Research on the Realization of Water-saving Social Service Application based on Knowledge Cloud Service

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Abstract: At present, the water problem is prominent, and the whole society needs to adhere to long-term water-saving behavior. This paper combines three knowledge service methods: keyword retrieval, knowledge recommendation and knowledge customization to improve the quality of knowledge service; The four knowledge recommendation algorithms of collaborative filtering recommendation, demographics based recommendation, content-based recommendation and rule-based recommendation are realized by using java language, which improves the accuracy of knowledge recommendation; At the cloud server, the knowledge is evaluated and scored according to a certain algorithm according to the statistics of users' behavior data such as knowledge clicks, so as to ensure the quality of water-saving knowledge. Take cloud service as the intermediary condition to realize the combination of website knowledge extraction and knowledge base; At the same time, update and supplement the knowledge in the knowledge base according to the evaluation score of the cloud server on the provided knowledge. The water-saving service website has been developed to complete the construction of the website through micro service technology and realize different functional modules of the website, which plays a certain role in promoting the people's participation in water-saving awareness, water-saving publicity and the construction of water-saving society.

1 INTRODUCTION

Based on the current shortage of water resources in China, since 2016, various parts of China have successively issued policy documents based on water security, water pollution and water shortage, emphasizing the establishment of a water resources management mechanism centered on water rights and water market, so that the market can restrict and regulate water-saving behavior, give full play to the role of economic means and improve water efficiency. At the same time, the state has also established several water resources management systems, such as the water pricing system and the sewage discharge permit system, and the water saving system has been gradually improved. The National Water-saving Action Plan issued by The State Council in 2019 clearly points out that to solve the shortage of water resources in China, the first step is to adhere to the water-saving priority policy, gradually improve the social awareness of water-saving, improve the water-saving system, and accelerate the innovation of water-saving technology (Kang, 2019). Water saving is related to the production and life of the whole society, involving many industries and sectors. It is not enough to rely on the government's unilateral efforts and appeals. Only by water-saving behaviors of the whole society we can accelerate the solution of the shortage of water resources supply and demand (Sun et al., 2018). In order to achieve better water-saving effect and improve the water-saving behavior of the whole society, it is necessary to combine with information technology and build a social water-saving service website (Qiao et al., 2017). Although there were many water-saving websites in the past, most of them contained major events and news at home and abroad, with a long updating cycle and a large length of text, without relevant pictures and videos. The functional module of the website water saving forum is also empty and no one cares. Figure 1 shows the main problems of traditional water-saving websites.

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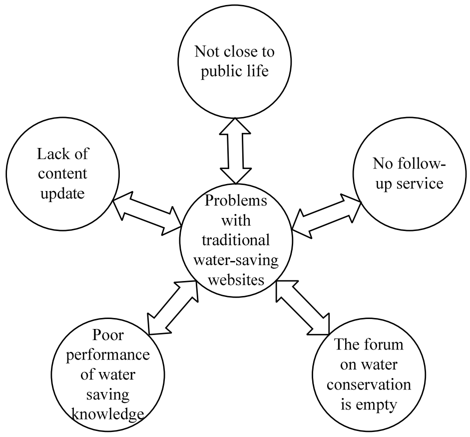

Figure 1: Problems of traditional water-saving websites.

In terms of website construction technology, this paper uses springboot, springcloud and docker to realize the development of water-saving socialized website by micro service; In terms of website content, user objects are divided, and targeted knowledge services are provided according to different user objects; In terms of service form, it is mainly based on cloud services to sort and recommend knowledge, so as to realize the water-saving socialized service of the website. Through the above research, the problems existing in the past traditional websites have been solved, the knowledge quality is higher, the service is more targeted and humanized, the publicity role of traditional websites has been strengthened, and the social consciousness of the whole people to participate in water saving has been improved.

2 KNOWLEDGE CLOUD SERVICE FRAMEWORK

In essence, knowledge cloud service is to provide socialized services in the form of knowledge services. In the past, socialized services usually refer to agricultural socialized services. This socialized service is public welfare, mainly to alleviate and eliminate the asymmetry of information technology in production and promote the circulation of resources (Gu et al., 2019). The socialized services studied in this paper are mainly in water saving, that is, to provide socialized services on water saving for the whole society and alleviate the information asymmetry in water saving in production and life.

2.1 Composition of Knowledge Services

Knowledge service refers to a series of links such as extracting, refining, integrating and innovating the explicit and tacit knowledge owned by individuals or social organizations based on the knowledge needs of objects and the analysis of the objective environment, and finally providing users with highly targeted services for solving problems (Yang & Yang, 2021). The beneficiary groups of knowledge services are diverse, with a large number of users and levels; However, the water-saving socialized service studied in this paper makes the beneficiary groups have obvious user characteristics and can provide targeted knowledge services according to user behavior. This knowledge service system mainly includes the following modules:

2.1.1 Knowledge Retrieval

Knowledge retrieval is to provide targeted knowledge services for users according to their needs, mainly including rules, patterns, and other related knowledge. Knowledge retrieval methods usually include two kinds: keyword retrieval and classified navigation (Guo et al., 2021).

2.1.2 Personalized Sorting

Personalized sorting is to sort the relevance of search results according to the specific needs of users, and quickly locate the target information by combining engine algorithm, mathematical modeling and other tools (Liu et al., 2021). This sorting method avoids the uniformity of retrieval results, makes users directly locate the target information in a large number of retrieval information, and provides users with the most targeted personalized knowledge services. Among them, the extraction of user personalized features mainly includes explicit and implicit extraction methods. Explicit extraction refers to the personal information that users manually submit at the front end of the knowledge service system; Implicit extraction mainly refers to the background modeling according to the user's browsing behavior and retrieval purpose, and transmitting it to the database.

2.1.3 Knowledge Push

Knowledge push is also an important part of personalized information service. Because the information in the knowledge base is constantly updated, users may not know the expansion of new knowledge they need in time. Therefore, the knowledge service system must include a knowledge push mechanism to enable users to obtain the new knowledge they need in time. The main push methods include: knowledge push of new resource documents and knowledge push associated with new knowledge.

2.1.4 Online Recommendation

Online recommendation is to recommend relevant knowledge resources for users according to their browsing behavior and retrieval objectives. This method is to recommend relevant information for real-time in the user's knowledge service system, and return the result of the recommendation information to the user. The intelligent analysis algorithm is mainly used to predict and recommend the user's upcoming retrieval goals and browsing behavior by integrating the user's browsing history and retrieval target results.

2.1.5 Knowledge Evaluation

Knowledge evaluation is a process of feedback, summary, correction and supplement of existing knowledge. It is mainly combined with modern information analysis technology to mine potential information in relevant fields, so as to promote scientific knowledge guidance and evaluation, and then promote the improvement of knowledge quality and knowledge service level (Sun & Liao, 2019). The knowledge framework is shown in Figure 2.

