



# COMPSCI 780 Research Report

## The Development and Design of the Learning Website for the Computing Essentials Course

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# Abstract

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With the rapid development of information technology, online learning has become a trend in recent years. How to use information technology to help college students learn more efficiently has become a topic that we need to study. This website uses information technology to help college students learn the Computing Essentials course. The website is developed and implemented using the Model-View-Controller (MVC) design pattern in software engineering, with HTML, JavaScript, Python, and DBMS technologies. It consists of several modules, including course browsing, discussion board, passing quiz, user data administration and system resource management. The website allows students to learn from courses, share experience, examine learning result and save progress by using web browser. It provides a source for students to obtain learning resources and contributes to students' experience when they learn.

**Key words:** Web; learning website; database

# **Introduction**

## **1.1 Motivation to Develop the Website**

With the continuous development of computer and internet technology, the internet is playing an increasingly important role in the study and life of university students, and is having a more and more profound impact on the way they learn. Through the internet, students can access a large number of learning resources, exchange learning experiences and ask questions to lecturers. The internet has not only broadened the ways in which students can learn, but also increased the ways in which lecturers can teach. In particular, a large number of university students have chosen to study online in the past couple of years due to the coronavirus pandemic, which has placed a higher demand on universities and educators to teach online. This of course includes the Computing Essentials course. Learning computing essentials is necessary for every university student. Therefore, the development of a website for teaching computing essentials courses has become a very necessary task at the moment.

The web-based learning website has advantages of being convenient, real-time, not limited by classroom resources, and being able to give timely feedback. It is widely accepted by students and has been used to a certain extent. There are a number of online teaching websites on the web, but not many of them are aimed at university students and provide teaching in the computing essentials course.

The computing essentials course learning website has many modules, such as course resource browsing, discussion boards, passing quizzes, and user information and teaching resource management. The design of this website is of great importance to university students, especially those in the early years of their studies in Computer Science.

Based on the facts above, it is very important to design and develop a website for university students so that we can provide them with computing essentials course better, deepen their understanding of basic computer knowledge, and to develop their programming and computational thinking skills.

## **1.2 Problem Identification**

As a functional website for teaching computing essentials course, the management of course resources is an important part in the design of the website. The website can be deployed to the internet, open to many users, and can be used by both students and lecturers. The website can provide students with a variety of functions such as teaching resources browsing, lecturer information browsing, passing quizzes, discussion boards, etc. The information in each section is interoperable. Through this website, university students can better study the computing essentials course, promote the cultivation of computational thinking ability based on computer technology, and improve their comprehensive quality and innovation ability.

The computing essentials course learning website mainly involves two points: the delivery of teaching resources and teaching quality inspection. At the same time, it's best to include a platform where users can communicate. Especially the communication between students and lecturers can answer the doubts in learning and improve the quality of teaching. The development of the system is done by me individually. The report mainly concentrates on the design of the above three modules, and try to make the data in each module organically combined, to achieve a fully functional and easy-to-use computing essentials learning website.

## Literature Review

According to the 23rd China Internet Development Statistics Report released by the China Internet Network Information Center (CNNIC) in January 2009, college students are currently the most active group among internet users, and surfing the internet has become one of the most common things to do of college students after studying.

Guo Xuying (2009) pointed out that the application of information technology is becoming more and more extensive. It can present information in a way that is most acceptable to learners, process information in line with students' characteristics, and construct effective teaching methods that present information can fully arouse the enthusiasm of students in learning. In classroom teaching, teachers should make full use of information technology to improve students' participation and improve teaching quality.

Liu Wei and Wang Jiang (2009) pointed out that the construction of teaching websites enables lecturers to learn more about the connections among various courses, and re-understand the teaching of courses from an overall perspective and from the perspective of solving practical problems. This not only inspires lecturers' enthusiasm for a new round of teaching reform and research, but also promotes the improvement of teachers' professional level and professional ability, and truly achieves a win-win situation in teaching and learning.

According to a study by Ren Ziting (2013), Computing Essentials is a basic course for computer science and technology majors. It is a precursor and core course, and is an overview of the complete knowledge system of the computer major. Many domestic colleges and universities offer this course in the freshman year. In teaching, it is found that students lack a comprehensive understanding of professional knowledge, lack an overall logical system, and have poor learning ability and problem-solving ability.

Song Yan (2010) conducted a research on the teaching website of the Computing Essentials Course. He believes that traditional teaching and research methods and teaching management methods can no longer meet the needs of current education development. The application of Web-based network learning will affect and change the current teaching methods, make up for the shortcomings of traditional teaching methods, and improves learning quality. The website he designed consists of the

following modules: course description module, course website module, video module, message board module.

The website I am going to implement has certain similarities with the research carried out by Song Yan (2010). In contrast, my website implements more functions, such as quiz functions and score records, and uses a newer technology stack. My website is more scalable and easier to maintain. This is because the coupling between modules on this website is low. In fact, when I was developing this website, each module was developed separately. When I combined them, I found it unexpectedly easy, only need to add the association between the modules in the database model, add url routing, and expand the HTML template based on the same base. With the above advantages, I think my website can take the research of the Computing Essentials Course learning website one step further.



# Methods

## 3.1 Research Method Selected

This project belongs to Design Projects. Specifically, the research method I chose is to use software engineering methods to develop website systems. This is my graduation project at SWU. This topic was selected in the university website. On the other hand, I think that developing a website is of great help to the learning and teaching of Computing Essential Course.

With the help of modern web frameworks, a fully functional website can be developed quickly. When choosing the technology stack, I first considered ASP.NET as the server side. This is because many of the similar websites use it, so it will be familiar to website administrators. However, difficulties were encountered in website development. With a high degree of coupling, websites developed using older technologies will be more difficult to maintain, and it is not easy to add new features. Even the configuration of the development environment is a cumbersome task. The web server needs to be installed and configured, and there are also compatibility issues between the web server and the server side.

Later, I learned about Django in the tutorial provided by Mozilla.org. Although it may be unfamiliar for website administrators, its advantages are obvious. Django comes with a web server, so it runs on the server with just a line of code. No need to consider compatibility issues. In addition, I can use the package from python community to easily implement some advanced features. Django can solve some technical details in the development process, allowing me to focus on function realization. Using Django to migrate the database only requires a few lines of commands, which I think is very convenient. Therefore, I found that Django is a suitable web framework for developing this website.

