Research on Higher Education Collaborative Management Platform Based on Relationship Graph

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Received: 11 February 2022; Accepted: 29 March 2022

Abstract: According to the current problems of higher education management informatization, this paper puts forward a development scheme of collaborative platform on education management. The main technology includes three parts. First, integrate the distributed database and use two-tier linked list to realize dynamic data access. Second, the relation graph is used to display the data of each student, so as to realize the visual sharing of data. Third, realize the collaborative information security mechanism from three aspects to ensure the legal sharing of data. Finally, the platform development is completed with Java. It can help to improve the effectiveness of educating students.

Keywords: Collaborative management; relationship graph; linked list

1 Introduction

In the educational management of universities, different departments have their own information systems, and educational guidance mainly depends on teachers' experience [1,2]. To achieve full staff collaboration, whole process education monitoring and all-round training, we should use advanced information technology to collaborative Management Platform. At present, collaborative management faces two main problems in the process of higher education.

First, the efficient education cooperation mode lacks technical support. There are overlapping parts in the work process of different departments, and their rights and responsibilities cannot be completely separated [3,4]. So, Information sharing is necessary. However, the information systems of different departments are managed and used independently, and the information communication between them is not timely and smooth.

In addition, Collaborative management is to improve the quality of education. However, all-round education lacks effective data support [5]. Relying on the guidance of experience, the pertinence is poor, the persuasion to students is not enough, and the effect is low.

With the development of the Internet, the information management platform of higher education has been mature, the management process has been continuously optimized, and the means of education management are more convenient. In order to further improve the effectiveness of education,

the research on distributed collaborative information platform with big data and artificial intelligence technology has become a new goal of higher education management informatization.

Therefore, this paper studies the collaborative work platform of education management with relationship graph to promote multi role collaborative office. The main work is as follows:

(1) Integrate distributed database to realize data sharing at the bottom;
(2) Display data in the unit of individual student to realize data sharing in the application layer;
(3) Build an information security mechanism.

2 Main Technology

2.1 Dynamic Access Structure Based on Two-tier Nested Linked List

The linked list structure is flexible and can realize the dynamic change of storage structure. Define a two-level nested linked list, which includes inner table and outer table. The inner table contains multiple objects that are used to store exported data items. And the function of outer table is to add an inner linked list for each user, and then conduct joint query with the user array. Then save the query results in a new two-tier linked list. Actually, the inner table is a linked list based on query items, and the outer table is a linked list based on users. Therefore, it can query and export different data items according to the needs of different users.

When storing, get the stored data items with POI and save them to objects. And these objects are stored in a linked list. Then the data is stored in the linked list with POI. Then they are written into the corresponding table of the database by searching the database.

The dynamic access of data is realized with the dynamic structure of linked list. The access process is shown in Fig. 1.
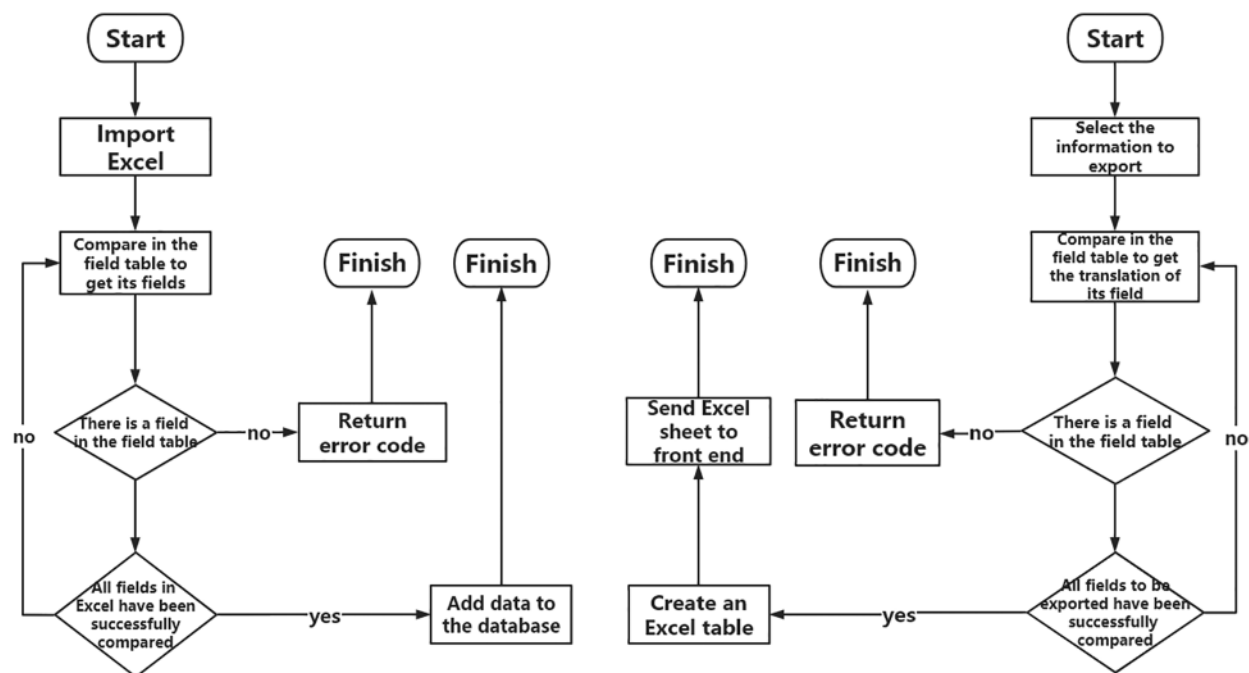