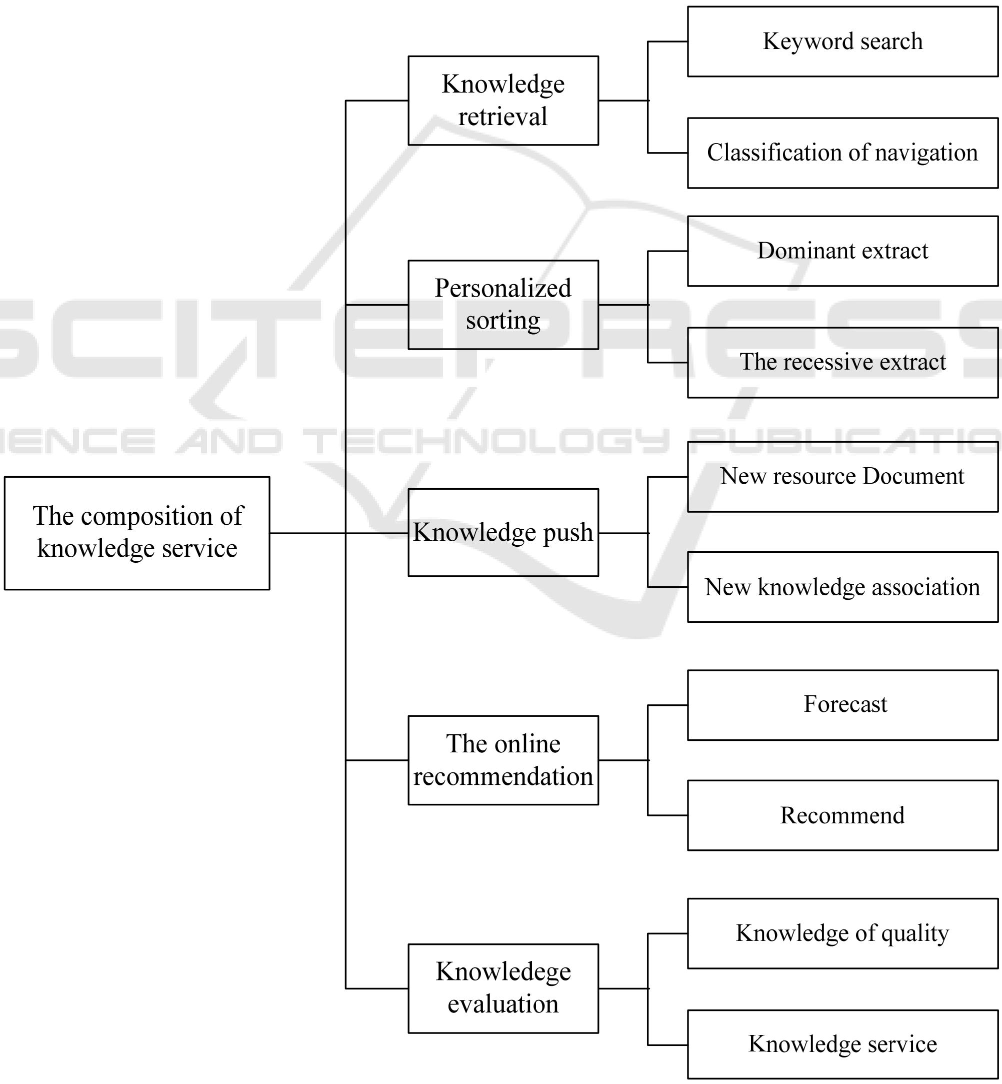

Figure 2: Composition of knowledge service.

2.2 Construction Ideas of Knowledge Cloud Service

Knowledge cloud service mainly provides users with water-saving knowledge services, so it mainly includes two aspects: knowledge recommendation and knowledge evaluation. The combination of these two processes can make users satisfied with the knowledge services provided and complete the updating and improvement of the knowledge base (Zheng et al., 2021). With cloud service as the intermediary, the knowledge base completes the knowledge provision to users and the update iteration of the knowledge base, which is of far-reaching significance to promote the improvement of social water-saving knowledge level and the awakening and strengthening of water-saving consciousness, and the water-saving effect is significantly improved. The specific cloud service system diagram is shown in Figure 3:

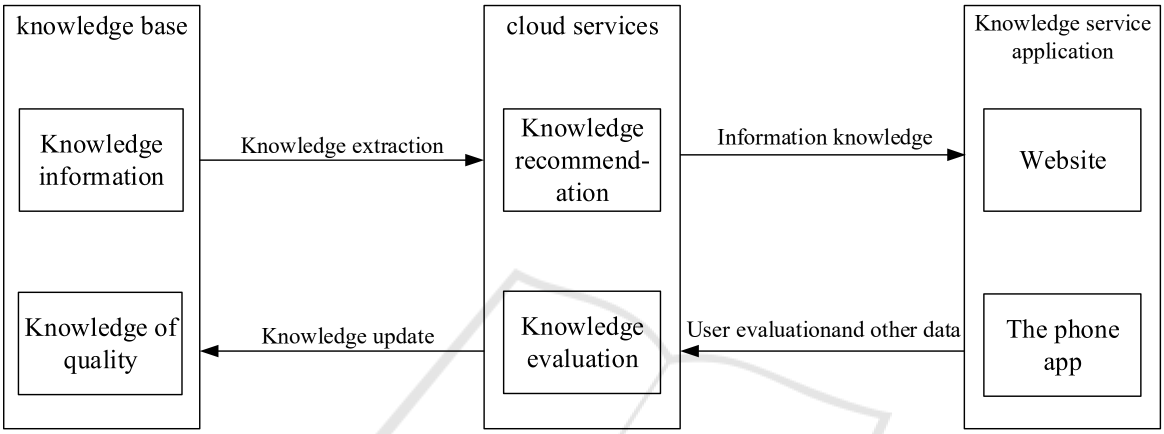

Figure 3: Diagram of knowledge cloud service system.

2.2.1 Mode of Knowledge Service

The effect of knowledge service depends on the mode of knowledge service. There are three common user-oriented knowledge service modes: passive service mode, active service mode and mixed service mode.

(1) Passive service mode

Passive service, a knowledge service mode, mainly completes knowledge service based on user retrieval behavior. When users do not know their knowledge needs, this service method can not achieve accurate or fuzzy query through keyword retrieval to get their desired results. Therefore, in the construction of knowledge cloud service, we should not only match the keywords based on the user's retrieval information, but also use the recommendation algorithm to analyze the keywords, so that the recommended water-saving knowledge is close to the user's knowledge needs, and the results are more comprehensive. At the same time, the results are also instructive for user screening.

(2) Active service

The active service method is to timely push the user's personalized knowledge by obtaining the user's browsing behavior, characteristics, hobbies, age, occupation and other information, combined with the knowledge recommendation algorithm. This service method does not complete knowledge push through the user's search keywords. By collecting data on users' interest in water-saving subjects and browsing information of water-saving knowledge, we can achieve real-time, push users' needs and interest in water-saving knowledge by means of e-mail and official account subscription.