## 3.2 Technical Concepts and Tech Stack

### 3.2.1 Model-View-Controller (MVC)

Model-view-controller (usually called MVC) is a software design pattern commonly used to develop user interfaces. It divides program logic into three interrelated elements

(Reenskaug., 2009). MVC Has become a popular model for designing Web applications. Many programming languages such as JavaScript, Python, Ruby, PHP, Java, and C# have MVC frameworks, which are used for the development of Web or mobile applications.

The division of the three elements is as follows:

Model -- Algorithm implementation and database schema definition.

View -- Graphical interface design.

Controller -- Forwarding and processing requests.

Fig.3.1 shows the connection of components of MVC:

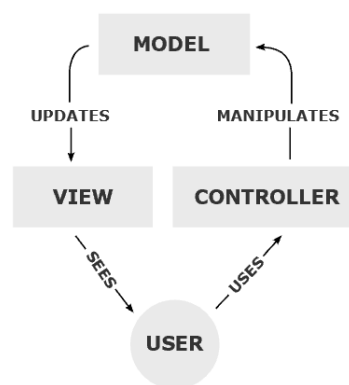


Fig.3.1 MVC process connection structure diagram

The user uses the controller to modify the data in the model (for example the data in the database), then the model updates the view, and finally feeds back to the user.

MVC is widely used in network applications. Although originally developed for desktop applications, it has been widely adopted as the design of web applications in many programming languages.

### 3.2.2 Python and Django Web Framework

Python is an interpreted, high-level and general-purpose programming language. Its language structure and object-oriented approach are designed to help programmers write clear and logical code for small and large projects. It has always been listed as one of the most popular programming languages.

Django is a free and open source web framework based on Python, following the model-template-view (MTV) architectural pattern. It is maintained by the Django Software Foundation (DSF).

The main goal of Django is to facilitate the creation of database-driven websites. The framework emphasizes the reusability and "pluggability" of components, with less code, low coupling, and fast development speed. The core framework of Django can be regarded as an MVC architecture. Controller here refers to the URL dispatcher based on regular expressions, which is usually defined in `urls.py`.

Some well-known websites that use Django include PBS, Instagram, Mozilla, The Washington Times, Disqus, Bitbucket and Nextdoor (Shaw., 2017).

### **3.2.3 SQLite Database**

SQLite is a relational database management system (RDBMS) included in the C library. Unlike many other database management systems, SQLite is not a client-server database engine. Instead, it is embedded in the terminal program.

SQLite generally following the PostgreSQL syntax. It can be said to be the most widely deployed database engine, because it is used by a wide range of browsers, operating systems, and embedded systems (such as mobile phones). SQLite has bindings to many programming languages (Choi., 2017).

## **3.3 Development Tools**

### **3.3.1 Navicat for SQLite**

Navicat for SQLite is a powerful SQLite GUI, which provides a complete set of database management and development functions. Users can quickly and safely create, organize, access and share information. It has a graphical user interface similar to a resource manager, and supports multiple database connections for local and remote databases.

### **3.3.2 Visual Studio Code**

Visual Studio Code is a free source code editor by Microsoft for Windows, Linux and macOS. Features include support for debugging, syntax highlighting, smart code completion, snippets, code refactoring, and embedded Git. Users can change themes, keyboard shortcuts, preferences, and install extensions. In the StackOverflow 2019 Developer Survey, Visual Studio Code was rated as the most popular developer

environment tool.

### 3.4 User Demand Analysis

After analyzing the demands of user, I found that the functions that need to be implemented on this website are: browse and learn courses in the form of text, pictures and videos; register and login user account; ask questions in the discussion boards, and wait for other students or lecturers to answer; check learning result; and save learning progress.

In response to these demands, I decided to implement the above functions modularly, and also includes a administration backend that allows administrators to add, delete and modify courses and user data.

The users of this website can be divided into four types: unregistered users, students, lecturers, and administrators. The website can provide different modules for different types of users, so that the entire website will work well. The user demand model is shown in Figure 3.2:

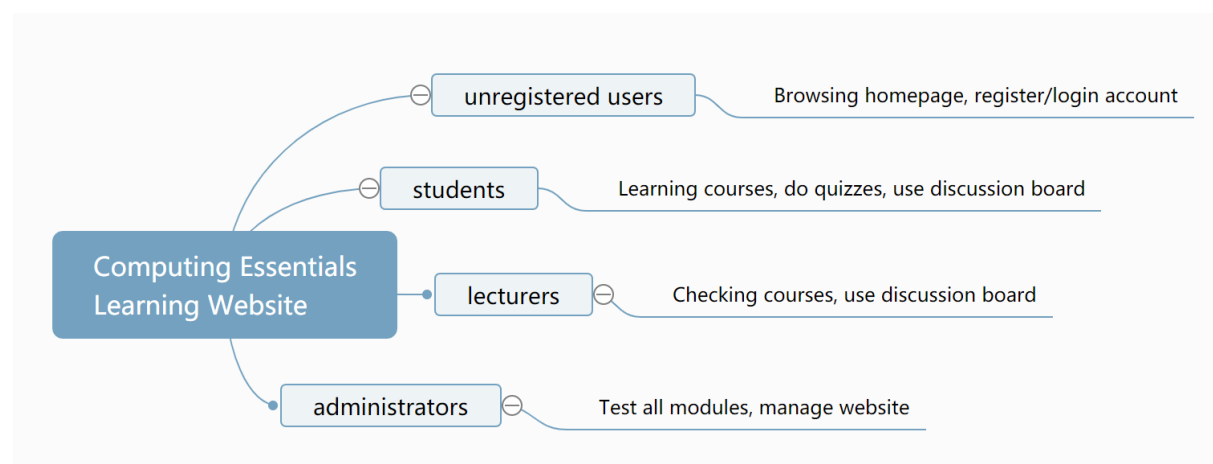


Fig.3.2 User Demand Model Diagram

Functions for different types of users are:

(1) For unregistered users:

Check the homepage of the website, so they can find number of lecturers and courses currently on the website, and register or login a user account.

(2) For students:

Browse course resources, do the quizzes, save quiz results and passed course list, and post on the discussion board as a student.

(3) For lecturers:

Check course resources, and post on the discussion board as a lecturer.

(4) For Administrators:

Test all the modules of the website, and manage website resources and user data.

