

UNDERGRADUATE PROJECT PROPOSAL

Project Title:	Web-based Senior High School Course Selection System
Surname:	Zhang
First Name:	Ningyue
Student Number:	201918010403
Supervisor Name:	Gore Jiang
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1 Introduction

1.1 Background

According to the national policy, senior high school students in Sichuan province who will be enrolled in 2022 and beyond will take the new form of college entrance examination. The new form of college entrance examination uses a '3+1+2' course selection model, which is completely different from the previous one. First of all, students have three compulsory courses, Chinese, mathematics and English. Next, they need to take either physics or history. Then take two courses from chemistry, biology, geography and politics.

It is found that the existing course selection systems are mostly based on credits and mainly designed for college students. Using big data and cloud computing to help establish the credit-based system is an important measure for higher education teaching reform (Su, Tang and Zhang, 2021). However, these credit-based systems are not suitable for senior high school students, and there is no satisfactory course selection system in the market to meet the new form of college entrance examination.

In order to solve the above problems, this project develops a course selection system based on the '3+1+2' model. Senior high school students and their teachers will benefit from this system. The system displays information about teachers and their courses. Students can view this information and choose courses according to their preferences. Teachers can check which students are enrolled in their courses. Moreover, this course selection system has the characteristics of simple operation, large storage and high confidentiality.

The rest of this report is structured as follows. 1.2-1.4 present the overall aim, detailed objectives, product scope and audience. Section 2 conducts background research on the existing systems and compares features. Section 3 describes the approaches and technologies used in the project, and the vision management plan. Section 4 plans the development process and makes the Gantt chart.

1.2 Aim

Based on the '3+1+2' model, develop a course selection system that can support senior high school students to choose courses according to their interests. The system is convenient for schools to manage the information of students and teachers.

1.3 Objectives

The objectives are as follows.

- (1) Conduct background research.
- (2) Implement the login module.
- (3) Create the student management module.
- (4) Develop the teacher management module.
- (5) Make the administrator module.
- (6) Carry out test.
- (7) Present the work to the audience.
- (8) Maintain the system.

1.4 Product Overview

1.4.1 Scope

The product provides a course selection system based on the '3+1+2' model. There are nine courses in the system with 12 course selection combinations (see figure 1).

The system is mainly divided into three modules: student management module, teacher management module and administrator module. The student management module stores students' personal information, such as name, age and telephone number. After logging in, students can view and modify their information, choose courses and drop courses. The teacher management module stores teachers' personal information, such as name, age, courses taught and teaching time. After logging in, teachers can view and modify their information and find out how many students are taking their courses and the names of those students. The administrator can search and edit information about all students and teachers.

Numb	Course Selection System Based on the '3+1+2' Model		
1	Chinese	Physics	Chemistry and Biology
2			Chemistry and Geography
3			Chemistry and Politics
4			Biology and Geography
5			Biology and Politics
6			Geography and Politics
7	Mathematics	History	Chemistry and Biology
8	English		Chemistry and Geography
9			Chemistry and Politics
10			Biology and Geography
11			Biology and Politics
12			Geography and Politics

Figure 1: 12 Course Selection Combinations

1.4.2 Audience

The product is suitable for senior high school students who take the new form of college entrance examination and their teachers. They will benefit from the system's flexible course selection mechanism.

2 Background Review

The study found that it is a trend for universities to adopt the full credit system on course selection (Guo and Song, 2021). The credit-based system can be built by three different methods: greedy algorithm, search method and dynamic programming (Qiu, Liu and Sun, 2021). The greedy algorithm is defined as always taking the course with the highest credits at each step of the problem-solving process (Qiu, Liu and Sun, 2021). However, these credit-based systems may ignore students' preferences. Regardless of their will, students need to take a sufficient number of courses to earn enough credits. Moreover, the study shows that academic quality and work-related issues are the most important factors influencing students' course selection (Asari, Perera and Pratheesh, 2018). Based on this, the hybrid recommendation method can be used to help students choose the courses that fit their abilities and interests, so as to avoid the negative impact that the wrong course selection may have on their future career (Lynn and Emanuel, 2021). The recommendation method assists students to choose courses reasonably to reduce the cost of study and the time to obtain a degree (Morrow, Hurson and Sedigh Sarvestani, 2020). Besides, the traditional collaborative filtering algorithm can also realize personalized recommendation by collecting and analyzing students' historical data of course selection, solving the blind and inefficient problems that may appear in the course selection process (Han, 2022). Furthermore, artificial intelligence and big data can be used to analyze the relationship between students' performance and course choices (Wu and Wu, 2020).

Additionally, according to background research, not all senior high schools in Sichuan province are equipped with an advanced course selection system that can adapt to the new form of college entrance examination. Some schools still use manual statistics on course selection. Students fill in their choice of courses on the paper, and then the relevant personnel make statistics.

The following is a comparison of different course selection systems (see table 1) and their features (see table 2).