(3) Mixed service

When users cannot retrieve relevant knowledge or have special needs for knowledge, knowledge cloud service can quickly customize according to users' knowledge needs, return the results to users, and store the customized knowledge in the knowledge base for subsequent use by other users. The comprehensive integration platform and visual knowledge map are adopted to quickly respond to the new knowledge needs of users, quickly draw the knowledge map and push the knowledge in time. This method combines knowledge retrieval, knowledge map customization and knowledge push to form a hybrid service mode, enriching the traditional knowledge service mode and improving the quality and effect of knowledge service.

2.2.2 Knowledge Recommendation

Knowledge recommendation is to complete knowledge recommendation services for users, according to users' characteristics, interests, age, occupation and other information, combined with models and algorithms. Knowledge recommendation is mainly used in knowledge push, personalized knowledge ranking and online push.

(1) Knowledge recommendation system model

Recommendation system modeling mainly includes three parts: system modeling, project modeling and recommendation algorithm. User modeling is to express the user's browsing information, evaluation information, purchase records and other information in data, and store the data in the user's preference model, so that the recommendation system can master the user's characteristics, interests and preferences. Project modeling is mainly to quantify and express the information of all user related projects, and form a project data system. Recommendation algorithm is a recommendation model that recommends items to users. The specific process of knowledge recommendation system is shown in Figure 4:

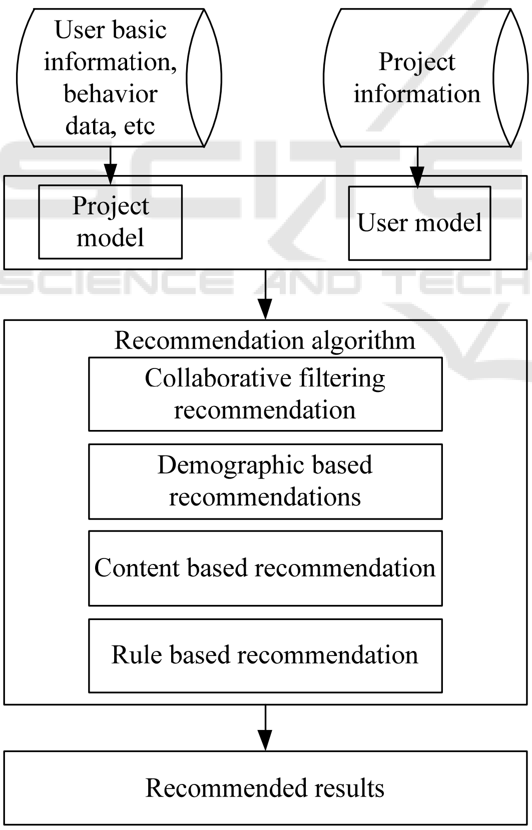

Figure 4: Recommended system flow chart.

At present, the commonly used recommendation algorithms include rule-based, demographic, content-based recommendation methods and collaborative filtering recommendation methods. Among the four methods, collaborative filtering recommendation algorithm is the most widely used. In the process of use, it does not need knowledge in related fields, and has strong pertinence. Therefore, the collaborative filtering recommendation algorithm is mainly introduced:

Collaborative filtering mainly obtains the similarity between users or items according to the user's love for items, predicts the user's love for untouched items based on these similarity, and obtains a score. Complete personalized recommendation to users according to different scores. At the same time, collaborative filtering algorithms can be divided into two categories: user based collaborative filtering recommendation algorithm and item based collaborative filtering recommendation algorithm. The implementation steps of the two algorithms are similar. This paper mainly introduces the user-oriented collaborative filtering recommendation algorithm.

(2) Steps of user based collaborative filtering recommendation algorithm

a. Information collection

The user's preference for the viewed items is expressed by score, and then put into an M × Users of N - in the item scoring matrix, M represents the number of users and N represents the number of items. Through matrix representation, the collected information is processed to realize the management of user information and determine user preferences.

b. Nearest neighbour search

Nearest neighbour search mainly determines the similarity between target users and calculates the similarity value of each user in the target group. The calculated similarity value can provide decision support for recommended content. Common similarity calculation methods include: cosine similarity, adjusted cosine similarity, Pearson similarity and Jaccard similarity. These four methods are implemented in the constructed knowledge cloud service system, and the more accurate and simple similarity algorithm will also be incorporated into the knowledge recommendation system.

Calculation formula of cosine similarity:

$$\mathrm{Sim}(i,j) = \frac{\sum_{k=1}^{n} x_{1k} x_{2k}}{\sqrt{\sum_{k=1}^{n} {x_{1k}}^2}\sqrt{\sum_{k=1}^{n} {x_{2k}}^2}} \tag{1}$$

Where:

x_{1k}, x_{2k} is user's (x_1 、 x_2)score of the k-th knowledge;

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K represents the sequence number of knowledge, k = 1,2,3,..., m;

The value of cosine similarity algorithm is [0,1]. The closer the value is to 1, the higher the similarity is. The closer it is to 0, the lower the similarity is. Cosine similarity algorithm is suitable for qualitative judgment, which judges the similarity of abstract items such as knowledge and interest. Figure 5 shows the Java programming implementation of cosine similarity algorithm.

```java
SimAlgorithm.java
package

import java.util.HashSet;

public class SimAlgorithm {


    public static double cosineAlgorithm(double[] p1, double[] p2) {
        double dotProduct = 0.0;
        double lengthSquaredp1 = 0.0;
        double lengthSquaredp2 = 0.0;
        for (int i = 0; i < p1.length; i++) {
            lengthSquaredp1 += p1[i] * p1[i];
            lengthSquaredp2 += p2[i] * p2[i];
            dotProduct += p1[i] * p2[i];
        }
        double denominator = Math.sqrt(lengthSquaredp1) * Math.sqrt(lengthSquaredp2);


        if (denominator < dotProduct) {
            denominator = dotProduct;
        }


        if (denominator == 0 && dotProduct == 0) {
            return 0;
        }

        return 1.0 - dotProduct / denominator;
    }
```

Figure 5: Implementation of cosine similarity algorithm.

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Adjust the cosine similarity calculation formula:

$$\mathrm{sim}(i,j) = \frac{\sum_{u\in U}\left(R_{u,i}-\bar{R}_u\right)\left(R_{u,j}-\bar{R}_u\right)}{\sqrt{\sum_{u\in U}(R_{u,i}-\bar{R})^2}\sqrt{\sum_{u\in U}(R_{u,j}-\bar{R}_u)^2}} \quad (2)$$

Where:

$R_{u,i}$ refers to the i user's rating of knowledge;

$\bar{R}_u$ refers to the average score of all knowledge evaluated by user i;

Adjusting the cosine similarity recommendation algorithm can effectively solve the problem of different users' preference for items, that is, the scoring of items is different. The problem of scoring preference can be effectively solved by subtracting the average of all item scores from the user's score for each item. Figure 6 shows the Java programming implementation of adjusting cosine similarity algorithm.