## 3.5 System Module Design

### 3.5.1 Module Overview

Based on the demand analysis, I divided most of the functions of the website into 3 modules: teaching resource module, quiz module, and discussion board module. It also contains a administration backend. Fig.3.3 shows the Module Overview of this website:

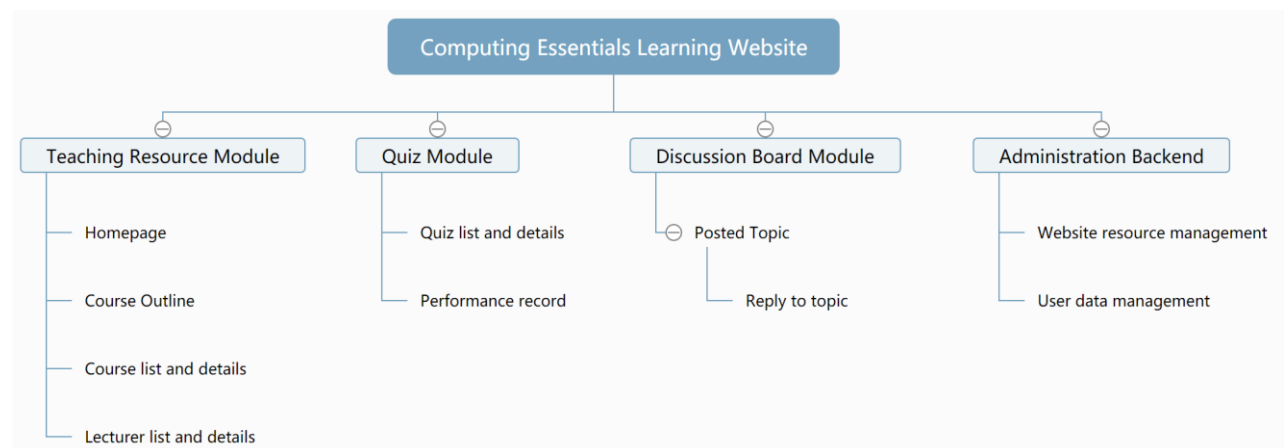


Fig.3.3 System function module diagram

### 3.5.2 Module Details

#### (1) Teaching Resource Module

The teaching resource module is the first module in the development of this website, and it is the basic part to pass on knowledge to students. The details of this module is shown in Figure 3.4:

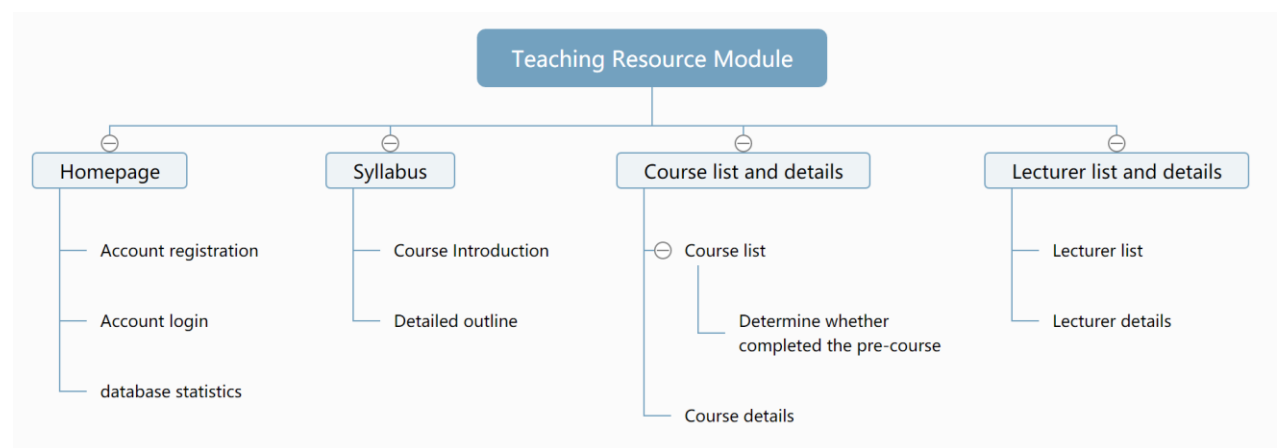


Fig.3.4 Schematic diagram of teaching resource module

The homepage of the website includes a user account section. A user can create a new account or login an account that has already been created. Both the registration and login forms will be validated by the website. The home page also contains a simple statistics section, which counts the number of courses and lecturers currently on the website.

The Syllabus is used to represent the general course introduction and course structure diagram of the course.

The course list is used to list all course information. This website can set “pre-courses” for courses. If a student did not complete the pre-course, s/he will not be able to enter the course. This feature is optional and not applicable to lecturer accounts. The detailed information of the course includes text, pictures and videos.

In lecturer list and details, users can view the lecturer's name, avatar, user name and other information.

## (2) Quiz Module

The quiz module is designed to test the learning result of students. This module contains a section of multiple choice questions and test results. The detail of this module is shown in Figure 3.5:

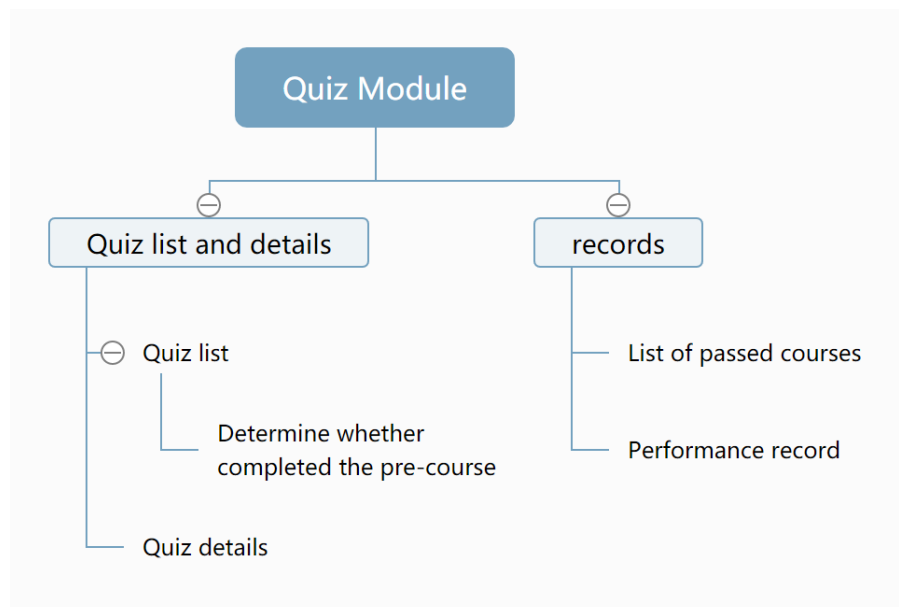


Fig.3.5 Schematic diagram of the quiz module

The quiz list is similar to the course list, and it also has the logic of determining whether to enter the quiz by the "pre-course" of the course. To pass a course, students need to

get at least a passing score in quiz. After passing a course, the record will be stored in the database.

