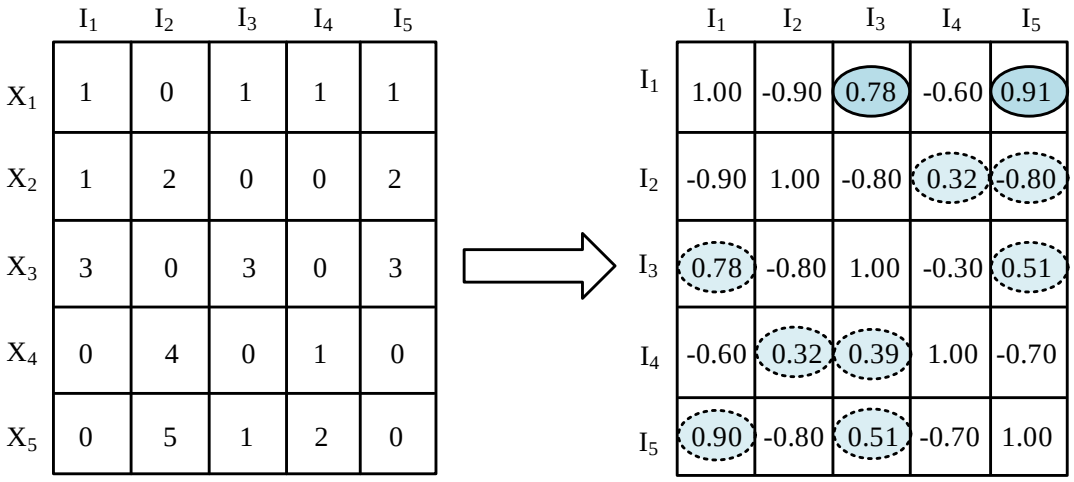



Fig.3. Schematic diagram of English multimedia teaching resource sharing platform based on SOAP.




(a)User-Item matrix (b)Similarity matrix

Fig.4. User resource rating and similarity matrix between resources.

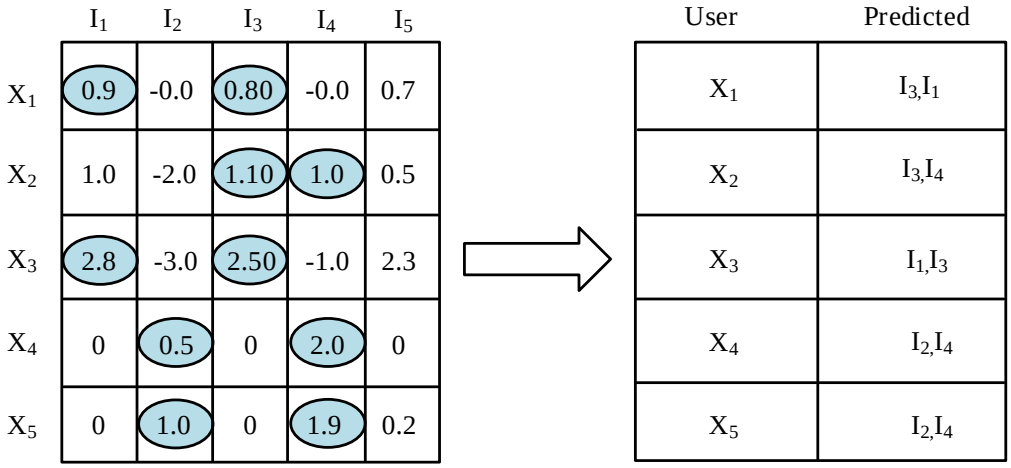
Adjusted Cosine Similarity (ACS) is used to measure the similarity of two learning resources $i$ and $j$ as shown in eq. (7).

$$sim(i,j)=\frac{\sum\left(R_{x,i}-\bar{R}_x\right)\left(R_{x,j}-\bar{R}_x\right)}{\sqrt{\sum\left(R_{x,i}-\bar{R}_x\right)^2}\sqrt{\sum\left(R_{x,j}-\bar{R}_x\right)^2}} \quad (7)$$

