Artificial Intelligence Aided Course Scheduling System

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Abstract. College and department courses are broad, elegant and diversified. The demand for interdisciplinary elective courses is increasing, and the teaching management work is becoming increasingly heavy. Therefore, the administrative work of arranging and adjusting courses cannot be increased. We should carry out reform according to the actual difficulties. In the preliminary study of different educational administration work between colleges, the action research case study was started. This paper discusses how to apply the thinking of software engineering in educational administration system, innovate the current operation procedure, find out the solution, and realize the Artificial Intelligence Aided course scheduling system. This paper discusses the difficulties and difficulties of the current course scheduling system, and designs the new core principle and algorithm. Based on the problems collected by action research, the entity relationship between system analysis and system design is discussed, and the correct relation diagram is drawn to realize the function module of system design. After discussion, the group decided to adopt browser / server mode architecture, run the prototype of Artificial Intelligence Aided course scheduling system, and gradually test and eliminate problems, so as to realize the feasibility of the system and share the successful experience.

1. Introduction
With the rapid development of new 5G Internet technology, the immediacy of personal Internet information is becoming more and more mature. In this era, the college curriculum system needs to promote the instant information delivery service to personal mobile phones, and realize the personal instant course service Internet service mode.

The main task of university is teaching, and the teaching method needs teachers and students to discuss together in the classroom. The teaching process has grade learning map, but also depends on the effective operation of the educational administration system[1]. The system is directly related to the teaching work. It is a course arrangement and teaching activity from a semester to a school year. At present, the course scheduling method is that the academic administrator of the college reports to the academic affairs office. The academic affairs office collects the teaching plan of the whole school, uniformly arranges the course manually, and then distributes the preliminary abdominal plan to each college. The computer single machine operation is arranged by using office software or small course scheduling software. The course scheduling design completely depends on the academic administrator's personal thinking[2].
C.C. Gotlieb once put forward an application idea[3]. The core of the problem of Artificial Intelligence Course Scheduling assistant system is course scheduling, which is expected to solve the six factors of curriculum, teachers, classroom, students, class and time. In the process of curriculum adjustment of grades and different majors, the conflicts among curriculum, time and classroom should be avoided.

Course scheduling results must be combined with the overall teaching plan of the college, taking into account the learning progress of teachers and students and the pace of life, so it is a very complex problem[4]. We can understand that scheduling is a very difficult job. The result of course scheduling can not satisfy everyone and needs to be adjusted manually[5].

2. Systems analysis
From the perspective of system function and architecture, considering the basic architecture of the system, we need to have the Browser / Server mode of Internet function, Peer to Peer (P2P) system architecture, Hypertext Markup Language (HTML), Cascading Style Sheet (CSS), JavaScript, spring Model View Controller (MVC), Java database connectivity (JDBC), Database connection pool (DBCP), MySQL free database.

2.1. The conception of curriculum arrangement system
The user's view of the course scheduling system is the whole school curriculum, and the output is the timetable. Teachers use the teaching course, students are the class schedule, and the academic affairs group of the college is the curriculum database of all students and teachers. The school is divided into four levels: students, teachers, academic affairs group and academic affairs office[6]. The organization chart describes the relationship between the college organization and the course scheduling system, as shown in Fig. 1 Organization chart.

The maintenance manager of the course scheduling system is responsible for managing the data information of the system. The meta data in the system includes department data, class data, professional course data, class data and other system databases. Managers have the authority to process data, and can add, delete, modify, query and other operations and maintenance, such as table 1 schedule system responsibility table.

![Organization chart](image_url)

Table 1. Schedule system responsibility table.

| Number | Unit                                      | Function description                        |
|--------|-------------------------------------------|--------------------------------------------|
| 1      | Academic Affairs Office                   | Arrange the whole school curriculum         |
| 2      | Educational administration group of Secondary College | Summarize and declare the curriculum plan of the college at the same level |
| 3      | Teachers                                  | Query teaching plan, class and course      |
| 4      | Students                                  | Query personal timetable                   |
2.2. Analysis of system administrative process
The administrative process of course scheduling system describes the relationship between job roles and the system in the course scheduling system, and describes the course scheduling process according to the actual course scheduling process, as shown in Fig. 2 business flow chart of course scheduling system.

Figure 2. Business flow chart of course scheduling system.

2.3. System functional requirements analysis
The demand analysis of artificial intelligence course scheduling system is to transform the business model into the specific functions of the system. According to different users, it divides three functional requirements, including four basic functional modules. As shown in Fig. 3. Based on the functional requirement diagram of the course scheduling system, the functional modules of the planning system are analyzed, and table 2 is completed.