Pearson similarity calculation formula:

$$\mathrm{sim}(X,Y) = \frac{\mathrm{cov}(X,Y)}{\sigma_X\sigma_Y} = \frac{E\left((X-\mu_X)(Y-\mu_Y)\right)}{\sqrt{E(X^2)-E^2(X)}\sqrt{E(Y^2)-E^2(Y)}} \quad (3)$$

Where:

$cov(X,Y)$ refers to the covariance of X, Y;

$\sigma_X\sigma_Y$ refers to the standard deviation product of index X and Y;

Pearson similarity algorithm is mainly used to calculate the linear correlation between the two variables. Its role in knowledge recommendation is mainly used to calculate the sum of squares of the two users' scores when both users have evaluated the same knowledge, and calculate the product sum of each score. The value range of Pearson similarity algorithm is [0,1]. The closer the value is to 1, the higher the similarity between the two users. The closer the value is to 0, the lower the similarity between the two users. The result set obtained by Pearson algorithm is larger and the recommendation range is wider. Therefore, compared with Jaccard similarity algorithm, the accuracy is lower, and it is suitable for scenes with low requirements for the accuracy of recommendation knowledge. Figure 7 shows the Java programming implementation of Pearson similarity algorithm.

SimAlgorithm.java

```java

    public static double adjustedCosineAlgorithm(double[] p1, double[] p2) {
        double dotProduct = 0.0;
        double lengthSquaredp1 = 0.0;
        double lengthSquaredp2 = 0.0;
        double p1total = 0.0;
        double p2total = 0.0;

        for (int i = 0; i < p1.length; i++) {
            p1total += p1[i];
            p2total += p2[i];
        }
        double p1avg = p1total/p1.length;
        double p2avg = p2total/p2.length;
        for (int i = 0; i < p1.length; i++) {

            lengthSquaredp1 += (p1[i] - p1avg) * (p1[i] - p1avg);
            lengthSquaredp2 += (p2[i] - p2avg) * (p2[i] - p2avg);
            dotProduct += (p1[i] - p1avg) * (p2[i] - p2avg);
        }
        double denominator = Math.sqrt(lengthSquaredp1) * Math.sqrt(lengthSquaredp2);


        if (denominator < dotProduct) {
            denominator = dotProduct;
        }


        if (denominator == 0 && dotProduct == 0) {
            return 0;
        }

        return 1.0 - dotProduct / denominator;
    }
```

Figure 6: Implementation of adjusted cosine similarity algorithm.

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SimAlgorithm.java

```java

    public static double pearsonAlgorithm(Map<String, Integer> pm1, Map<String, Integer> pm2) {
        int n = 0;
        int sxy = 0;
        int sx = 0;
        int sy = 0;
        int sx2 = 0;
        int sy2 = 0;

        for (Entry<String, Integer> pme : pm1.entrySet()) {
            String key = pme.getKey();
            Integer x = pme.getValue();
            Integer y = pm2.get(key);
            if (x != null && y != null) {
                n++;
                sxy += x * y;
                sx += x;
                sy += y;
                sx2 += Math.pow(x, 2);
                sy2 += Math.pow(y, 2);
            }
        }

        double sd = sxy - sx * sy / n;
        double sm = Math.sqrt((sx2 - Math.pow(sx, 2) / n) * (sy2 - Math.pow(sy, 2) / n));
        return Math.abs(sm == 0 ? 1 : sd / sm);
    }

```

Figure 7: Implementation of Pearson similarity algorithm.

Jaccard similarity calculation formula:

$$\mathrm{Sim}(X, Y) = \frac{X \cap Y}{X \cup Y} \tag{4}$$

Jaccard similarity calculation is to find the ratio between the number of intersection elements and the number of union elements in two sets X and Y. the value range is [0,1]. The closer the value is to 1, the stronger the commonality of the two sets is, and the closer it is to 0, the weaker the commonality is. The Jaccard similarity coefficient can quantitatively describe the common characteristics and interests of two users. In the case of high similarity, it can recommend the knowledge that the other user is interested in but not exposed to two users at the same time. This method is applicable when Boolean value is used to measure the similarity between individuals, and can not give the size of difference value. In the process of knowledge recommendation, the similarity can be calculated according to the user's interest to obtain whether the user is interested in a knowledge topic, so as to recommend according to the correlation points between interests and related knowledge. Using the Jaccard similarity calculation method, the result set is small and accurate, which is suitable for scenes with high requirements for knowledge recommendation accuracy. Figure 8 shows the Java programming implementation of the Jaccard similarity algorithm.

```
*SimAlgorithm.java


    public static double jaccardAlgorithm(String str1,String str2) {
        Set<Character> s1 = new HashSet<>();
        Set<Character> s2 = new HashSet<>();
        for (int i = 0; i < str1.length(); i++) {
            s1.add(str1.charAt(i));
        }
        for (int j = 0; j < str2.length(); j++) {
            s2.add(str2.charAt(j));
        }

        float mergeNum = 0;
        float commonNum = 0;

        for(Character ch1:s1) {
            for(Character ch2:s2) {
                if(ch1.equals(ch2)) {
                    commonNum++;
                }
            }
        }

        mergeNum = s1.size()+s2.size()-commonNum;

        float jaccard = commonNum/mergeNum;
        return jaccard;


```

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Figure 8: Implementation of Jaccard similarity algorithm.

```
RecommendAlgorithm.java
package

import java.util.List;


public class RecommendAlgorithm {

    public static double predictScore(double[] simUV,double[] Rvi) {
        double numerator = 0.0;
        double denominator = 0.0;
        for (int i = 0; i < simUV.length; i++) {
            numerator += simUV[i] * Rvi[i];
            denominator += Math.abs(simUV[i]);
        }
        return numerator/denominator;
    }


    public static double AdjustedPredictScore(double[] simUV,double[] Rvi,double[] Ru) {
        double numerator = 0.0;
        double denominator = 0.0;
        double RviTotal = 0.0;
        double RuTotal = 0.0;
        for (int i = 0; i < Ru.length; i++) {
            RuTotal += Ru[i];
        }
        double RuAvg = RuTotal/Ru.length;
        for (int i = 0; i < Rvi.length; i++) {
            RviTotal += Rvi[i];
        }
        double RviAvg = RviTotal/Rvi.length;
        for (int i = 0; i < simUV.length; i++) {
            numerator += simUV[i] * (Rvi[i] - RviAvg);
            denominator += Math.abs(simUV[i]);
        }
        return RuAvg + numerator/denominator;
    }
}
```

Figure 9: Implementation of prediction scoring algorithm and adjusted prediction scoring algorithm.

(3) Result generation

The set of users with high similarity can be obtained through nearest neighbor search. According to the user's score on the knowledge in the user set, the knowledge not scored by the target user is predicted and scored, the prediction scores are arranged from high to low, and the first n prediction scores are selected to generate recommendation results and complete the knowledge recommendation process.