Figure 1: The access process

2.2 Dynamic Display Based on Relationship Graph

The relationship graph can show the relationship between concepts [6,7]. Take the individual students as the research object and integrate all the information in the training process. This paper analyzes the daily management needs of higher education, then defines the entities of the relationship graph, their attributes and the relationship between entities. In the actual research, two-tier conceptual entities and their attribute constraints are defined, as shown in Tab. 1.

Table 1: Definition of entities and their attribute

Entity	Subentity	Attributes	Constraints
Student	None	Student number	Character
		Name	Character
		Age	Integer
		Gender	Character
		Student cadre	Character
		Grade	Character
		Major	Character
		Class	Character
Study	Credit	Credits of degree courses	
		Credits of elective courses	Integer
		GPA	
		Failed course	Character
	Competition	Name	Character
		Year	Date
		Level	Character
		Awards	Character
	Honor	Year	Date
		Level	Character
		Name	Character
Practice	Voluntary service	Name	Character
		Duration	Integer
	Social practice	Name	Integer
		Year	Character

The relationships between the entities are divided into three categories: ownership relationship, basic relationship and acquisition relationship, as shown in Tab. 2.

Based on the above definition of entities and their relationships, the conceptual structure of higher education management relationship graph is shown in Fig. 2.

Table 2: Relationship between entities

Relationship type	Relationship name	Related entities	Relationship description
Ownership relationship	Is	Student and own attributes	Students and their own basic information
Basic relationship	Classmate	Students	Students with the same class
	Dormitory members	Students	Students living in the same dormitory
Acquisition association	Get	Student and study Student and practice	Learning progress of student
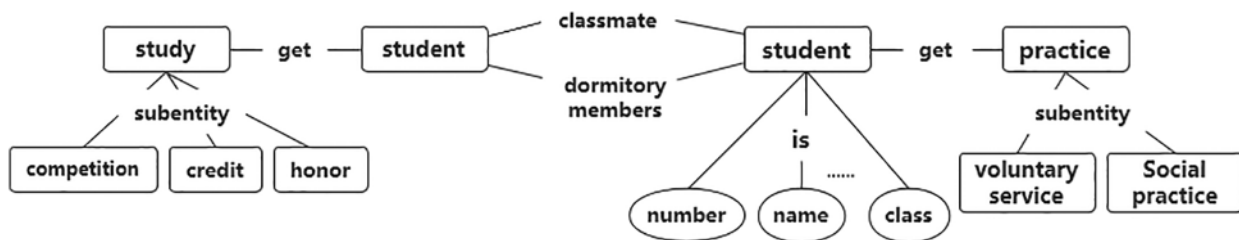
Figure 2: The conceptual structure of higher education management relationship graph

2.3 Information Security Mechanism in Collaborative Mode

The information security mechanism of multi role collaborative is set up from three parts: page permission, access permission and function permission. When accessing information, users can only enter the pages with specified permissions and use the functions with specified permissions. Some important data of users will be stored in the session of the server, and cookies only store the session ID. When the system needs these important data, it directly calls the session with the session ID and does not set the external access port. At the same time, a general module is set to access information in the system. This module can distinguish users' permissions according to users' codes. Then it can access the database according to users' permissions. The workflow is shown in Fig. 3.

