Design and Implementation of a Workload Management System for University Teachers Based on Python

Peng Qian, Yuexingzi Wu, Mengting Liu[*]
Anhui Sanlian University, Hefei 230601, China
*Corresponding Author.

Abstract:
With the rapid development of society and the widespread adoption of computer network technology, the daily management of universities is gradually shifting from traditional manual methods to intelligent and information-based approaches, in order to meet the increasingly complex and diverse educational demands. In this process, managing teachers' daily workloads, which is a fundamental and crucial task, is facing more and more challenges. Traditional manual recording and statistical methods suffer from problems such as data omissions, errors in recording, and delays in statistics, which seriously affect the accuracy and timeliness of workload evaluations. Therefore, solving this issue has become an urgent task for universities. This research aims to design and implement an efficient and scientific university teacher workload management system, which seeks to enhance the precision and timeliness of workload assessments through informatization, ensuring fairness and justice in the management process. This will optimize the allocation and evaluation mechanism of teachers' workloads, thereby improving the work efficiency and motivation of teaching management personnel. The system is primarily developed using Python, presenting a solution that meets the needs of modern university management. The system not only addresses various issues in traditional management methods but also provides data analysis and decision support capabilities, offering strong technical support for the management of university teaching.

Keywords: university daily management, teacher workload, management system, database

INTRODUCTION

With the rapid development of computers and networks, as well as the continuous growth of the scale of teachers and students in universities, the workload of teachers has also increased. The management of teacher workload is also an important component of higher education management, serving as an important basis for determining teacher workload and evaluating professional titles. It is also an important means of controlling teaching quality and providing reference for unit leaders to make decisions or personnel arrangements. Therefore, designing an efficient and intelligent teacher workload statistics system to address the issue of teacher workload management in universities is of great significance.

The concept of educational informatization emerged as early as the 1990s.Kenneth Green, a professor at the University of Clermont in the United States, first proposed the concept of "Campus Computing" in 1990: a digital work, learning, and living environment that integrates teaching, learning, management, and life, with a campus network as the background [1]. European and American countries have long realized that the development of colleges and universities cannot be separated from informatization, and the informatization of campus is earlier than that of other countries. Due to the great importance of information technology in promoting the reform of higher education, developed countries such as Britain, the United States and France have penetrated information technology into the management, teaching, scientific research and other aspects of higher education, and the information and scientific teaching management has been in the forefront of the world [2,3].

In contrast, the educational informatization in China started relatively late. In the 1990s, with the development of computer technology and the later development of networked information highways, the concept of educational informatization in China was just proposed, which was later than that of European and American countries.

At present, most of the educational management systems in universities in China are only for daily teaching management, such as schedule arrangement, examination arrangement, score management, suspension of classes, and evaluation of teaching and learning. The system for teacher workload statistics is not implemented. The main content involved in this module includes class hours, homework review, paper guidance, grading, and training (internship) guidance, all of which will be included in the teacher's workload statistics work. The use of manual processing in this work has certain limitations and complexity, which can easily lead to errors in workload

statistics and low work efficiency, which is not conducive to the improvement of university management level [4]. Therefore, it has become a critical issue that universities in China must urgently address to achieve the informatization, intelligence, and systematization of teaching management, resolve the shortcomings in the current management system, and improve work efficiency and management levels.

This paper aims to design an intelligent university teacher workload management system, which not only calculates teachers' teaching workload but also allows teachers to upload their teaching tasks within a specified timeframe. In addition, this system can also analyze and mine data through the database, providing a basis for teaching management personnel to timely understand the teaching situation and workload completion of teachers. This can improve the efficiency and accuracy of teaching management personnel in calculating teacher workload, improve management level and optimize management mode, and achieve information management in universities.

OBJECTIVES

The main purpose of this project is to design a high teacher workload management system, which can record the workload details of teachers in their daily teaching process, greatly improving the efficiency of teaching management personnel, and constantly grasping the dynamic situation of teacher workload, reducing management costs and errors. This project focuses on the following content:

1. Design the main system structure and implementation of main functional modules, mainly focusing on the implementation of the system's main interface and related functions.