Course Selection System	Course Selection Rules	Audience	Advantages	Disadvantages
Credit-based	Students choose a certain number of courses to complete all credits.	College Students	The system automatically calculates whether a student's credits are completed or not.	The system is not responsible for teacher management.
Manual Statistics (this approach does not use a specific system)	Students write down their chosen courses on a piece of paper and the relevant staff make statistics.	Senior High School Students	None	Low Efficiency Inconvenient Management
'3+1+2' Model	Chinese, mathematics and English are compulsory. Taker either physics or history. Choose two from chemistry, biology, geography and politics.	Senior High School Students Teachers	The system provides 12 different course selection combinations.	Advanced systems like this are not widely used in senior high schools in Sichuan province.

Table 1: Comparison of Different Course Selection Systems

Features Systems	Select Courses	Manage Students	Manage Teachers	Administrator	Calculate Credits
Credit-based	Y	Y	N	Y	Y
Manual Statistics (no system)	Y	Y	N	N	N
'3+1+2' Model	Y	Y	Y	Y	N

Table 2: Comparison of Features

3 Methodology

3.1 Approach

The approaches used in the project are as follows.

- (1) Use a waterfall model to divide the software life cycle into six basic activities: requirements gathering and analysis, system development, system implementation and coding, testing, deployment, and system operations and maintenance (Kramer, 2018). Specify a fixed sequence that flows from top to bottom (see figure 2).

- (2) Use social investigations and user survey to gather requirements (see table 3).
- (3) Conduct function tests, including login, student management, teacher management, administrator, and course selection and withdrawal (see table 4).
- (4) Conduct project tests, including white-box test, confirmation test, system test and acceptance test (see table 5).

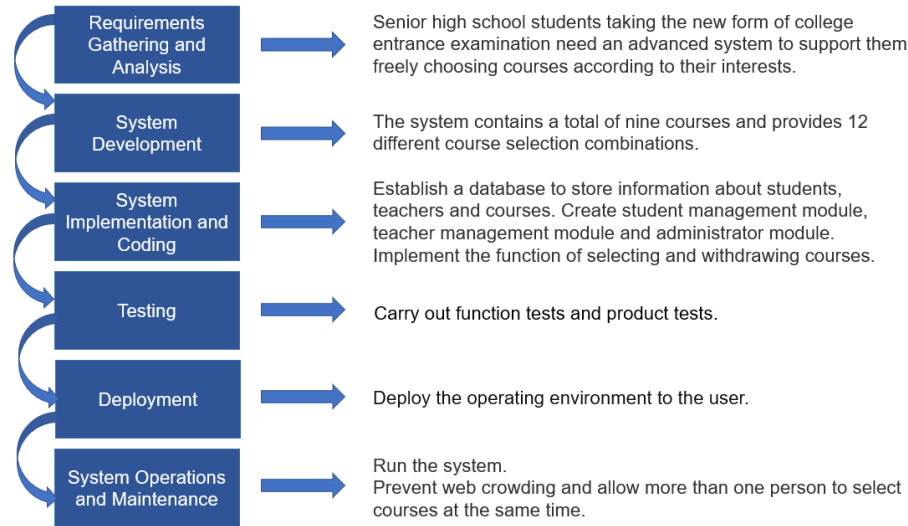


Figure 2: Waterfall Model

Gathering Method Requirement	Social Investigations	User Survey
Functional: (1) Student Management (2) Teacher Management (3) Administrator (4) Course Selection (5) Course Withdrawal	Investigate course selection systems used in senior high schools in Sichuan province. Check whether these systems satisfy the functional and non-functional requirements listed on the left.	Randomly survey senior high school students and teachers about their requirements and expectations on course selection systems.
Non-functional: (1) Confidentiality (2) Security (3) Efficiency		

Table 3: Requirement Gathering Method

Function	Evaluation
Login	Realize the login function of three different identities (student, teacher and administrator).
Student Management	After logging in, students can add, delete and modify their personal information.
Teacher Management	After logging in, teachers can add, delete and modify their personal information. They can also view how many students are taking their courses and the names of those students.
Administrator	The administrator can search and edit information about all students and teachers, and adjust the course time when there is a conflict.
Select Courses	Multiple students can choose courses at the same time.
Drop Courses	Students can successfully drop courses they don't want.

Table 4: Function Tests

Item	Test Method	Evaluation
Code (Program)	White-box Test	Check the program's internal data structure (Ateşoğulları and Mishra, 2019). Logical values should be tested for both true and false.
Function	Confirmation Test	Verify that the functions and performance are consistent with user requirements.
Software	System Test	The software and computer hardware are combined to check whether the whole system can run normally under the actual operating environment.
Hardware		
User	Acceptance Test	Show users that the system works as intended.

Table 5: Project Tests

3.2 Technology

The hardware, software and technology in project development are as follows.