In equation (7), $R_{x,i}$ denotes the score rated by the user $x$ for the resource $i$, $R_{x,j}$ denotes the score rated by the user $x$ for the resource $j$, and $\bar{R}$ is the total mean value of the ratings given to the resource by multiple users. From the user-resource rating matrix in Fig. 4(a), a similarity matrix between different resources can be derived, as shown in Fig. 4(b). The additional $k$ ($k \square n$) resources that have the highest possible similarity to the current resource are selected to form an ensemble of resources that are highly similar to the current resource. From equation (8), the possible values of the preferred resource $i$ for each user $x$ can be predicted.

$$P_{x,i}=\frac{\sum_{t\in N}\left(sim(i,t)*R_{x,t}\right)}{\sum_{t\in N}\left(\left\|sim(i,t)\right\|\right)} \quad (8)$$

In equation (8), $N$ represents a set of resources similar to the resource $i$ and $R_{x,t}$ is the rating given to the resource by its user $i$ $x$. The predicted result matrix is shown in Fig. 5(a), while Fig. 5(b) shows the set of resource suggestions that are likely to be preferred for the user.




(a)Prediction matrix (b)Collection of preferences of different users

Fig.5. User prediction preference matrix.

The set of user-preferred resources generated by the collaborative filtering algorithm is obtained by similarity, and the order of these resource recommendations does not follow a specific learning path. Since the process of learning English is coherent, the list of recommended resources displayed in the learning platform should follow the learning path of the English subject. The study introduces a sequential pattern mining algorithm based on a collaborative filtering algorithm to arrange the list of English learning resources according to the learning order. In the web-based teaching platform, the key to the sequential pattern mining algorithm is to search for a series of resources that meet the least supported order of learning frequency on a specific set of input data sequences $S$, each list is a sequence of frequent learning resources, the specific algorithm flow is shown in Fig. 6.

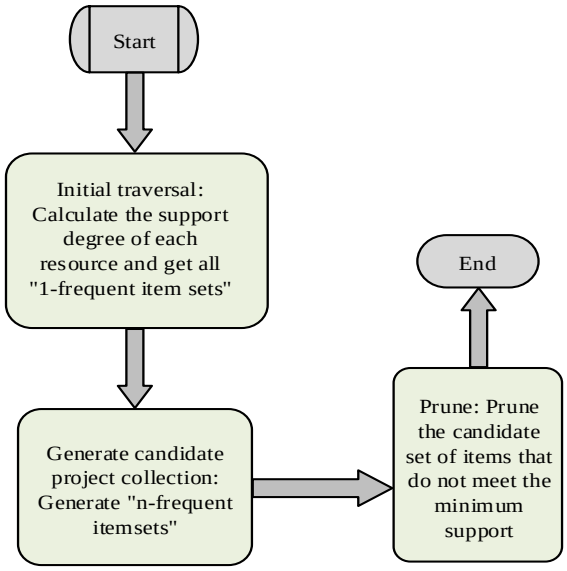



Fig.6. Flow chart of sequential pattern mining algorithm.

As can be seen from Fig. 6, the support degree of each resource is calculated during the initial search, and the set of all 1-frequency elements is obtained after the initial search, and the candidate set of n-frequency elements is generated from the set of n-1 (n>1) frequency elements. Finally, the candidate sets that do not meet the minimum support are removed by pruning branches. Since users may change their interest in learning content over time when they are learning online, the user resource scores in the web logs do not objectively reflect the current user ratings and interests in the learning resources. The study introduces a damping function in the collaborative filtering algorithm to adjust the weight of learning resources rated by previous users, as shown in eq. (9).

$$Weight = \frac{2}{1+e^{-(t-t_0)}} \tag{9}$$

In equation (9), $t_0$ denotes the current time, and the closer the learning resource is to the current time, the higher weight is given to it, and the process of calculating the similarity between resources is also given a higher weight, when $t \to t_0$, $Weight \to 1$ and $Value \to 1$. Since the calculation of similarity between resources is performed when the user is offline, when calculating the relevance of n resources, O(n2 ) space complexity is consumed to store the calculation results, increasing the space load and the efficiency of the recommendation algorithm decreases as the number of user visits increases. Therefore, the study selects only the most similar resources among the similar resources k as elements of the similar set in the computation process, which can greatly reduce the time complexity of the algorithm to a linear order of magnitude. In summary, the design of the study's proposed weblog-based online learning resource recommendation framework is shown in Fig. 7.