2. The design of the database system structure and system functions mainly includes the design of the table structure, the design of the database system architecture, the use of DBMS technology, the development tools and their architectures, the compilation of a definable SQL Server database system, the access port of the main interface user system, the input of data information and the implementation of the relevant program functions of the database system.

3. Implementation method for teacher workload statistics. The formulas used in workload statistics are both complex and variable. This system improves the algorithm for classical expression analysis and calculation, and designs a simple, flexible, convenient, and scalable new method to achieve timely and accurate workload statistics and improve work efficiency. When adding, deleting, or modifying workload items, there is no need to modify the original program, which has applicability and usability.

METHODS

System Development Mode

At present, the development of various system structures is mainly achieved through three levels of structures, namely, the presentation layer, the logic layer and the data layer. The system structure is shown in Figure 1 below:
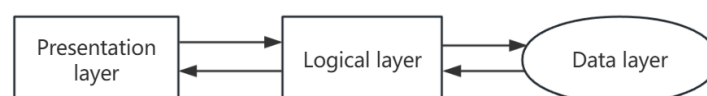

Figure 1. Three layer architecture model

In the above three hierarchical architecture models, the main functions of each level are as follows:

Presentation layer: This layer mainly provides the interface display function to facilitate users to have an intuitive understanding and easy operation. Simultaneously implementing a human-machine user interaction mode, achieving information exchange processing, and providing support and assistance to users.

Business logic layer: The main function of this layer is to perform logical processing on core businesses, such as workload classification, workload statistics, task modification, etc. In addition, the logical layer is the core layer of the three hierarchical architectures.

Data layer: This layer mainly processes and stores the previous data information, making it convenient for users to call at any time.

Requirements Analysis

The workload of university teachers involves a wide range, mainly including: reviewing homework or experimental reports, revising the teaching syllabus, attending classes, preparing lessons, grading papers, teaching research projects, guiding graduation thesis (design), etc. In universities, the workload assessment of teachers is an indispensable task and the main basis for the distribution of teacher labor remuneration. In addition, relevant departments of the school and leaders of the unit will make reasonable arrangements for other work tasks based on the workload of teachers, in order to improve the work efficiency of the unit.

Through preliminary investigations, it was found that some universities (departments) adopt a monthly or end of semester approach where teachers themselves report their workload to the teaching secretary of the department for summary. The teaching secretary then checks the information reported by the teachers, which can easily lead to low work efficiency such as data statistics errors and omissions. Some universities (departments) use pre class check-in and monthly unified summary, which increases the workload of teaching secretaries and is prone to statistical errors. At the same time, the other workloads of relevant teachers cannot be randomly controlled, which is not conducive to the leadership decision-making arrangements of the school and the unit, as well as the timely distribution of teacher labor remuneration, affecting the enthusiasm and life of teachers.

In response to the above situations, researching and designing a workload management system for university teachers is beneficial for improving the work efficiency and quality of teaching management personnel, and avoiding unnecessary troubles caused by mistakes in work; It is beneficial for university teachers to keep a real-time record of their workload; It is beneficial for schools or departments to keep track of the workload of teachers at any time and facilitate work arrangements; It is conducive to the construction of information technology in universities, and achieving networked management has become an inevitable trend.

Based on the statistics of the workload of university teachers surveyed in the early stage, the designed system should meet the following requirements [5]:

Applicability: To meet the needs of different users such as university teaching managers and teachers; The system functions, interfaces, and structure are concise, scientific, and reasonable; User operation is simple and convenient.

Flexibility: Teaching managers and teachers can handle flexible projects according to work needs, improving work efficiency.

Scalability: Teachers can add workload project names according to the needs of the teaching process, which has a certain degree of scalability.

Security: Access permissions are assigned by a dedicated person in the school, and vary for different users. All users must register with their real name before using it, and only those who meet the conditions can obtain the corresponding permissions. In addition, the system has the basic functions of a database, such as data storage, backup, recovery, import and export.