### (3) Discussion Board Module

As a platform for communication between students and lecturers, discussion boards play an important role in this website. Each course corresponds to a discussion board, and each discussion board can publish different topics. Topics can be replied by all users. Lecturer users will have special marks in the discussion board to let students know which information comes from the lecturer. The detail of this module is shown in Figure 3.6:

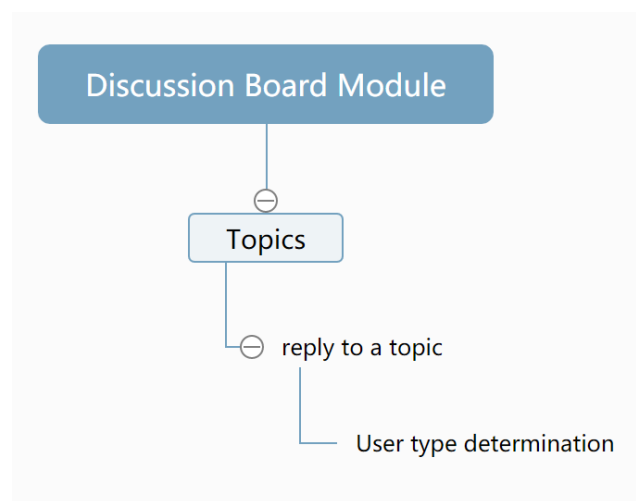


Fig.3.6 Schematic diagram of discussion board module

## 3.6 Database Design

### 3.6.1 Concept Design of Database

The website consists of three basic modules: Teaching Resource Module, Quiz Module, and Discussion Board Module.

The teaching resource module contains three main entities, i.e. courses, lecturers and syllabus. In addition, there is a user entity shared with other modules. The course entity contains the attributes of the course content, including the course number, title, summary, release date, body paragraphs, images and video links. The Lecturer entity contains attributes including lecturer number, name, title, college, introduction and avatar link. The Syllabus entity contains the syllabus number, status, introduction, and image links.

The quiz module contains three main entities, i.e. quiz, questions and answers. In addition, there is a user entity that is shared with other modules. The quiz entity contains attributes including the quiz number, the estimated completion time of the quiz, and the score required to pass the quiz. The question entity contains question number and question content, and the answer entity contains answer number, candidate answer content, and whether the answer is correct or not.

In the Discussion Board module, there are three main entities, i.e., Discussion Board, Topics, and Posts. In addition, there is a user entity shared with other modules. The Discussion Board entity has attributes of Discussion Board Number and Discussion Board Description. The topic entity has attributes of topic number, creation time and topic content. The post entity has attributes of post number, post content and posted time.

The user entity shared by the three modules mainly contains the following entity attributes: user number, user name, password, whether it is a staff member, and whether it is a super user.

### **3.6.2 Database Modeling in UML**

The UML diagram of the teaching resource module is shown in Figure 3.7. Since it is the first module, it was named "siteindex" during the development.



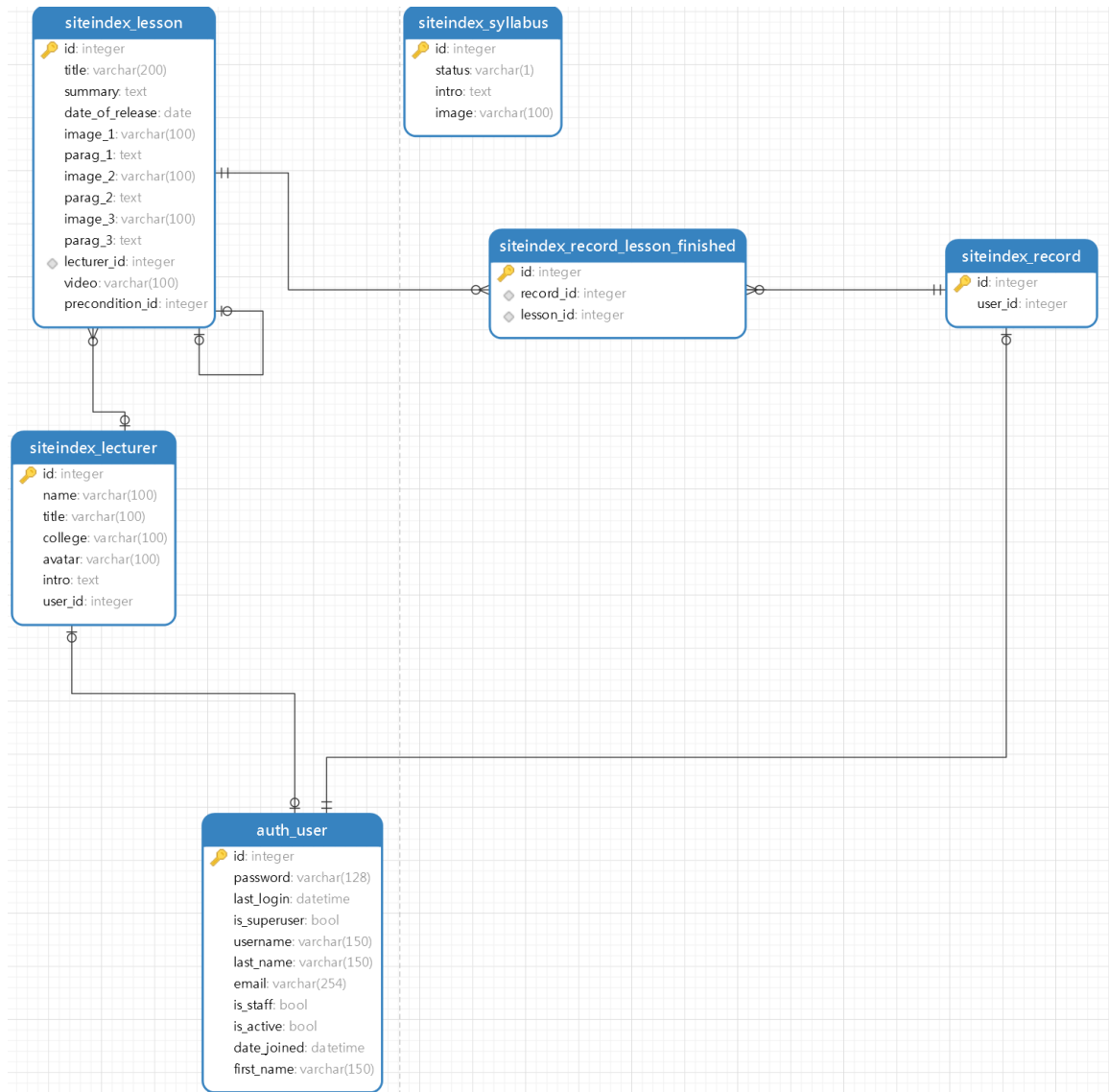


Fig.3.7 UML diagram of teaching resource module

In the teaching resource module, there are mainly three entities, namely lesson, lecturer and syllabus. It shares a user entity with other modules. In the lesson entity, it contains the lesson id, title, summary, release date, paragraphs, images and video links of the lesson. In the lecturer entity, the lecturer id, name, title, college, introduction and avatar link are included. The syllabus entity contains the entity attributes of the syllabus id, status, introduction, and a link of image. In addition, this module also contains information about the courses that students have passed.