Calculation formula of prediction score:

$$P_{u|i} = \frac{\sum_{v \in k} \mathrm{sim}(u, v) \times R_{vi}}{\sum_{v \in N} |\mathrm{sim}(u, v)|} \tag{5}$$

$$P_{u|i} = \bar{R}_u + \frac{\sum_{v \in k} \mathrm{sim}(u, v) \times (R_{vi} - \bar{R}_v)}{\sum_{v \in N} |\mathrm{sim}(u, v)|} \tag{6}$$

Where:

$P_{u|i}$ refers to the prediction score of user u on the ith untouched knowledge;

$sim(u, v)$ refers to the similarity calculation results of user u and user v;

R_{vi} refers to the user v's rating of the ith knowledge;

$\bar{R}_v$ refers to the average score of user v on the knowledge they have browsed;

$\bar{R}_u$ refers to the average score of user u on the knowledge they have browsed

Figure 9 shows the Java implementation of the user's prediction score calculation of an unpriced knowledge.

2.2.3 Knowledge Evaluation

Water saving knowledge evaluation is based on users' behavior such as browsing information, downloading data and scoring data, through the algorithms, to evaluate knowledge, and process the knowledge according to the evaluation results. The water-saving knowledge evaluation process is visible, and users can participate in the knowledge evaluation process. The knowledge evaluation standard is generated based on the user's behavior. The specific knowledge evaluation is as follows:

(1) Knowledge clicks

1 point will be added every time knowledge is browsed. The higher the score, the better the quality of knowledge. The cloud service statistics module is displayed according to the score from high to bottom. Note that for the same user, browsing multiple times on the computer can only be counted as one time.

(2) Number of knowledge Downloads

Add 1 point every time the knowledge is downloaded. The higher the score, the better. The cloud service statistics module displays the knowledge according to the score from high to bottom. Note that for the same user, downloading multiple times on the computer can only be counted as one time.

(3) Label selection times

This standard is to count the times of label selection, and add 1 point for each label used. The cloud service statistics module is displayed according to the score from high to bottom. Note that for the same user, multiple selections on the computer can only be counted as one.

(4) Number of knowledge references

Add 1 point every time the knowledge is quoted. The higher the score, the better. The cloud service statistics module is displayed according to the score from high to bottom.

(5) Knowledge recommendation times

Add 1 point for each recommended knowledge. The higher the score, the better. The cloud service statistics module is displayed according to the score from high to bottom.

(6) Knowledge scoring times

Every time knowledge is scored, 1 point will be added. The higher the score, the better. The cloud service statistics module is displayed according to the score from high to bottom.

(7) Number of knowledge reviews

Add 1 point every time knowledge is commented. The higher the score, the better. The cloud service statistics module is displayed according to the score from high to bottom. Note that multiple comments by the same user on the computer can only be counted as one.

Cloud services can sort the knowledge in the knowledge base from high score to low score according to different indicators by making statistics on users' evaluation data. The sorting results can be seen by users and managers, and the knowledge with high score can be retained in the knowledge base; For the knowledge with low score, re-enter the knowledge representation process, save the updated knowledge in the knowledge base, and recommend the knowledge again.

In short, the water-saving knowledge cloud service provides scientific knowledge recommendation service and knowledge evaluation service for the realization form of water-saving knowledge. The specific implementation process of knowledge cloud service is reflected in the process of meeting users' knowledge needs through the water-saving website.

3 ESTABLISHMENT OF WATER-SAVING SOCIALIZED SERVICE WEBSITE BASED ON KNOWLEDGE CLOUD SERVICE

Based on the construction of knowledge cloud service, combined with information technology, a water-saving socialization website is developed on the Internet. According to different service objects and audience groups, different knowledge service methods are adopted to carry out water-saving knowledge service.

Due to the large number of audience groups, the user groups are classified and subdivided according to the characteristics of age, occupation and education level, and the users are divided into groups with some common or similar characteristics and individuals with basically different characteristics. Combined with information technology such as web and integrated platform, carry out group oriented water-saving knowledge service, that is, water-saving socialized service.

3.1 Construction Ideas of Knowledge Cloud Service

The water-saving socialized service website created in this paper is not to overthrow the previous traditional water-saving websites, but to give better play to the utility of water-saving websites and solve the problem of existing websites (Wang, 2016). First, the starting point of building water-saving websites is the same. The development mode of building water-saving socialized service websites is basically similar, and the development mode of door type websites is adopted; Second, in order to make the service more targeted, it is necessary to divide the user object image; Third, we should improve the way of knowledge service (Wang & Jeong, 2018).

3.1.1 Realize Cloud Service and Provide Website Content

The content displayed by the traditional water-saving website is messy and illogical. On the one hand, the developer of the website is computer related personnel, on the other hand, the operator of the website is management personnel. The personnel of these two organizations are not professional relative to the water-saving content. The water-saving service website proposed in this paper is built on the basis of knowledge cloud service. The water-saving content of the website does not need developers and managers to provide. In a certain sense, it realizes the professionalism, and pertinence of water-saving content.

3.1.2 Realize Personalized Knowledge Service

Traditional water-saving websites do not distinguish user groups. The website content is large and extensive, and all the content is presented to users at one time. Users can only find what they need from a large number of messy content, which is not simple. Therefore, the water-saving socialization website should first divide the user groups according to the relevant characteristics, provide the knowledge content that users are interested in, realize personalized knowledge service and improve the quality of water-saving service.

3.2 Technical Support of Water-saving Socialized Service Website

The operation of water-saving socialized website needs continuous maintenance. With the continuous updating of water-saving knowledge, the service form of the website needs to be deepened and improved, and the module content of the website needs to be updated in time (Zhou et al., 2007). Microservice technology is used to build the website. When the website module is upgraded, some microservices remain running and the other part stops running. After the upgrade, the two parts are exchanged to complete the upgrade of the website system and improve the sustainable operation ability of the website. Spring boot, Spring cloud and Docker technologies are required to complete this exchange operation.

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3.2.1 Spring Boot

Spring boot framework can be used to develop a single micro service. Spring boot can realize automatic configuration, simplify users' work on project configuration, and improve the efficiency of project construction. Moreover, Spring boot integrates embedded web container, which can quickly complete the construction of applications. During deployment, the web container can also run normally to complete the hot deployment.

3.2.2 Spring Cloud

Spring cloud is a tool set for rapidly building a microservice system based on spring boot, and has lightweight microservice components with perfect functions. The microservice cluster built by spring cloud provides a guarantee for the smooth operation of microservices. Spring boot builds a single microservice; Spring cloud organizes these micro services to form a micro service group, and then constitutes the whole business system.

3.2.3 Docker

Docker is a lightweight virtual engine. Compared with previous virtual machines, docker has a very low share of hardware resources and improves the utilization of system resources. You can deploy the image files generated by the running environment and application software into the docker container, instead of completing the environment configuration of the application software every time, so as to improve the efficiency of operation and maintenance.