3 Implementation

3.1 Functional Design

The purpose of building the full staff collaborative management platform is to achieve comprehensive data sharing, data monitoring and accurate data analysis. The platform realizes the integration of students' personal information, academic information and extracurricular practice information in the whole stage of higher education. In order to ensure information security, user permissions are set according to the work functions of each department. The individual information and data analysis of students are displayed in a graph, so that administrators in different positions can better understand these information. The design of platform function module is shown in Fig. 4.
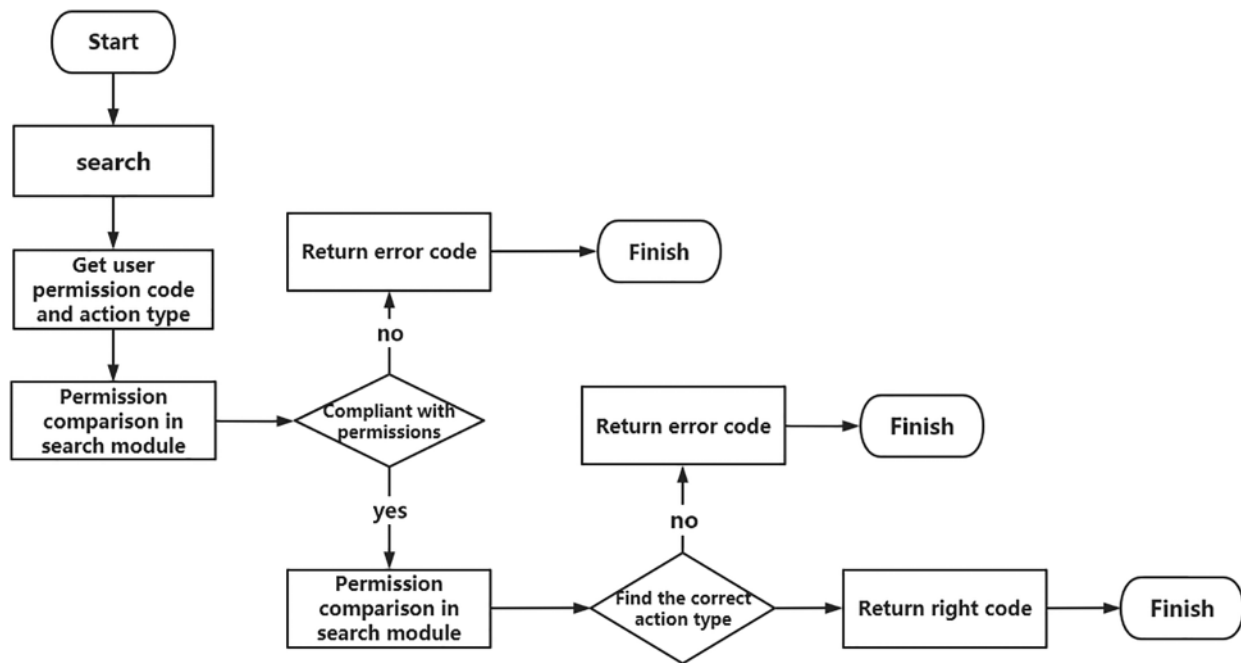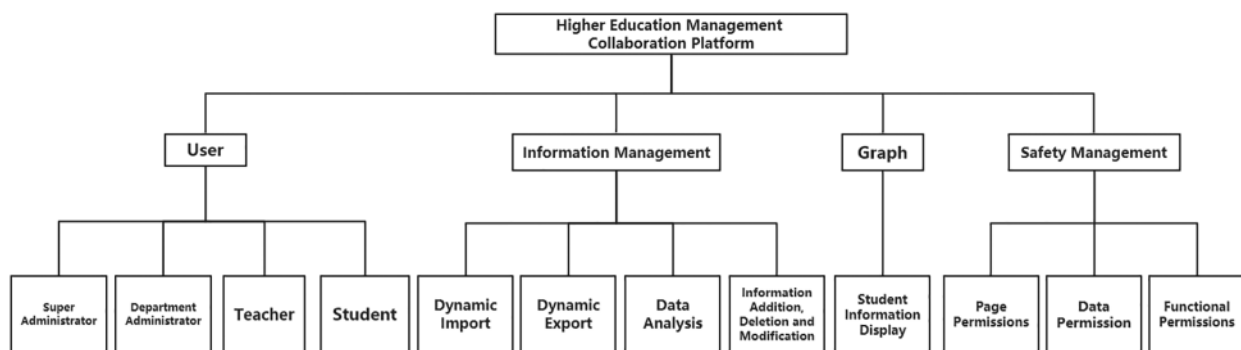
Figure 3: The workflow of security mechanism