System Design

Functional module design

The functions of the workload management information system for university teachers are mainly reflected in three aspects: firstly, the user module; The second is the administrator module; The third is the system administrator module. The structural form is shown in Figure 2:
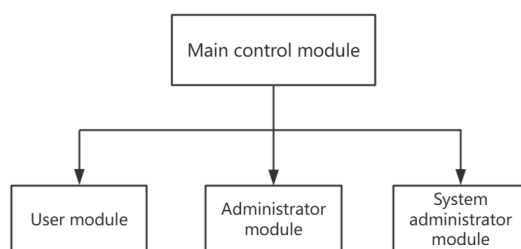

Figure 2. System structure diagram

The three modules of the teacher workload management system mentioned above require identity verification to ensure the legitimacy of users and the security of data, and to prevent unauthorized users from entering and modifying at will. The functions of each module are as follows:

(1). User module

The main functions of this module are: teachers can access the system through their own accounts to view course schedules, enter and query grades, and provide internship or graduation guidance records.

(2). Administrator module

The main function of this module is that the teaching management personnel of the college (department) can adjust the actual workload processing of teachers and calculate the workload of each project category.

(3). System administrator module

The main functions of this module are: the school educational administration office is responsible for the management of the system, with the final management authority, the allocation of user account, the right to process data information, and the right to open the system functions.

Database design

At present, the system design mainly uses various databases such as Oracle, Access, MySQL [6], SQL Server, etc. for designers to use. Among these databases, MySQL is the most commonly used one, which meets the needs of program developers. It is easy to operate, easy to learn, easy to use, and has low hardware requirements for computers. It can be implemented by ordinary personal computers [7]. Although the Access database is also simple and easy to operate, its functions are limited. It belongs to the built-in database system of Office software, and its functions are limited, which cannot meet the needs of most system developers. Therefore, MySQL database system is the optimal choice compared to other database systems.

The design of databases usually adopts two methods: attribute based attribute oriented classes and entity function based entity oriented classes [8]. The design of subject class attributes preserves the correlation between attributes after merging them into entities. The dominant class entity design starts with entity construction and then determines attributes. When the number of entities is less than one tenth of the total number of attributes, the simulation effect of entity advantage classes is the most ideal. The usual steps for developing a database are as follows:

(1). Design of database system structure;

(2). Use DBMS technology, development tools, and their structure;

(3). Compile a definable MySQL database system;

(4). The access port of the main interface user system;

(5). Input of data information;

(6). The relevant program functions of the database system can be implemented.

This database system consists of relevant data tables, mainly teacher information tables, used to record user login information; Administrator information table, used to record administrator permissions; Course information table, used to record relevant information modules of teacher courses; Practice information table, used to record relevant practice information modules guided by teachers; Class information table, used to record the class name and number of people. The specific table structure information is shown in Tables 1 to 5:

Table 1. Teacher information table

Field name	Type	Function
TeacherId	int	Teacher number
TeacherName	nvarchar(50)	Teacher name
Password	nvarchar(50)	Teacher's code
TeacherTitle	nvarchar(50)	Teacher title

_____

Table 2. Department number table

Field name	Type	Function
DepartmentId	int	Department number
Departmentname	varchar	Department name
Departmentpwd	varchar	Department code

Table 3. Theoretical course numbering table

Field name	Type	Function
CourseId	int	Course number
Coursename	varchar	Course name
CourseCoefficient	int	Course coefficient

Table 4. Practice course numbers

Field name	Type	Function
practiseId	int	Practice number
practisename	varchar	Practical course title
practiseCoefficient	int	Practical course coefficient
practiseWeeks	int	Number of weeks of practical courses

Table 5. Class information table

Field name	Type	Function
Classname	varchar	Class name
ClassNumber	int	Class size

System Interface Design

Using the PyQT5 toolkit to create a GUI interface for the teacher workload management system, which facilitates the statistics and management of teacher workload information. The specific design process can be divided into the following steps:

Database import

Using the QtWidgets library in PyQt5, set the buttons and labels, and import the main code as follows:

import sys

Importing QApplication, QWidget, QLabel, QLineEdit, and QPushButton from PyQt5.QtWidgets.

Main window creation

Set the size range and position layout information of the main window, edit the title name, and the main code is as follows:

```
app = QApplication(sys.argv)

win = QWidget()

win.setGeometry(100, 100, 400, 300)

win.setWindowTitle("University Teacher Workload Management System")
```

Create components such as edit boxes, buttons, and field names

Design a simple and user-friendly GUI interface through PyQT5 [9]. When the user clicks a button in this interface, the relevant program will call button1_ The click function retrieves the teacher information in the edit box, then queries the workload of the teacher and displays relevant information. In addition, other components can be added to the main interface according to the needs of management personnel to achieve the required functions, making the main interface more flexible and convenient.