3.3 Functional Modules of Water-Saving Socialized Service Website

The main functional modules of the water-saving socialization website constructed in this paper are divided into five parts: industry news, laws and regulations, water-saving science popularization, water situation map and water-saving forum. Water saving knowledge service is the most important module of website construction, so the water saving knowledge service module is listed separately and detailed separately. The main function modules of the website are shown in Figure 10:

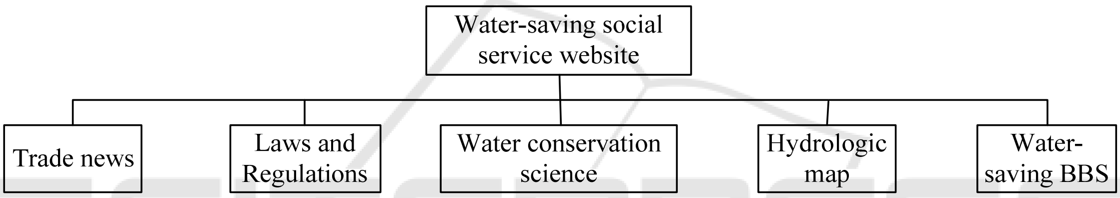

Figure 10: functional module diagram of water saving socialized service website.

3.4 Construction of Water-Saving Social Service Website

3.4.1 Home Page

The home page of the website includes the entrance of each module, mainly including the brief information of other modules and relevant water resources news information. By clicking on different functional modules, you can view industry news, popular science knowledge, laws and regulations, water regime map, water-saving services, water and health and other knowledge information by category, as shown in Figure 11:

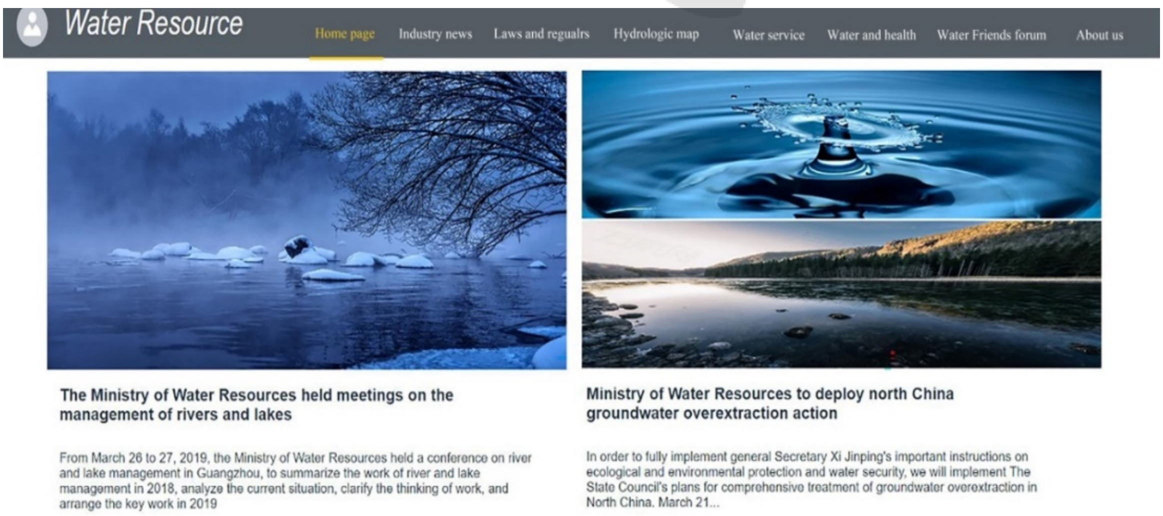

Figure 11: Homepage of water saving socialized service website.

Figure 12: Main interface of industry news.

3.4.2 Industry News

The industry news module includes three parts, including national policies, detailed reading of news and water-saving highlights. It is mainly about the interpretation of the national policies and policies on water resources management, the interpretations of the latest local water use news, and the report of relevant water-saving results. Figure 12 is the cross-sectional view of the industry news module.

3.4.3 Laws and Regulations

This module mainly introduces national policies, laws and regulations, mechanisms and systems, as well as the interpretation of relevant policies and regulations. It can be divided into five parts: the latest introduction, water-saving laws, water-saving regulations, industry quota and policy interpretation. The public and technicians can click the corresponding interface to access the knowledge they are interested in, which is of great significance to domestic water saving and economic production water saving. Figure 13 is a cross-sectional view of laws and regulations.

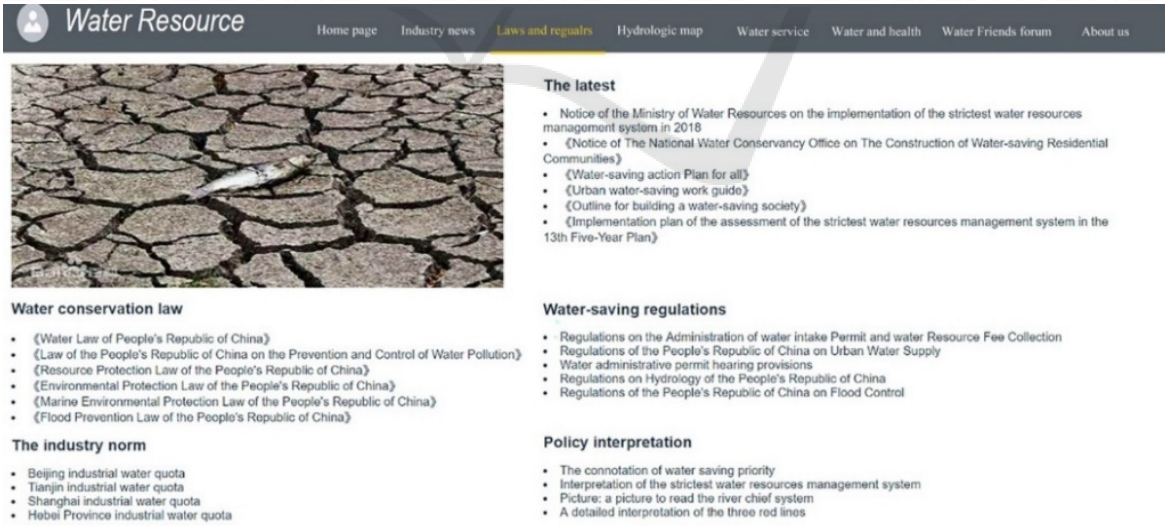

Figure 13: Main interface of laws and regulations.

3.4.4 Water Saving Science Popularization

This module mainly serves two objects: one is the popularization of domestic water-saving skills and water-saving technologies and tools for the public; The second is the popularization of relevant knowledge about industrial water saving and agricultural water saving for relevant personnel of water-saving technology. Figure 14 shows the interface of water saving Science Popularization.