The UML diagram of the quiz module is shown in Figure 3.8.

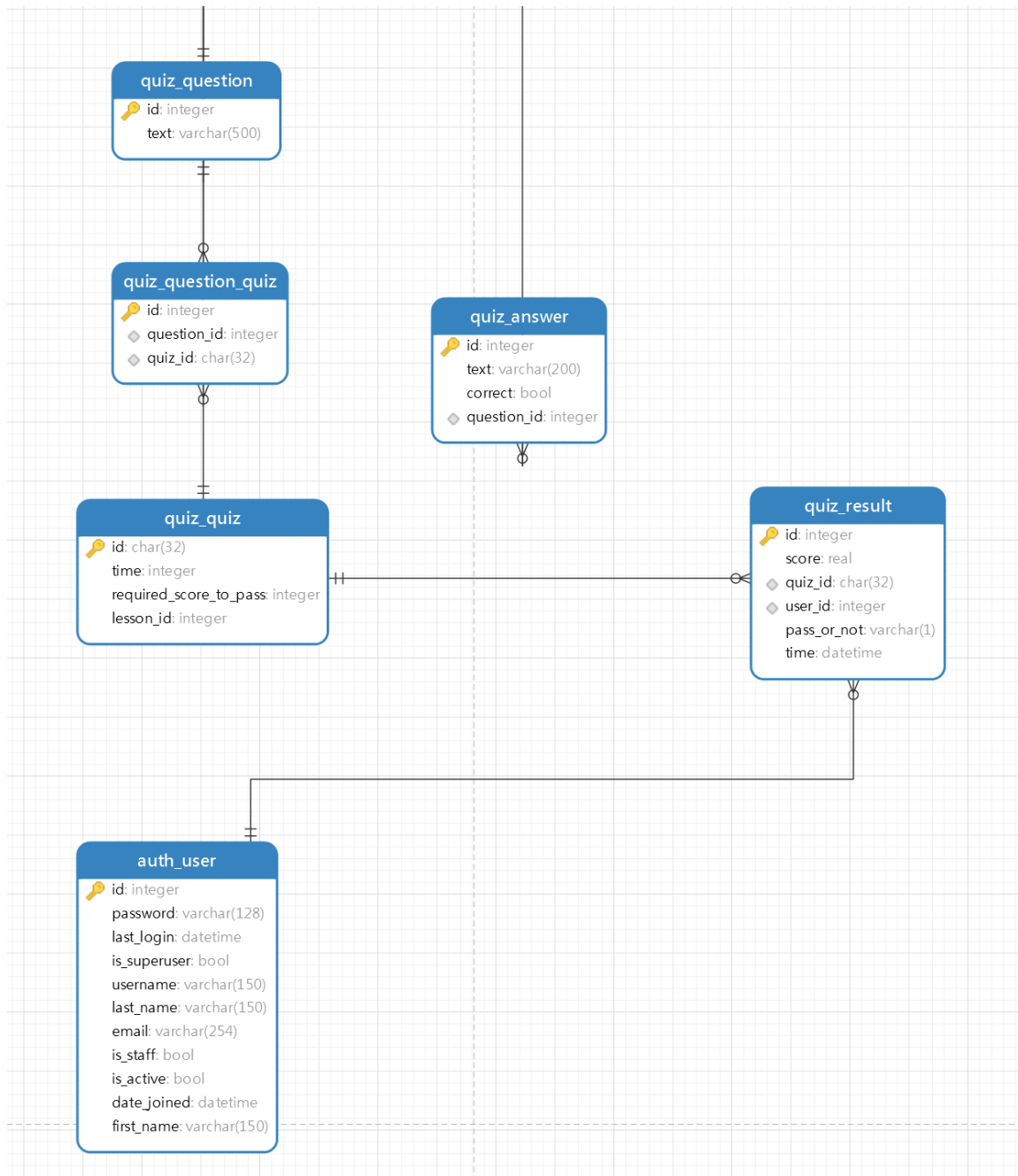


Fig.3.8 UML diagram of quiz module

In the quiz module, there are mainly three entities, namely quiz, question and answer. It shares a user entity with other modules. In the quiz entity, it contains quiz id, estimated time requirement, and the score required to pass the quiz. The question entity contains entity attributes of question id and text, the answer entity contains the answer id, the candidate answer text and whether the answer is correct or not. This module also contains records of quiz results.

The UML diagram of the discussion board module is shown in Figure 3.9.