RESULTS

Based on the previous requirements analysis and system design, fully consider the flexibility, practicality, scalability, security, and maintenance requirements of the workload management system for university teachers, and conduct a detailed analysis and design of the system to achieve good expected results [10].

The design of a workload management system for university teachers is achieved through object-oriented design concepts and component-based development methods. The main software technology in the background is written using Python language programs, and the traditional software MySQL is used for the database [11]. Users can transfer the relevant information of RTS to the logic layer with services through the presentation layer, which will identify the user's operation instructions to execute the corresponding functions, and then obtain the relevant data from the database and return to the presentation layer to implement the user's instruction operations [12]. The hierarchical mode divides system tasks by hierarchy, so that changes in the internal data structure and business logic of the system do not have any impact on the system interface. The system structure is shown in Figure 3.
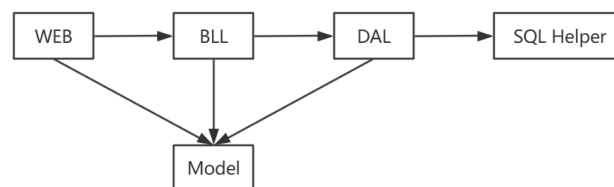

Figure 3. System block diagram

In Figure 3, the interaction between the WEB and users is implemented to forward requests and request identification, and BLL is used to achieve relevant configurations, such as setting and inputting teacher workload information content, system function configuration, etc; DAL is an object-oriented technology that can quickly and accurately access, update, and other related operations in the database; BLL achieves the organic combination of multiple functions to solve problems that arise in the system, such as course scheduling, log management, etc; The function of Model is to implement data partitioning, providing data entity classes for DAL, BLL, and web calls; The function of SQL Helper is to simplify code writing and standardize [13].

The teacher workload management system mainly includes modules such as teacher information management, teaching task allocation, teaching resource management, and teaching quality evaluation. The implementation process of each module is as follows [14]:

1. Teacher information management module

The teacher information management module can build Web applications through Python's Flask framework, and use SQLALchemy database ORM framework to interact with MySQL database. Flask-admin In Flask application, this topic uses the definition of a RESTful API to implement operations such as adding, deleting, and changing projects, and also provides a visual background management interface with the help of the flask-admin plug-in.

2. Teaching task allocation module

The teaching task allocation module can be used to build web applications using the Django framework and interact with MySQL databases using the Django ORM framework. In the Django application, this topic achieves teaching task allocation function by defining view functions and URL mapping. At the same time, data submission and validation can also be achieved by using the Django Form component.

3. Teaching resource management module

The teaching resource management module can use the Flask framework to build web applications, and use the Flask RESTful plugin to implement RESTful API interfaces. This project implements the upload and download functions of teaching resources by defining interfaces for file upload and download. On the server, use Nginx to deploy static file services [15].

4. Teaching quality evaluation module

The teaching quality evaluation module can be used to build web applications using the Django framework and interact with MySQL databases using the Django ORM framework. Implement teaching quality evaluation function by defining view functions and URL mapping. At the same time, data submission and validation can also be achieved by using the Django Form component [16].

This project uses the mysql. connector module to connect to a MySQL database. After establishing the connection, we use cursor objects to execute SQL statements, obtain query results, and perform traversal output. Finally, we close the cursor and connection object. The specific implementation code is as follows:

```
import mysql.connector
# Establishing a database connection
cnx = mysql.connector.connect(
host="localhost",
user="root",
password="yourpassword",
database="yourdatabase")
# Create a Cursor
cursor = cnx.cursor()
# Query all records in the teacher information table
query = "SELECT * FROM teacher_info"
cursor.execute(query)
# Obtain query results
result = cursor.fetchall()
for row in result:
print(row)
# Close cursors and connections
cursor.close()
cnx.close()
```