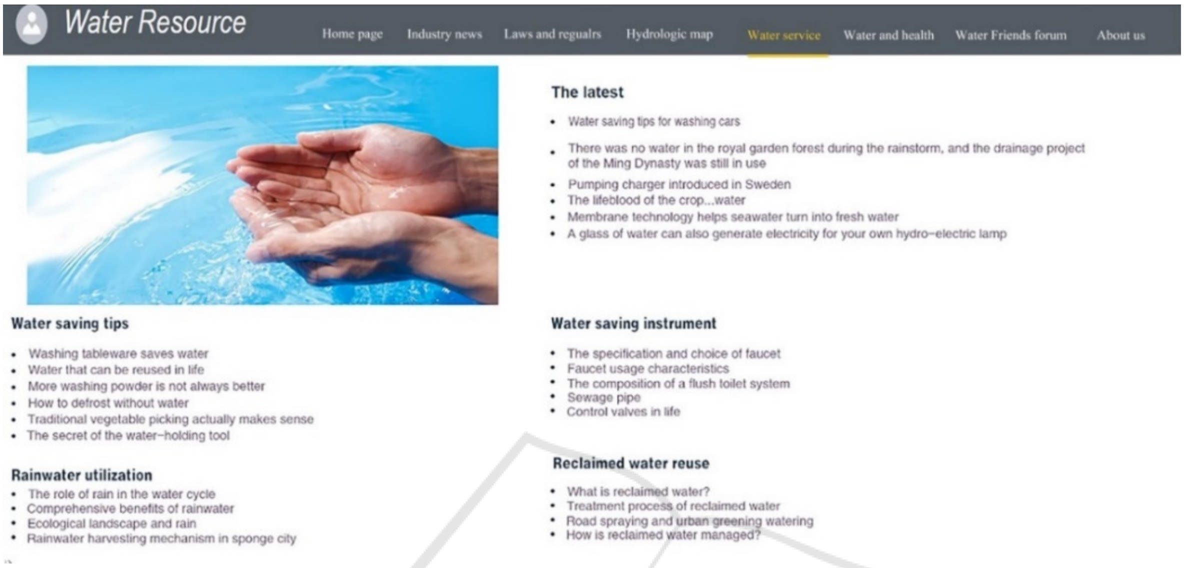

Figure 14: Main interface of water saving science popularization.

3.4.5 Hydrological Map

This module mainly establishes a two-dimensional plane map, and intuitively reflects the sewage source information, watershed water regime information, quoted water source information and other relevant water regime information in the map. By obtaining the location of the user, the user can know the water environment of the area. Figure 15 shows the interface of water regime map:

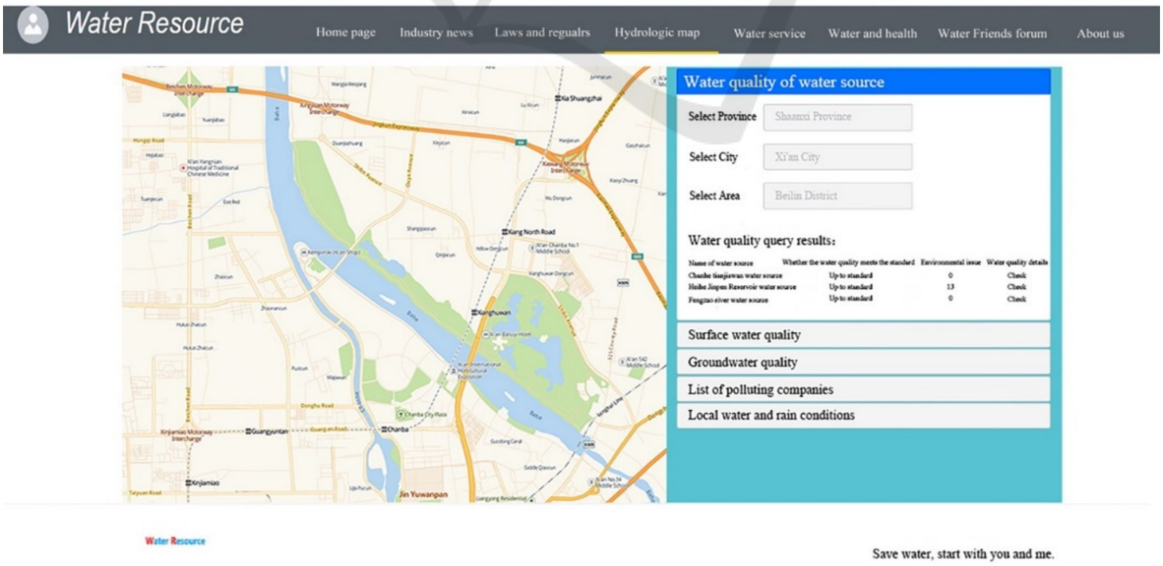

Figure 15: Main interface of water regime map.

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3.4.6 Water Saving Forum

This module mainly provides the public with a platform for water-saving exchange. In the water-saving forum, the public can exchange water-saving experience, report polluted rivers, and answer questions from experts. Specific discussion topics include: domestic water-saving exchange, water environment supervision, expert Q & A and water-saving technology exchange. Figure 16 shows the interface of water saving Forum:

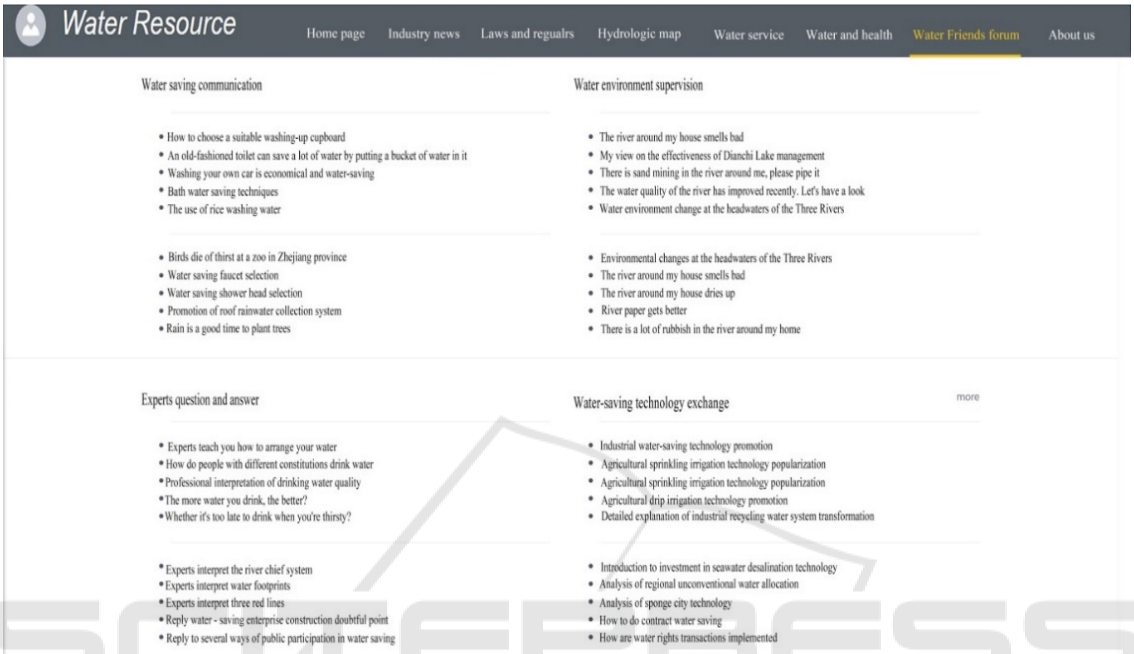

Figure 16: Interface of water saving Forum.