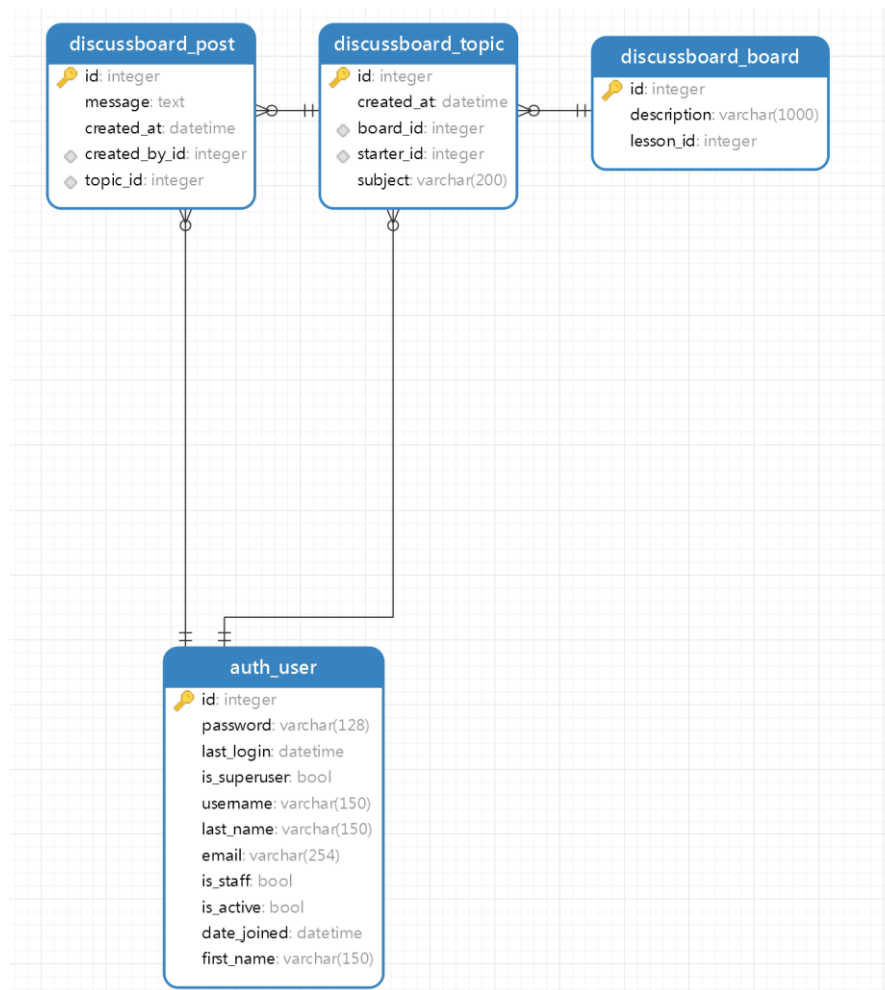


Fig.3.9 UML diagram of discussion board module

In the discussion board module, there are mainly three entities, namely board, topic and post. It shares a user entity with other modules. The board entity contains board id and description. The topic entity contains topic id, time created, and subject. The post entity contains post id, message and the time it created.

The overall UML diagram of all modules of the website is shown in Figure 3.10.

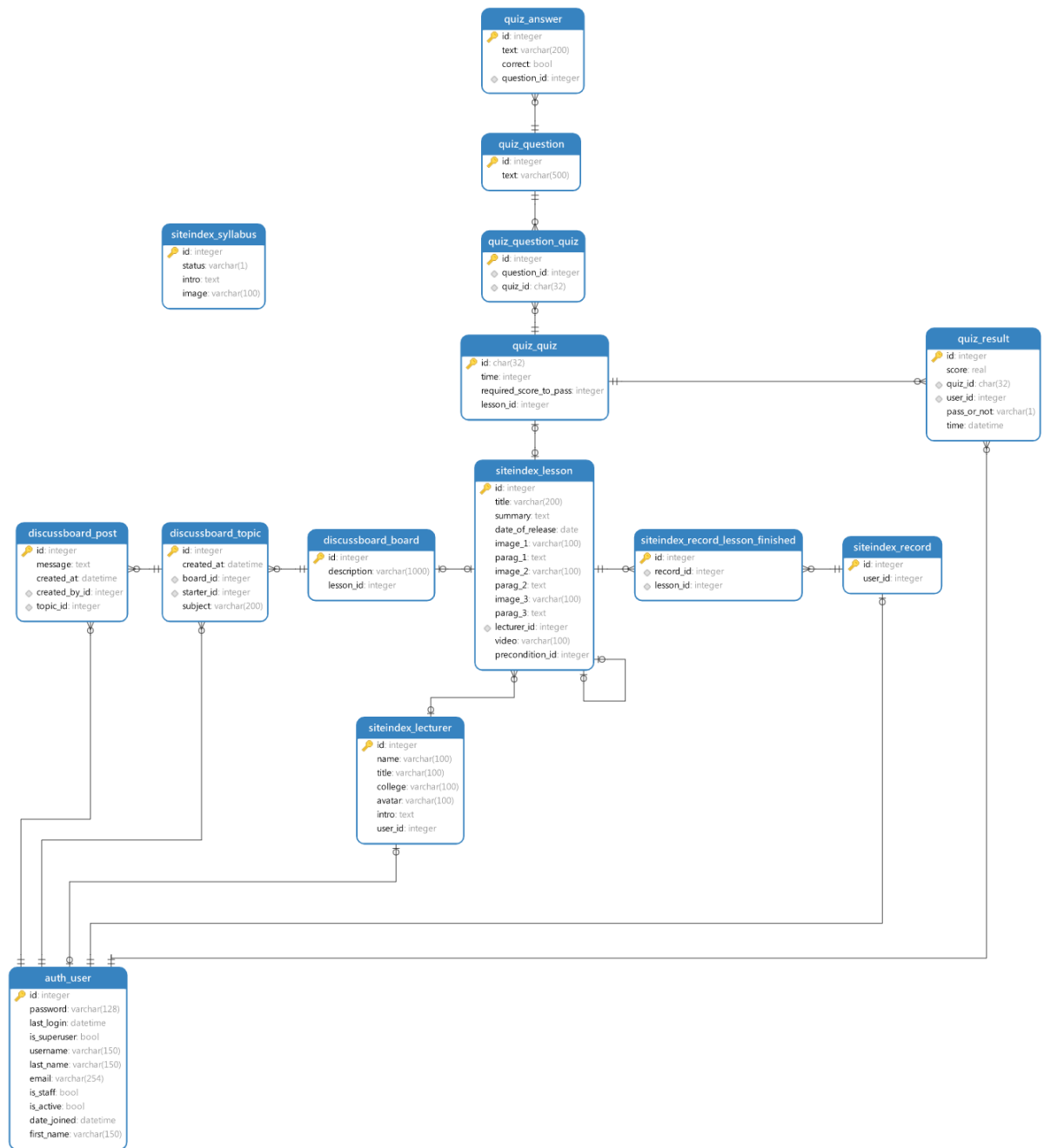


Fig.3.10 Overall UML diagram of all modules

The "user" entity is shared by all modules. The modules are connected to each other through the "user" entity and the "lesson" entity.

### 3.6.3 Tables of Database

With reference to the SQLite database specification, I designed the data table of the website database.