As can be seen in Fig. 7, offline pre-processing and filtering of user learning traces and resource records is performed to collect material that users may frequently access or want, and finally the merged resources are categorized according to the specific relationships between the different data to provide personalized services to users. And a tracking module is added to track whether users accept personalized recommendations from the platform as a way of tuning the data for future recommendations. To address the problem of new users with no learning history in online learning, the study groups and classifies new users based on the demographic information of users in the platform, and likewise groups and classifies new resources based on the resource topics in the resource database, thus solving the problem of cold processing in the design of the recommendation framework.

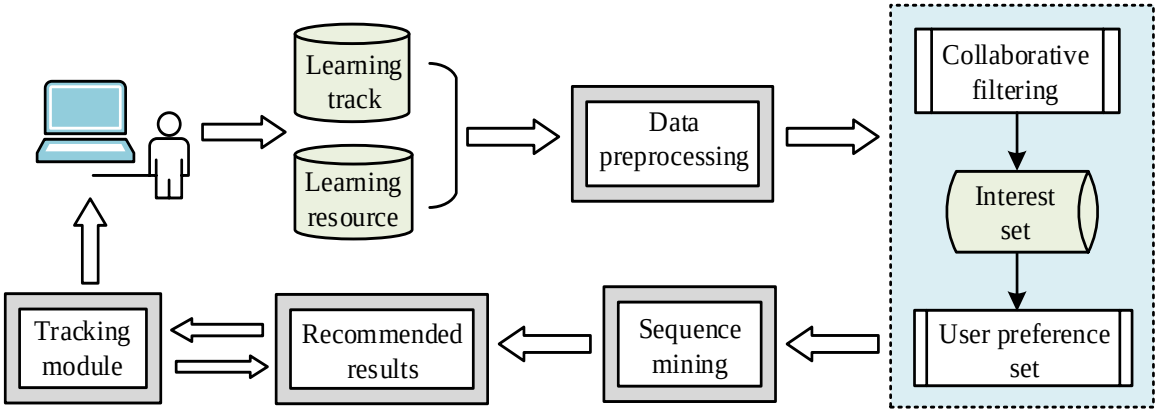



Fig.7. Web log-based recommendation framework for online learning resources.

## IV Simulation Testing of the English Shared Resource Platform and the Performance of Personalised Recommendations

In order to demonstrate the reliable performance of the researched and developed universal platform for shared resources (denoted as Platform 1), the collaborative recommendation-based English teaching resource management platform proposed by Hu Ting scholars (denoted as Platform 2) and the blockchain-based virtual English teaching resource platform jointly designed by WANG P and QIAO S H.E (denoted as Platform 3) were used as experimental control, and the three platforms were used as a common platform for real English multimedia teaching materials on virtual hardware of the same scale and hardware standard. To make the experimental results more intuitive and to better prevent the problem of low variability of performance data due to the low concurrency of the system, the study selected 1200 sets of concurrent data with similar configuration parameters for testing. In addition, each test lasted around 3 minutes to fully account for the impact of the virtual environment and to protect the web hosts from high concurrent loads. The resource upload throughput results for each platform are shown in Fig. 8.

As can be seen from Fig. 8, as the concurrency continues to increase, the number of resource interactions handled by Platform 1 is higher than the other two benchmark platforms, and the curve changes less than the other two platforms. This indicates that the platform proposed in the study has a good load balancing capability in handling resource sharing requests, with each node of the platform handling user requests, which distributes the concurrency evenly to each node, allowing more resource requests to be handled. A graph of the response time results for each platform is shown in Fig. 9.

As can be seen in Fig. 9, the response times of the platforms created by the Institute are all lower than the response times of the benchmark platforms. Due to network congestion caused by concurrent transmissions, the response times of the platforms created by Platform 2 and Platform 3 increased dramatically, while failing to meet the requirements of a wide range of users, thus extending the response time of the shared resources. The results show that the platform designed in this study performs better, has better response speed and processing speed, can respond to users' daily access needs, and has strong load processing capacity.

To test the superior performance of the personalized recommendation model designed in this study, the experimental design and recommendations were compared using a weighted evaluation criterion, and the experimental results with different parameter settings were analyzed. Before evaluating the performance of the recommendation framework, the effect of the size of the parameter similarity set and the variation of the minimum support on the experimental results were determined. The study recommends resources to users based on similarity sets of different sizes and calculates the corresponding REM values for different minimum support cases, and the experimental results are shown in Fig. 10.