Figure 4: The design of platform function module

3.2 Platform Architecture

In order to integrate different types of distributed databases and extract relationships from various databases in different departments, an independent relationship extraction module is constructed. The extracted data is stored in a new database by dynamic linked list structure. Then extract data from the database to display and analysis with graph. The platform architecture is shown in Fig. 5.
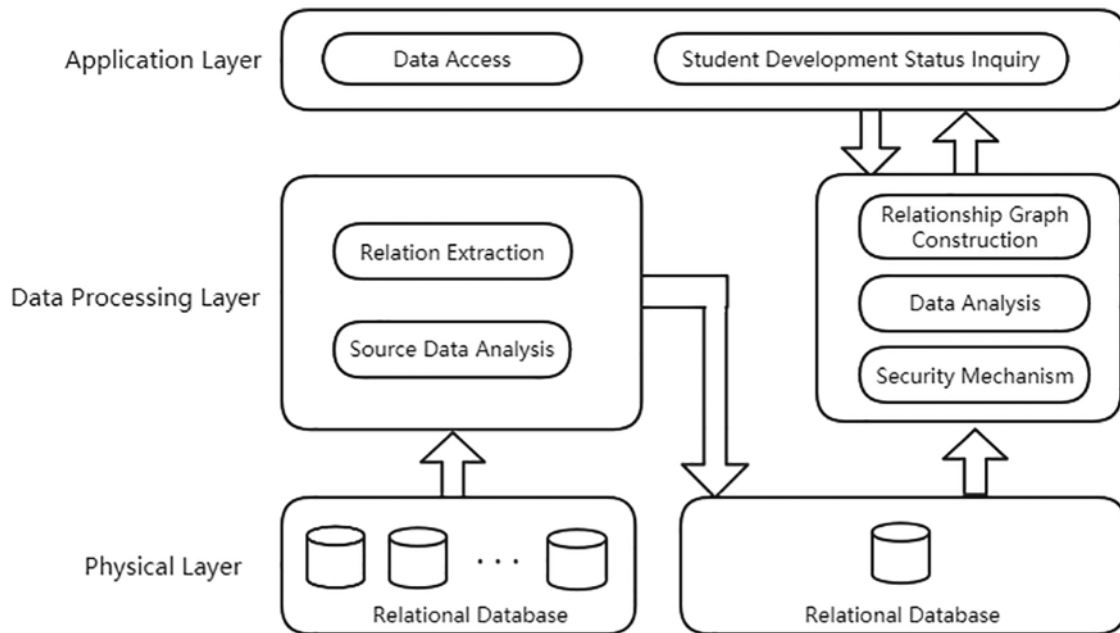
Figure 5: The platform architecture

3.3 Program Implementation

The development language is Java, and the database is developed with MySQL. On the server side, the JSON data are operated by JackJson or FastJson, and the data in Excel are processed with POI.