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3.5 Service Process of Water Saving Socialized Service Website

3.5.1 Website Service Process Design

The application of cloud services realized through websites mainly completes the knowledge service process through keyword retrieval (Deng, 2015). Users send knowledge requests to the cloud service through keywords, and the cloud service recommends water-saving knowledge to users according to keyword matching and related algorithms; The web page feeds back the user's browsing history, download times, knowledge map evaluation scoring and other data to the cloud service(Du et al., 2021); Cloud service evaluates the knowledge content according to the knowledge evaluation algorithm, and the high-quality knowledge content will be pushed again to complete the push process; Low quality knowledge needs to be improved and then enter the next round of knowledge recommendation process to complete knowledge push (Zhang et al., 2017). The specific flow chart is shown in Figure 17.

3.5.2 Implementation of Website Service Process

Social service websites not only passively provide users with required knowledge services, but also actively complete knowledge services for users. Push water-saving knowledge to users through subscription, knowledge space and personalized push, constantly attract users' attention, stimulate users' interest, and make water-saving knowledge service more convenient and humanized (Zhang, 2011). In order to make the provision of water-saving knowledge more targeted, user groups need to be divided. According to the role played by user groups in water conservation, water conservation knowledge services are divided into three service modes: managers, professionals and water users (Yang, 2015). The manager group is defined as the government manager. The focus of this group on water-saving knowledge is mainly in the construction of water-saving society, water-saving policies and regulations, water use efficiency of enterprises, etc; Professionals mainly refer to scholars and engineers who study water-saving systems, technologies, laws and regulations, etc. Their focus is on the evaluation of water-saving effect and the promotion of water-saving system; Water users refer to the actual water users, including residential water users and non residential water users. Non residential water users mainly refer to enterprise water users, irrigation area water users, etc. This group mainly focuses on the improvement of their water use efficiency and water-saving potential (Si, 2009). The specific classification of knowledge service types is shown in Figure 18.

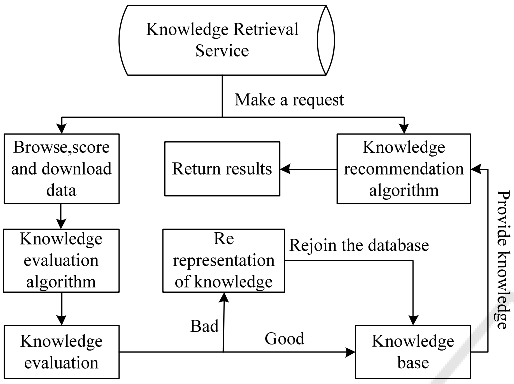

Figure 17: Flow chart of knowledge provision based on retrieval service.

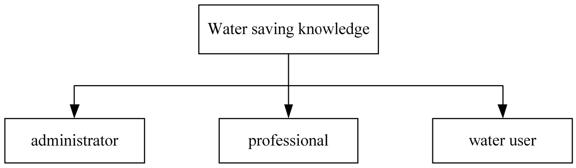

Figure 18: Division of knowledge service types.

3.5.3 Take the Implementation of Knowledge Retrieval Service for Managers as An Example

This section mainly introduces the case realization of water-saving knowledge service in the service mode of knowledge retrieval with managers as the user group. First, the service modules of the water saving service include retrieval service, knowledge recommendation, concerned topics and management, WeChat official account and so on.

Enter industrial water saving in the keyword search box, and return the search results of the knowledge map related to industrial water saving knowledge to the user through the retrieval of water saving cloud services and knowledge recommendation services based on topics and personal concerns. Click the industrial water saving assessment icon to enter the main interface of industrial water saving assessment.

Figure 19 is an introduction to the knowledge map of industrial assessment, which can be downloaded locally:

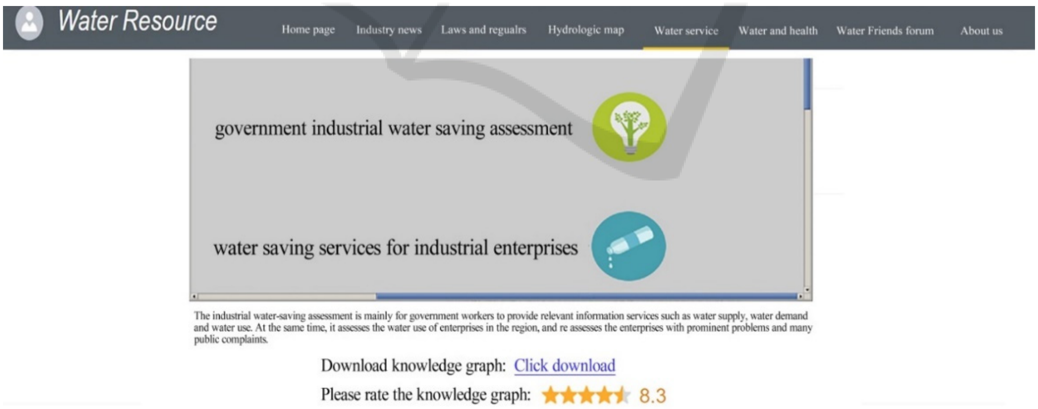

Figure 19: Functions of industrial water saving assessment interface.

After downloading, the web page will transfer the real-time download times of the knowledge map to the cloud service; After browsing the knowledge map, you can score the evaluation of the knowledge map. The cloud service evaluates the knowledge through the knowledge evaluation algorithm by downloading times and scoring. And the web page will recommend knowledge maps with similar topics to users.

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4 CONCLUSION

This paper completes the iteration of providing and updating water-saving knowledge based on cloud services, and provides targeted and timely water-saving knowledge services for users according to different user groups. In terms of website construction technology, Spring boot, Spring cloud and Docker technologies are used to realize the construction of web pages by micro services, and the functional modules of the website are divided.

Through the knowledge cloud service, it connects the application of water-saving knowledge base and water-saving knowledge service, makes the knowledge recommendation dynamic and continuously updated, and improves the quality of knowledge content and the efficiency of knowledge service application. The service website and cloud service are interrelated. According to the characteristics of water-saving knowledge service objects, the user groups are divided, and the design and implementation of knowledge service process for different groups and different knowledge service modes are completed. The development of water-saving socialized service application not only improves and supplements the application system of water-saving knowledge service, but also has a certain reference significance for the development of water-saving work in the future.

Based on knowledge cloud service, according to the concept of water-saving socialized service, a web portal of water-saving socialized service is developed based on Java language, using microservice architecture, Spring boot, Spring cloud, Docker and other framework technologies.

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