As can be seen from Fig. 10, the REM value decreases as the similarity set increases. However, the curve does not change significantly when the set of similarity goes from 7 to 10. Considering that the spatial complexity increases as the set of similarity increases, the study chose a similarity set size of 6 as the optimal value for subsequent experiments. The REM value changes as the minimum support increases. The REM value decreases when the minimum support is 0.1-0.5 and increases from 0.15 onwards. Therefore, in order to obtain more accurate recommendations, the minimum support was set to 0.15 in subsequent experiments. After the optimal parameter values were obtained, the parameters of each algorithm were set to the best value chosen and then tested. The results of the resource recommendations were categorized into three cases. The results of the collaborative filtering algorithm, the results of the generic sequence extraction algorithm, and the results obtained by a hybrid algorithm of collaborative filtering + sequence mining consisting of weighting, switching and merging, noting the above algorithms as Algorithm 1, Algorithm 2 and Algorithm 3, respectively. In the experiments, users pre-selected and ranked the topics of interest and their browsing. Their browsing history was also recorded by the platform. The resources of interest recommended by the platform to the users were then processed and calculated by different types of hybrid models and the correct recommendations were compared with the actual recommendations using the REM formula. The comparison of the recommendation results of each algorithm is shown in Fig. 11 and 12.

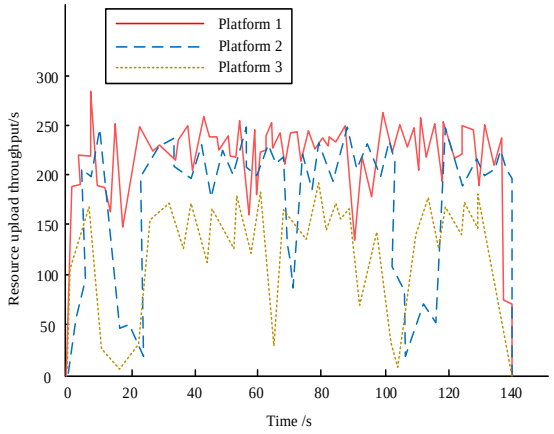



Fig.8. The upload throughput of English teaching resources on each platform.

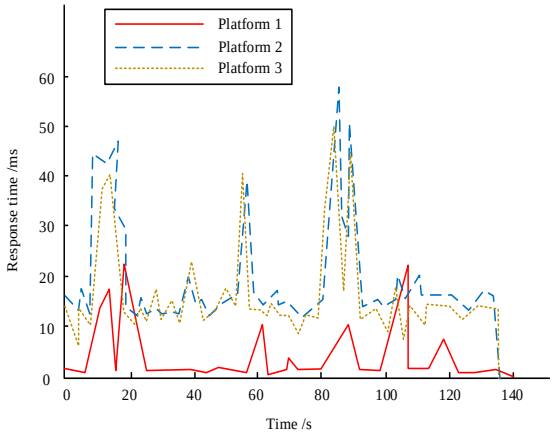



Fig.9. Response time by platform.

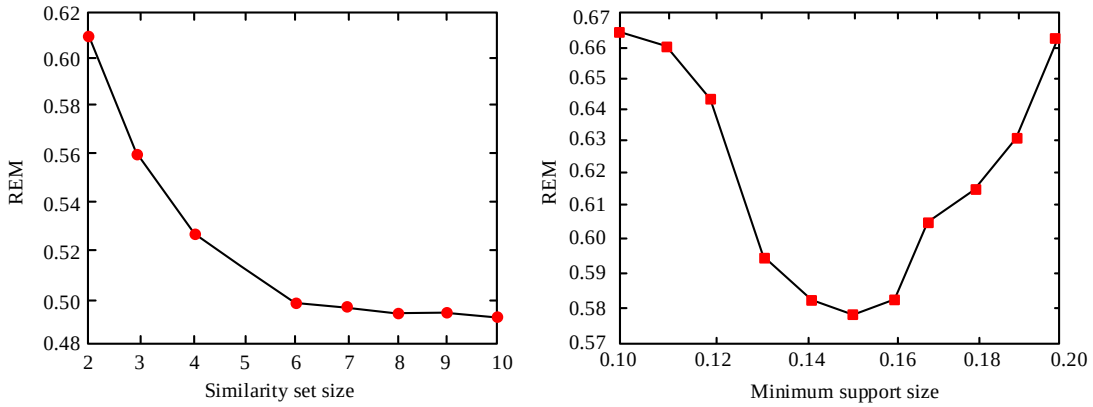



Fig.10. REM value variation under different similar set sizes and minimum support.