Figure 3. System functional requirements analysis.
Table 2. A brief list of the function modules of the course arrangement assistant system.

| Number | Function name       | Users                  | Input               | System response                                                                 | Output                          | Exhibition               |
|--------|---------------------|------------------------|---------------------|---------------------------------------------------------------------------------|---------------------------------|--------------------------|
| 1      | Department maintenance | System administrator  | Operation           | According to the user's corresponding operation, respond to the school department information | Department information list       | Table display            |
| 2      | Teacher management  | System administrator  | operation           | Respond to the teacher information of the school according to the user's corresponding operation | Teacher information list        | Front end table display  |
| 3      | Class search        | System administrator and user | Major, grade, College | Return the specified class information according to major, grade or college | Class information list         | Front end table display  |
| 4      | Class timetable     | System administrator and user | operation           | Respond to all class timetable information according to user operation          | Schedule information list       | Table display            |
| 5      | View course         | System administrator and user | operation           | Respond to all the course information of the school according to the user's corresponding operation | Course information list        | Table display            |
| 6      | Course selection    | System administrator and user | Academic year and term | Respond to the corresponding course information according to the academic year and semester | Course information list        | Table display            |
| 7      | Course revision     | System administrator  | Course information  | Update the assigned course according to the course information and respond to the modification result | Course information modification status code | Pop up tips               |
| 8      | Course deletion     | System administrator  | Course ID           | Delete the specified course information with the course ID and respond to the deletion result | Course information deletion status code | Pop up tips               |
| 9      | Add course          | System administrator  | Course information  | Save the course information, response to save the results                      | Save result status code         | The front end updates the latest course results |
| 10     | View the classroom  | System administrator  | operation           | Respond to classroom information based on user actions                         | Classroom information list      | Table display            |

3. System design

After completing the requirement analysis of the artificial intelligence course arrangement assistant system, the design project is realized step by step according to the function list, and the system design is carried out.

3.1. System architecture design

The system architecture adopts browser client / back-end server (B/S) architecture design model to analyze and design the overall architecture of the system. As shown in Figure 4 system architecture design. In the overall architecture design of school intelligent course scheduling system, it mainly includes user layer / client layer, server layer, database service layer and hardware layer.
3.1.1. View layer
The view layer is based on HTML5, CSS3, JS, JSP technology, mainly including the back-end display JSP pages and related static resources.

3.1.2. Control layer
The external performance of the control layer is to receive the client's request, process and respond to the request. In the control layer, there is no specific business details involved. As the commander of the system, the control layer receives the client requests externally, and internally processes the related requests by calling the business module in the business logic layer.

3.1.3. Business logic layer
The business logic layer is the core logic layer of the whole course scheduling system, including the specific implementation details of each function module, which provides business support for the control layer.

3.1.4. Data layer
Data layer provides data access support for business logic layer

3.1.5. Database service layer
As the back-end database layer of the system, the database service layer provides data support services for the business of the course scheduling system and responds to the read-write requests from the data layer in the server layer. The course scheduling system mainly uses MySQL database as the back-end database.

3.2. Data sheet design
On the basis of entity design, entity information is described by database conceptual model, and finally described as related data table.

3.2.1. User table Sch_user
User table Sch_User is established on the basis of teacher entity, and records the basic login information and authority letter of system user, as shown in Table 3 Sch_User structure table.
### Table 3. Sch_ User structure table.

| Table fields | Type      | Length | Not null | Primary key | Notes                      |
|--------------|-----------|--------|----------|-------------|----------------------------|
| id           | int       | 11     | Yes      | Yes         | Teacher ID                 |
| teacher_name | varchar   | 25     |          |             | Teacher name               |
| teacher_no   | varchar   | 50     |          |             | Teacher's job number       |
| passwd       | varchar   | 255    |          |             | Login password             |
| faculty      | int       | 255    |          |             | Department                 |
| status       | varchar   | 25     |          |             | State                      |
| is_login     | varchar   | 255    |          |             | Log in or not              |
| create_time  | datetime  | 0      |          |             | Creation time              |
| last_login_time | datetime | 0      |          |             | Last landing time          |
| is_admin     | varchar   | 25     |          |             | Is it an administrator     |

#### 3.2.2. Class table Sch_ class

Class data table is the data table corresponding to class entity, class data table Sch_ Class records the class information of the whole school, as shown in Table 4.

### Table 4. Sch_ Class structure table.

| Table fields | Type      | Length | Not null | Primary key | Notes                      |
|--------------|-----------|--------|----------|-------------|----------------------------|
| id           | int       | 11     | Yes      | Yes         | Class ID                   |
| class_name   | varchar   | 255    |          |             | Class name                 |
| class_size   | int       | 11     |          |             | Class size                 |
| major        | int       | 100    |          |             | Class major ID             |
| college      | varchar   | 50     |          |             | Department                 |
| grade        | varchar   | 25     |          |             | grade                      |

#### 3.2.3. Classroom table Sch_ classroom

Classroom table Sch_ Classroom is the data table corresponding to the classroom entity, which is used to record the classroom information of the whole school. Its table structure is shown in Table 5.