The partial implementation code is as follows.

```
import cn.sxxt.utils.json.JackJsonUtils;
import com.alibaba.fastjson.JSON;
import com.alibaba.fastjson.parser.Feature;
import net.sf.json.JSONArray;
import net.sf.json.JSONObject;

… … …

JSONObject json = JSONObject.fromObject(request.getParameter("data"));
    System.out.println(json);
    JSONObject options = json.getJSONObject("options");
    String username = json.getString("username");
    String anchor = json.getString("anchor");
    System.out.println("json:" + json);
    System.out.println("options:" + options);

    … … …
```

The implementation of the graph is shown in Fig. 6.
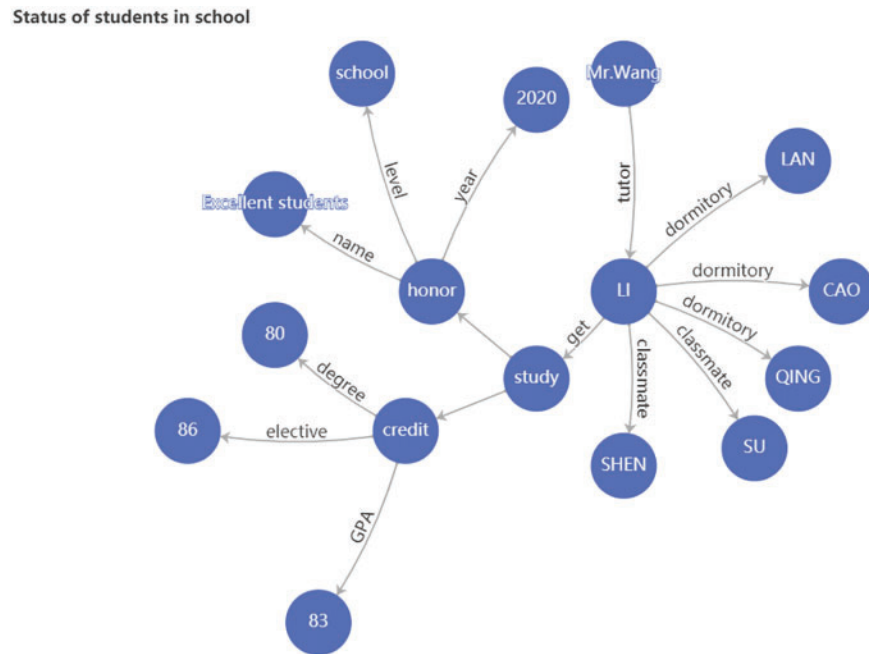
Figure 6: The implementation of the graph

3.4 The Result of Implementation

This platform has completed the integration of training data of various departments. On the one hand, students can understand their overall situation in real time. On the other hand, teachers can clearly see the problems of students. It can not only realize the highly collaborative work of various departments, provide data support for more effective training, but also help to improve students' self initiative.

It is used in School of Information Science and Technology, North China University of Technology. And it is mainly used for graduate management. Practice shows that it can help graduate education management very well. The proportion of students being warned with poor grades has remained at a low level. The student warning status is shown in Fig. 7 since 2015.
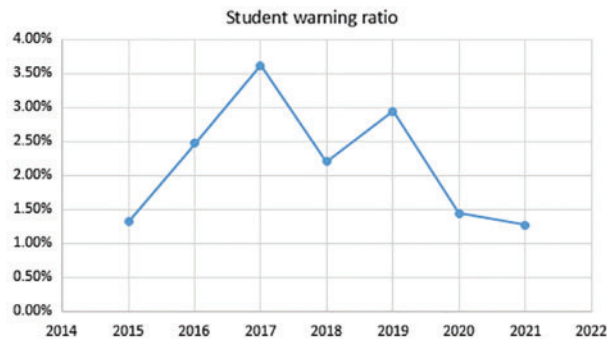

Figure 7: The student warning status

4 Conclusion

This paper proposes an implementation scheme of educational collaborative management platform. The access of distributed database is realized with the third-party database, and the dynamic access of data is realized with the secondary linked list. The centralized display of all aspects of information is realized with graph, and different permissions are set from page, access and function to ensure the security under information sharing. Finally, the collaborative work platform is completed to share all aspects of data and achieve an efficient cooperation mode. Practice has proved that the application of collaborative work platform can effectively improve the implementation effect of comprehensive education.

Conflicts of Interest: The authors declare that they have no conflicts of interest to report regarding the present study.

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