Computer Hardware	Processor	Intel(R) Core(TM) i7
	Random Access Memory	16.0 GB
Software	Operating System	Windows 10 and above (64-bit)
	Browser	Google Chrome/Firefox/Microsoft Edge
Technology	JavaScript	It is a scripting language for developing the Web.
	Servlet	Interactively browse data to generate dynamic Web content.
	MySQL	Store the data in separate tables.

Table 6: Technology Used

3.3 Version Management Plan

Use Git repository to manage version.

See: <https://github.com/2019Kaylin/Web-based-Senior-High-School-Course-Selection-System.git>

4 Project Management

4.1 Activities

The eight objectives and corresponding activities are as follows.

Objectives	Activities
(1) Conduct background research.	<ul style="list-style-type: none"> a. Conduct background research on the existing course selection systems. b. Conduct a systematic search and retrieve relevant literature. c. Create comparison tables.
(2) Implement the login module.	<ul style="list-style-type: none"> a. Realize the login function of three different identities (student, teacher and administrator). b. Use captcha to prevent malicious login.
(3) Create the student management module.	<ul style="list-style-type: none"> a. Design student information table in database. b. For students, realize the function of adding, deleting and modifying personal information. c. Implement the function of course selection and withdrawal.
(4) Develop the teacher management module.	<ul style="list-style-type: none"> a. Design teacher information table in database. b. For teachers, realize the function of adding, deleting and modifying personal information. c. Implement the function of searching the information of students who choose the courses.
(5) Make the administrator module.	<ul style="list-style-type: none"> a. Design administrator information table in database. b. For administrators, realize the function of adding, deleting, modifying and searching information about all students and teachers.
(6) Carry out test.	<ul style="list-style-type: none"> a. Test the login, student management, teacher management, administrator, and course selection and withdrawal functions (see table 4). b. Conduct white-box test, confirmation test, system test and acceptance test (see table 5).
(7) Present the work to the audience.	<ul style="list-style-type: none"> a. Show the user how to operate the system and its functions. b. Collect user experiences and suggestions.
(8) Maintain the system.	<ul style="list-style-type: none"> a. Optimize the system based on user comments. b. Launch an updated version that better meets the needs of users.

Figure 3:Activities

4.2 Schedule

Use a Gantt chart to schedule the development process, showing activities and dates.

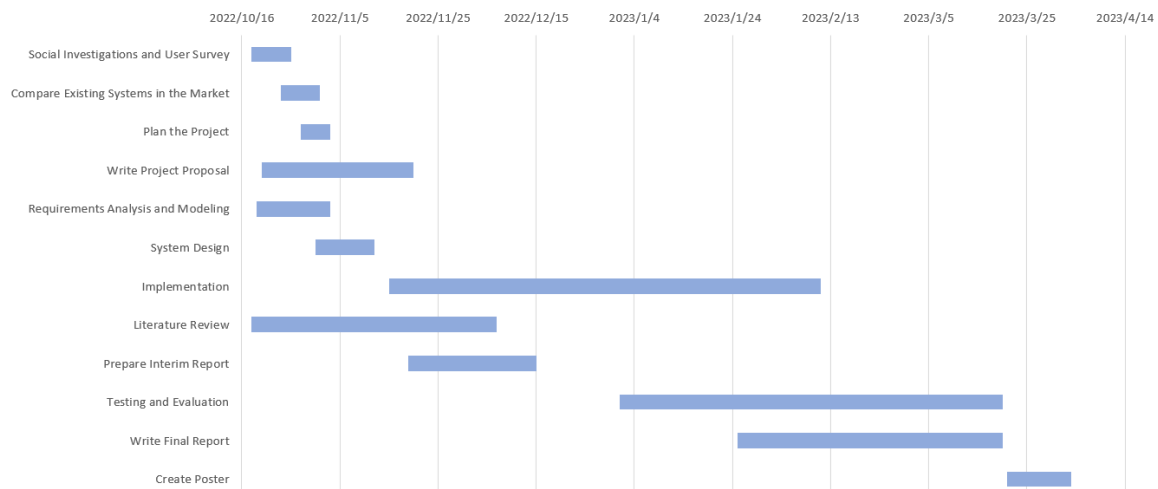


Figure 4: the Gantt Chart

4.3 Data Management Plan

Use Git folder to manage data.

Folder Name	Content
Weekly Meeting Logs	Every week's report including tasks completed, next steps and supervisor comments.
Requirements	User Stories Sprint Plans and Reviews
Testing Documentation	Function Tests and Project Tests
Reports	Project Proposal Progress Report Final Report
Ethics Form	Ethics Review Form E1 Ethics Review Form E2 (if needed)
Literature	Literature Review

Figure 5: Data Management

4.4 Deliverables

The deliverables are as follows.

- (1) Ethics Review Form E1
- (2) Ethics Review Form E2 (if needed)
- (3) Weekly Reports
- (4) Project Proposal

- (5) Progress Report
- (6) Final Report
- (7) Project Code
- (8) Poster

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