Figure 4 shows the login page, the main functions of this interface are to enter the user name, password, role selection, login, and new user registration. After administrators enter the system, they can manage the workload of teachers [17].
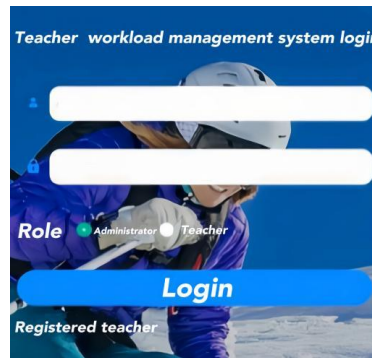
Figure 4. System login interface

When entering the teacher management module, teachers need to input basic personal information first, and the system will automatically generate form information [18]. Teachers can modify and confirm the fields in the form according to their own situation, and the corresponding information will be saved in the database.

In addition, the relevant basic information in the teacher management interface, such as: course number, course name, class time, teaching place, etc., can be added, deleted and modified according to the actual situation, and the processed information will be saved in the database, as shown in Figure 5:
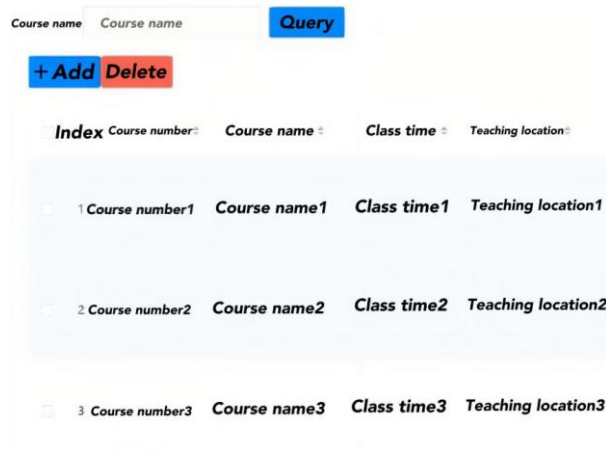

Figure 5. Information input interface

In the interface of teacher information and workload, the main functions are as follows: fill in the name of workload, query relevant information at the time of submission [19,20]; In addition, you can add or delete information records or export database information, including workload name, workload type, details, and teacher ID, as shown in Figure 6.
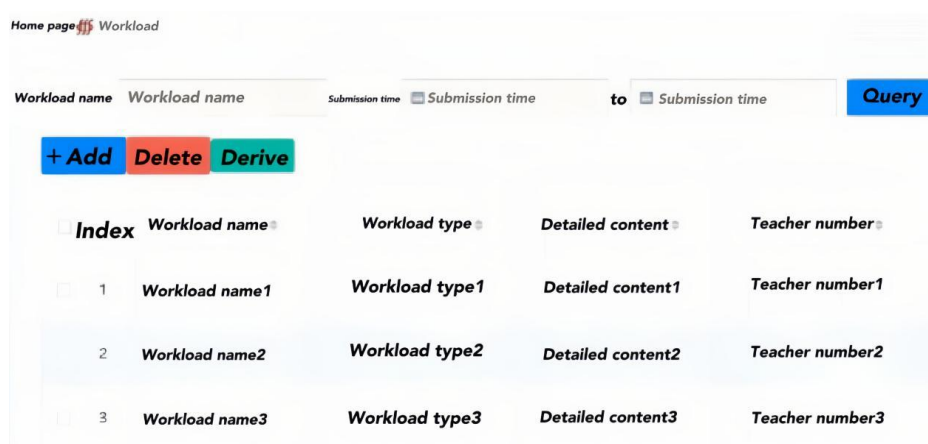

Figure 6. Save information interface

DISCUSSION

Although this study has made certain achievements in the design and implementation of an intelligent workload management system for university teachers, there are still some shortcomings that can be improved. First of all, the security and encryption issues of databases have not been well addressed, making them susceptible to non-invasive damage or theft of data. In addition, the system can meet basic functional requirements without detailed research and analysis, and the workload statistics module does not have detailed categories and types.

In order to achieve true functionality in the teacher workload management system, the engineering workload is relatively large and complex, and the design of this system is currently unable to achieve its perfection. But how to achieve a reasonable, fair, and scientific teacher workload evaluation system is worth further research and design, mainly involving the following aspects:

1. The construction of a teacher workload management system and an academic management system can be effectively combined, and currently, most academic management systems in universities do not have this function. Therefore, the demand in this area is still very large.