## 1. Teaching Resource Module:

### (1) Syllabus table:

Table 3.1 Syllabus information table

name	type of data	Nullable	key	Description
id	integer	no	Primary key	Syllabus number
status	varchar(1)	no		status
intro	text	Yes		Introduction
image	Varchar(100)	Yes		image link

### (2) Lecturer table:

Table 3.2 Lecturer Information Table

name	type of data	Nullable	key	Description
id	integer	no	Primary key	Lecturer Number
name	varchar(100)	no		Name of lecturer
title	varchar(100)	no		Lecturer title
college	varchar(100)	no		Affiliated college
avatar	varchar(100)	Yes		Avatar url
intro	text	Yes		Lecturers
user_id	integer	Yes		User ID

### (3) Course table:

Table 3.3 Course Information Table

name	type of data	Nullable	key	Description
id	integer	no	Primary key	Course ID
title	varchar(200)	no		Course title
summary	text	no		Course summary
date_of_release	date	Yes		Release date
image	varchar(100)	Yes		image link
parag	text	Yes		Body paragraph
video	varchar(100)	Yes		Video link
lecturer_id	integer	Yes		Course Lecturer Number

precondition_id	integer	Yes		Pre-course number
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## 2. Quiz Module:

### (1) Quiz table:

Table 3.4 Quiz Information Table

name	type of data	Nullable	key	Description
id	char(32)	no	Primary key	Quiz number
time	integer	no		estimated time
required_score_to_pass	integer	no		Passing score
lesson_id	integer	Yes		Corresponding course number

### (2) Question table:

Table 3.5 Quiz Question Table

name	type of data	Nullable	key	Description
id	integer	no	Primary key	Question number
text	varchar(500)	no		Question text
quiz_id	char(32)	no		Quiz number

### (3) Answer table:

Table 3.6 Quiz Answer Table

name	type of data	Nullable	key	Description
id	integer	no	Primary key	Answer number
text	varchar(200)	no		Answer text
correct	bool	no		is it right or not
question_id	integer	no		Question number

### (4) Quiz record table:

Table 3.7 Quiz Record Table

name	type of data	Nullable	key	Description
quiz_id	char(32)	no	Foreign key	Quiz number

user_id	integer	no	Foreign key	User ID
score	real	no		Test score
pass_or_not	varchar	no		Passed
time	datetime	no		Quiz time

### 3. Discussion board module:

#### (1) Discussion board table:

Table 3.8 Discussion board information table

name	type of data	Nullable	key	Description
id	integer	no	Primary key	Discussion board number
description	varchar(1000)	no		Discussion board description
lesson_id	integer	Yes		Corresponding course number

#### (2) Ttopic table:

Table 3.9 Discussion board topic table

name	type of data	Nullable	key	Description
id	integer	no	Primary key	Subject number
created_at	datetime	no		Creation time
subject	varchar(200)	no		main content
board_id	integer	no		Discussion board number
starter_id	integer	no		Publisher User ID

#### (3) Post table: see table 3.10

Table 3.10 Discussion board post table

name	type of data	Nullable	key	Description
id	integer	no	Primary key	Post number
message	text	no		Post content
created_at	datetime	no		issuing time
created_by_id	integer	no		User ID of the

topic_id	integer	no	poster Subject number
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In addition, this website also includes some data tables that come with the web framework, among which user data tables play an important role in the website.

table 3.11 is the user data table used in the website:

Table 3.11 User Data Table

name	type of data	Nullable	key	Description
id	integer	no	Primary key	User ID
username	varchar(150)	no		username
password	varchar(128)	no		password
is_staff	bool	no		Is it a staff member
is_superuser	bool	no		Is super user



# **Results and Discussions**

## **4.1 Website System Requirements**

### **4.1.1 Hardware Requirements**

(1) Server-side: The website can run on almost all modern computers, and it can also run on a Virtual Private Server (VPS). My laptop is used in the development, and the hardware as follows:

Processor: Intel Core i5-10210U @ 1.60GHz quad-core

Memory: 16 GB

Hard Disk: Toshiba KXG60ZNV512G TOS 512 GB

Network adapter: Intel Wireless-AC 9560 160MHz

After the development completed, I tried to deploy the website on the VPS provided by vultr.com, with a single-core processor, 512 MB RAM and 10 GB SSD.

(2) User side: Support devices equipped with modern browsers, including computers, mobile phones, and tablets.

### **4.1.2 Software Environment**

(1)Server: Python3.9 with Django3.1 and SQLite3.

(2) User side: Google Chrome, Mozilla Firefox, Microsoft Edge and Other browsers that support modern web standards.

## **4.2 Website Demonstrations**

### **4.2.1 For Students**

Open the homepage of the website and click the registration link in the left navigation bar to register a new student account. As shown in Figure 4.1:

Fig.4.1 Registering a new user

After the user registered, it will return to the homepage of the website. The navigation links in the sidebar has changed, as shown in Figure 4.2:



Fig.4.2 homepage and sidebar for students

When we click on the course list, we can choose the course we want to study. As a new user, I have not passed any courses, so I can only enter the first lesson. As shown in Figure 4.3 and Figure 4.4:



Fig.4.3 Schematic diagram of entering the course



Fig.4.4 Schematic diagram of not being able to enter the course

Figure 4.5 shows the course details page:

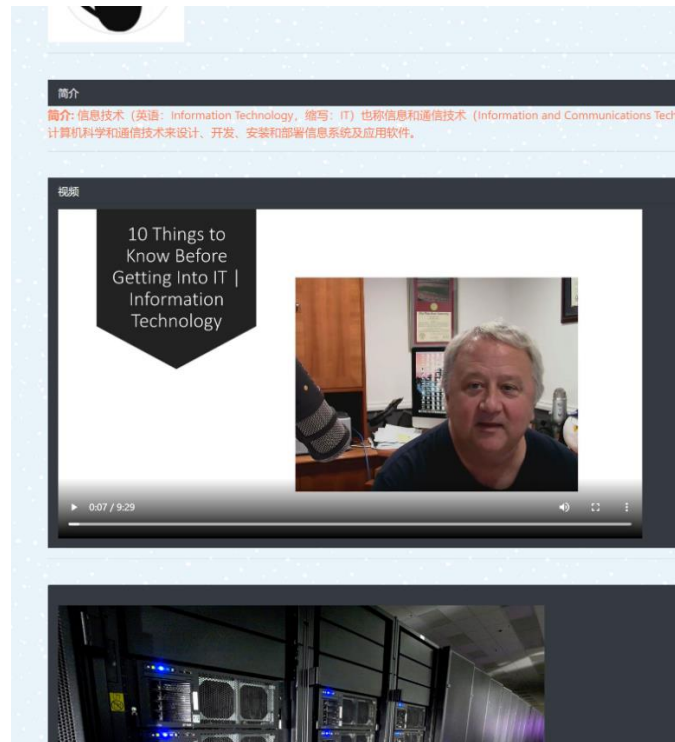


Fig.4.5 Course details

Now Enter a quiz. This quiz consists of 5 questions, and the passing score is 70%. Do four questions right and one wrong in the quiz here. The quiz page and quiz result page are shown in Figure 4.6 and Figure 4.7.



Fig.4.6 Quiz page



Fig.4.7 Quiz result page

After passing the quiz, the website will save the record of passed lessons. Figure 4.8 is the quiz record page.