When the minimum support was chosen to be 0.15, the trend of REM changes as the size of the similar set expands from 2 to 10 as shown in Fig. 11. The simulation results show that as the similarity set expands, the REM values of all types of algorithms decrease, with the most obvious decreasing trend for the optimization algorithm 3 proposed in the study, and the REM value of algorithm 1 has almost no relationship with the size of the similarity set. The REM value of this hybrid algorithm model tends to be the smallest when the similarity set is greater than 6, which indicates that the algorithm is most accurate at a minimum support of 0.15, and the accuracy stabilizes when the similarity set size reaches 7.

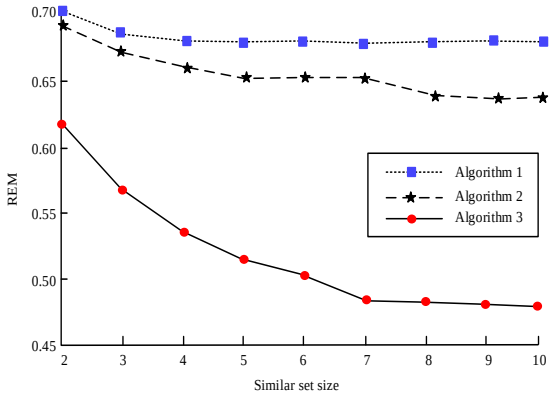



Fig.11. REM changes with the size of similar sets under specific support.

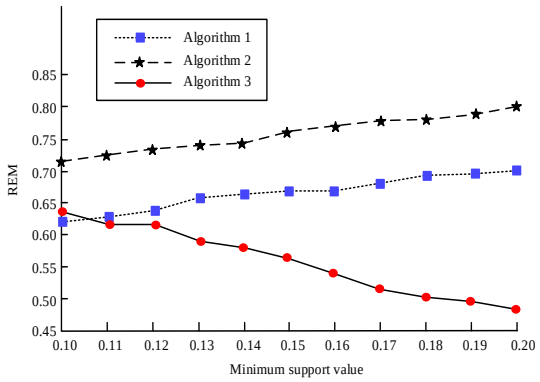



Fig.12. Change of REM with minimum support under specific similar set size.

When the size of the selected similarity set is 6, the trend of the REM values of each type of algorithm is shown in Fig. 12 as the minimum support degree increases from 0.1 to 0.2. The simulation results show that the larger the value of minimum support is taken, the gradually increasing REM value and decreasing accuracy of algorithms 1 and 2, while the continuous decreasing REM value and gradually increasing accuracy of the hybrid algorithm. In summary, the platform created by the research shows good performance in terms of resource transfer capability, achieving efficient teaching resource sharing in a short response time, and the proposed hybrid algorithm has the smallest REM value and the highest accuracy.

## V CONCLUSION

In response to the problems of scattered English online teaching resources that are difficult to achieve centralization and inefficient education resource recommendation, the study constructed an English online education resource sharing platform based on Web services. Simulation results show that the created platform performs well in terms of resource transfer capability and can achieve efficient teaching resource sharing in a short response time. The hybrid algorithm of collaborative filtering combined with sequence mining proposed in the study performs well in the validation of the recommendation algorithm. Compared with other algorithms, it has the smallest REM value and the highest accuracy rate. The simulation results prove that the English web-based educational resource sharing platform constructed by the study can perform the educational resource sharing task better and complete the English educational resource recommendation. There are also some shortcomings in this study; not enough user security authentication information is collected, and it is not effectively verified in the security module. It is expected that the in-depth research on this part will be strengthened in future research. In addition, the platform is not rich enough in features, and it is expected that more practical features will be added to the platform in the subsequent research to enhance the usefulness of the platform.

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