2. Provide warning prompts for teachers who are absent or switch classes to a certain proportion: firstly, it can avoid forgetting during busy daily work; The second is to remind teachers to adjust the number of class suspensions, which affects the quality of teaching.

3. Implement the system to automatically classify and accumulate the workload of teachers, which can further improve work efficiency from the previous foundation.

ACKNOWLEDGMENT

REFERENCES

[1] Yang Yang. Analysis and Design of Scientific Research Management Information System of Art Universities Based on J2EE. Master's Thesis of University of Electronic Science and Technology of China, 2010. (10).

[2] Wang Qingxi, College Teacher Workload Management System. Digital Technology and Application, 2016 (06): 183.

[3] Yuan Li. Design and Implementation of a Teacher Workload Management System. Information Technology and Informatization, 2018 (10): 45-47.

[4] Lyu Guanyan, Li Fenghua. Research and Design of Teacher Workload Accounting Statistics System. Modern Computer, 2023, 29(15):113-116.

[5] Ni Xiqin, Zou Jianjian. Design and Implementation of a Workload Management System for Vocational College Teachers under a Cloud Service Platform. Information and Computer (Theoretical Edition), 2020,32 (20): 215-217.

[6] Gao Wei, Fan Qing, Gao Wenqiang, et al. Design and Implementation of a Teacher Workload Management System Based on PHP and MySQL. Journal of Inner Mongolia Agricultural University (Natural Science Edition), 2017 (09): 52-53.

[7] Li Jiaqi, Feng Huanzhong, He Qi, et al. Design and Implementation of a Web-based Workload Management System for University Teachers. Electronic Technology and Software Engineering. 2018 (10).

[8] Wu Qiong, Feng Changbao, Ren Ni. Construction ideas for a workload management system for university teachers. Science and Technology Information. 2019 (02).

[9] Huang Wenwu, Fu Qiang, Luo Zhuobi. Design and Implementation of a Teaching Workload Management System for University Teachers. China Education Informatization. 2014 (12): 65-66.

[10] Zhao Shuang. Exploration of the Reform of the Management System for Evaluating the Workload of Teachers in Private Universities. Modern Commerce and Industry. 2021 (34).

[11] Wang Ye. Design and Implementation of a Teaching Workload Management System for University Teachers. Computer Knowledge and Technology, 2013 (11): 7173-7182.

[12] Zhang Yang, Wei Ting, Chen Yixuan. Research and Practice on Informationization of Teaching Workload Management in Vocational Colleges. Light Industry Technology, 2021,37 (10): 58-60.

[13] Liang Yan. Practical Research on the Workload of Teachers in Higher Vocational Colleges: Background, Current Situation, and Enlightenment. Journal of China Multimedia and Online Teaching (Mid ten-day), 2022 (03): 245-248.

[14] Gu Wenwen. Intelligent Application and Research on Teacher Workload Management in Academic Affairs Management of Five Year Vocational Education Departments. Information and Computer (Theoretical Edition), 2021,33 (17): 214-216.

[15] Da Lixiong. Design and Implementation of a Workload Management System for College Teachers Based on ASP. NET. 2014 (02): 52-53.

[16] Chen Zuze. A Web-based Kanban Based Workload Management System for Evaluating Teachers in Universities. University of Electronic Science and Technology, 2009 (05): 21-31.

[17] Nie Shucheng. Analysis and Design of a Workload Management System for University Teachers. Northeast Petroleum University, 2012 (06): 6-14.

[18] Liu Qian, Zhang Hui, Fan Lin, et al. Design and Implement of University Teachers' Workload Management System. Journal of Physics: Conference Series,2022,2278(1): 012012.

[19] Zihao Zhou. Research on the Design of Teacher Workload Management System. Proceedings of 2019 2nd International Conference on Intelligent Systems Research and Mechatronics Engineering (ISRME 2019). Francis Academic Press,2019:683-689.

[20] Ekanayaka E M S B, Gunawardhana A A S, Mihirani M B, et al. Workload Management System for Cricketers. Annual International Conference of the IEEE Engineering in Medicine and Biology Society. IEEE Engineering in Medicine and Biology Societ y. Annual International Conference,2021: 7292-7295.