Fig.4.8 Quiz record page

Finally, jump to the discussion board and create a new topic in the discussion board of the first lesson. As shown in Figure 4.9.



Fig.4.9 The topic page

## 4.2.2 For Lecturers

Lecturers can check all the lessons, shown in Figure 4.10.



Fig.4.10 Lesson List for Lecturers

Switch to the discussion board and create a new topic in the board of the first lesson. As a lecturer, the website will display an avatar and indicate that this is a lecturer. As shown in Figure 4.11.



Fig.4.11 Lecturer posting test

Finally switch to the administration page. Lecturers can manage the website to a certain extent. The specific authority is determined by administrators. As shown in Figure 4.12.



Fig.4.12 Limited administration backend

### 4.2.3 For Administrators

Administrators can fully manage the website background resources and user data. As shown in Figure 4.13.

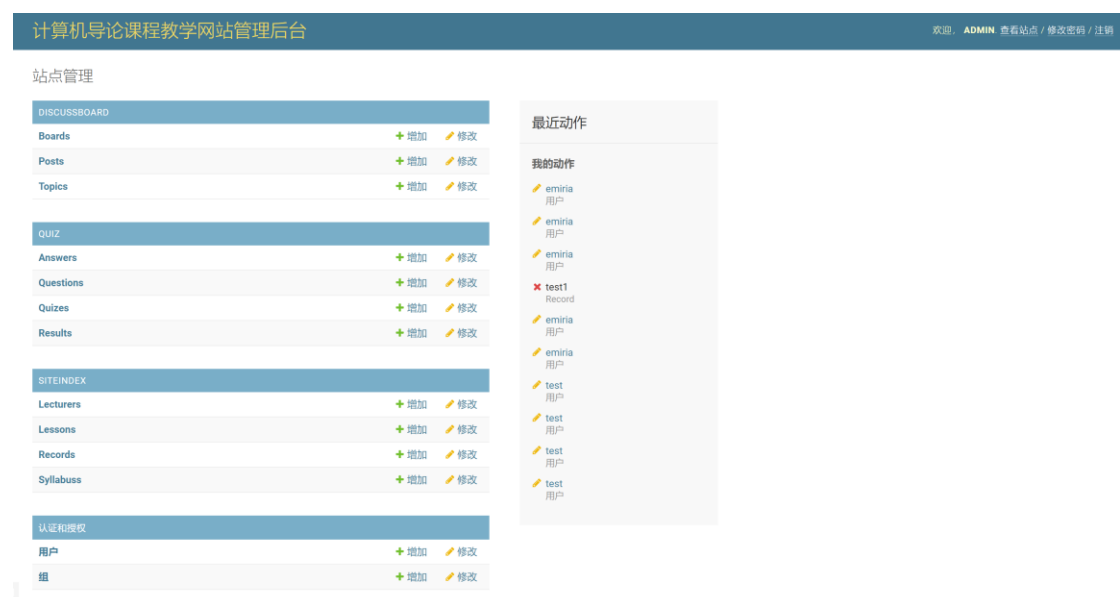


Fig.4.13 Administration backend

Administrators can manage all website data, including course resources, quiz question bank, user data, etc.

## 4.3 Website System Test

According to the scenarios of different types of users and system security needs, the following test items are performed: student user test, lecturer user test, administrator user test, and system security test. After the system test, the system test results obtained are as follows:

Student user test results are shown in Table 4.1:

Table 4.1 Student user test results

Test items	Test Results	Remarks
Whether the sidebar displayed correctly	Yes	n/a
Whether teaching resources are displayed correctly	Yes	n/a
Whether the quiz module functional	Yes	n/a
Whether the quiz scored correctly	Yes	n/a
Whether the progress saved correctly	Yes	n/a



Whether the discussion board module functional	Yes	n/a
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Lecturer user test results are shown in Table 4.2:

Table 4.2 Lecturer user test results

Test items	Test Results	Remarks
Whether the sidebar displayed correctly	Yes	n/a
Whether can access all courses	Yes	n/a
Whether the lecturer mark in discussion board shows	Yes	n/a
Whether possible to manage the website	Yes	n/a

Administrator user test results are shown in Table 4.3:

Table 4.3 System administrator user test results

Test items	Test Results	Remarks
Whether the sidebar displayed correctly	Yes	n/a
Whether the administrator mark in discussion board shows	Yes	n/a
Whether the website can be fully managed	Yes	n/a

System safety test results are shown in Table 4.4:

Table 4.4 System security test results

Test items	Test Results	Remarks
Can unlogged users browse the login protection view	no	expected
Can users without permission manage the website	no	expected
Can users cheat access courses and quizzes	no	expected

## **4.4 Ethical Evaluation**

In the development of this website, ethical risks have been fully considered. For example, in the quiz module, the calculation of the score is done automatically. The system will count the number of questions contained in a quiz, and give a score after submission. This ensures that quiz is fair to all students. In the discussion board, as a countermeasure against illegal comments, the administrator can modify or delete comments at any time, so that the administrator of this website can deal with abusive and discriminatory comments in a timely manner.

## **4.5 Future Issues**

Although the research in this report has achieved some success, there is still a lot of work to be done to develop a learning website for Computing Essentials Course. For example, the website needs to reflect more features of the Computing Essentials Course, such as embedded binary calculator, or even a built-in online compiler that supports multiple programming languages, so that users can do the programming on the website; the website needs to support more forms of teaching resources and further optimize the user experience, such as built-in LaTeX editor to make the layout of teaching resources better. The discussion board can be added a message reminder and make the community atmosphere more active. I believed that after continuous development and practice, the Computing Essentials Course learning website will become the first choice for students to learn the Computing Essentials Course.

## **Conclusion**

This website mainly implements a learning website for Computing Essentials Course which consists of teaching resources, quiz, discussion board, and administration module. College students can better study the Computing Essentials Course through this website, saving study time and improving study efficiency.

In general, the website works fine. Students can browse the teaching resources to learn the course, take the quiz to test the learning results, save learning progress, use the discussion board to communicate with the teacher and classmates, etc.; lecturers can use the discussion board to answer students' questions; Administrators can manage the system resources and user data of the website.

Some problems were encountered during the development, but they were solved in the end. For example, during the design process, there was a problem of unclear understanding of the requirements, which led to many abandoned cases. Some of them were features that were proposed but could not be implemented due to technical strength and development cycle; some were features that were found to have no practical meaning after implementation. Finally, after balancing many factors, the website development was completed well and on time. Also, there were times when I did not know how to implement some specific functions. For this, I reviewed a lot of documents, including documentations for Python, Django and bootstrap.

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