### Table 5. Sch_ Classroom structure table.

| Table fields | Type      | Length | Not null | Primary key | Notes                      |
|--------------|-----------|--------|----------|-------------|----------------------------|
| id           | int       | 11     | Yes      | Yes         | Classroom ID               |
| classroom_no | int       | 255    |          |             | Classroom number           |
| type         | int       | 11     |          |             | Classroom type             |
| capacity     | int       | 100    |          |             | Capacity                   |
| status       | int       | 25     |          |             | State                      |
| floor_type   | int       | 25     |          |             | Building                   |
| floor        | int       | 25     |          |             | Floor                      |

#### 3.2.4. Schedule Sch_ course

Schedule Sch_ Course is the data table corresponding to the curriculum entity, which mainly records the curriculum information of the whole school, such as table 6 curriculum structure table.

### Table 6. Sch_ Course structure table.

| Table fields | Type      | Length | Not null | Primary key | Notes                      |
|--------------|-----------|--------|----------|-------------|----------------------------|
| id           | int       | 11     | Yes      | Yes         | Course ID                  |
| course_name  | varchar   | 255    | Yes      |             | Course name                |
College form Sch_faculty is mainly responsible for recording the college information of the whole university, as shown in Table 7 Sch_Factly structure table.

| Table 7. Sch_Factly structure table |
|-------------------------------------|
| **Table fields** | **Type** | **Length** | **Not null** | **Primary key** | **Notes** |
| id                   | int      | 11         | Yes          | Yes            | College ID |
| faculty_department   | varchar  | 255        |              |                | Name of Department |
| faculty_no           | varchar  | 123        |              |                | Department code |

Course schedule Sch_plan

The curriculum schedule is the corresponding table of the entity curriculum plan, which records the opening plan information and is the input data structure of the course scheduling module. As shown in Table 8 Sch_Plan structure table.

| Table 8. Sch_Plan structure table |
|-----------------------------------|
| **Table fields** | **Type** | **Length** | **Not null** | **Primary key** | **Notes** |
| id                  | int      | 11         | Yes          | Yes            | Course plan ID |
| plan_no             | varchar  | 25         | Yes          |                | Course number |
| year_semester       | varchar  | 25         | Yes          |                | Semester academic year |
| course_id           | int      | 11         |              |                | Course ID |
| teacher_id          | int      | 11         |              |                | Teacher ID |
| class_name          | varchar  | 255        |              |                | Class arrangement |
| start_week          | int      | 50         |              |                | Starting week |
| end_week            | int      | 25         |              |                | End week |
| student_num         | int      | 255        |              |                | Number of students scheduled |
| comment             | text     | 59         |              |                | Remarks |

System module implementation

On the basis of the system architecture and module design, the following software development tools and technologies are used to implement each module of the system. The software environment is prepared for development, as shown in Table 9.

| Table 9. Statistical table of software development environment |
|---------------------------------------------------------------|
| **Software environment** | **Detailed information** |
| Oerating system       | Windows10, Linux(Ubuntu 16) |
3.4. System testing
The last stage is to run and test the system. The system test can find out the system problems and correct the system defects or loopholes in time.

3.4.1. Registration function test
Users can log in to the registration button at the bottom of the interface to access the registration function of the system. In the function test, enter the registration information in the registration interface, and observe whether the system can prompt the registration success information.

3.4.2. Function test of department management
It includes the maintenance function of the Department and the classroom management function, which mainly includes the addition, deletion, modification, query and the modification and query of teacher information.

3.4.3. Class management function test
It is mainly to view the class function test, view class function, mainly test the query, modification, deletion and addition functions of class information, and click to view the class, whether the default output of class information query function is normal.

3.4.4. Curriculum management function test
It mainly tests the course view function, which can query, delete, modify and add the course information, and users can click the view course tab. This function queries whether all course information is correct by default.

3.4.5. Classroom management function test
The main function is to view the test of classroom function, which is responsible for the query, modification, deletion and addition of classroom information. The user clicks the view classroom tab, and the system queries and displays all classroom information by default, and whether the query interface is correct.

3.4.6. Function test of course scheduling management
The function test of course scheduling management mainly includes system course scheduling function test, self-service course scheduling function test, manual course scheduling function test and checking whether the course scheduling function test is correct.

3.4.7. The function test of curriculum inquiry
The timetable query function is the general function of the system foreground and background. Through the timetable query function, we can query the class timetable, curriculum schedule, teacher schedule and classroom timetable. At the same time, it supports exporting to the local in the form of Excel.

4. Conclusion
This project is given to the fourth year of undergraduate, which is a successful implementation of teaching performance and verification of learning achievements. On the basis of the core function of
the course scheduling system, the functions of course information management, department information maintenance, classroom information management and curriculum management are correctly completed. Strictly following the system analysis and system design process of software engineering, the purpose is to develop the artificial intelligence course scheduling auxiliary system of university educational administration, and help the course scheduling personnel of educational administration units to complete the course scheduling work in advance more conveniently, accurately and efficiently. Using the action research method to collect the difficulties and expectations of the front-line course scheduling personnel's practical work, the completion of the test on schedule meets the basic needs of the operators. The reality is that the system is changeable and must be maintained for a long time. Of course, the system will have a life cycle. Continue the research of new system 2.0, can effectively improve students' development ability, cultivate students' professional skills when graduation and employment, easy to find ideal jobs, strive for opportunities to give back to the society and serve the people.

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