Beijing Jiaotong University

Bachelor's Degree Thesis

Thesis Title: Web Base E-Learning System Design and Implementation

School: Beijing Jiaotong University

Major: Software Engineering

Author: XX

Student No. : XX

Supervisor：XX

Date:

AUTHOR'S DECLARATION

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Date: Date:

Thesis Proposal for Bachelor Degree

Approval Form

Thesis：Web Base E-Learning System Design and Implementation

School：Beijing Jiaotong University **Major**：Software Engineering

Student Name： XX **Student No.**：XX

Problem diagnosis:

Nowadays education is really important to ensure our future for working in a company. But it seems that as a job seeker, especially fresh graduate students don't have what it takes to be an employee. Usually they can't pass through the interview because doesn't have enough knowledge or training about it. But most people don't have time for training and learning.

This is a major problem because especially competition for getting a job is getting serious. Many fresh graduate students have to wait for a long time to get some job. I work at Micro Learning. This company is focusing on communication between teacher and student, train students and new employee, and gives education that they need to become a good employee.

Micro Learning starts a project called WeiXun. This is a web based application system about learning and training. The goal of this project is to improve the users for teacher, student and employee.

References:

[1] Cynthia Shapiro. “What Does Somebody Have to Do to Get A Job Around Here?: 44 Insider Secrets That Will Get You Hired”, 2008,3:73-75
[2] http://www.wa.gov/esd/guides/jobsearch/strategy/interview_effective.htm
[3] http://freemarker.incubator.apache.org/docs/
[4] http://www.wx798.com
[5] http://www.lead-consult.com

Proposed treatment:

We use MyEclipse 10 (Java programming language), Hibernate, Struts 2 and Freemarker. Our project is web based application so we use this framework to make our dynamic website. As for database, we use MySQL. We use this framework because most of the developers familiar with these framework. As for the method, we use Waterfall method. We use this method because it is pretty straight and simple, get the requirement, make software architecture, implement, verify and maintenance.

Users can login, read, view, answer any kind of article, video, question and questionnaire on the website. We provide both PC and mobile site, so users can access it on their computer or on their phone. In each article there will be a question to help improve users understanding about the article. Teachers can make their own questionnaire that can be answered by users and can see the statistic and report of the questionnaire that they made. We provide search function to find specific article or specific category for the article. We make the search function by ourselves.

For the results, we will try to provide a better system design and implementation for this project. Make sure to focus on this project so there will be no bug and error. Analysis the requirement and make sure the

requirement will be done.

Scheduling for deliverables：

No.	Work content	Date	Remark
1	**Start the project**	**April 2015**	
2	**Deliver every function**	**October 2015**	
3	**Testing all the function**	**November 2015**	
4	**Add another function**	**November-February 2016**	
5	**Make sure all the requirement met**	**March 2016**	
6	**Start working on thesis**	**March 2016**	
7	**Proposal document**	**March 2016**	

8	**Internship weekly report and final assessment**	**May 2016**	
9	**Thesis first draft**	**May 2016**	

Supervisor Approval：

_____ _____

Signature of Supervisor **Date**

ABSTRACT

ABSTRACT:

Education, learning and training is always important for everybody, not only for students but for those who already works and has a job. But most of the time people tend to forget and doesn't have time to educate and train themselves. These days, people always on their phone, when on subway to work or going back from work. Micro Learning has already been on training industry for a long time and considers that education using technology would be a good idea. By implementing E-learning system with WeiXunWang website, Micro Learning hopes to create a way for people to educate themselves in surer way and less expensive way. WeiXunWang project has started from long time ago, but it was stopped because there are not many people using technology at that time. Then the project was continued in 2015 when the smartphones is a basic need for almost everyone. The project itself is a web application with a responsive page for both PC and mobile. People can actually use this project anywhere and anytime as long as they have internet access. The purpose of this thesis is to gives a detailed explanation and a proof that WeiXunWang project is going to be a good way to educate people and gives benefit to users. This thesis contains requirement and design architecture to support the functionality of the project. The WeiXunWang project has courses that divided by category and level, which will make the courses are easy to find and according to the needs. The idea behind this project is not restricted to only educate people, as Micro Learning hopes to build a community using this project where people will start using E-learning system as a new way to train and learn something.

KEYWORDS：

E-Learning System, Web-based application, Education and Training

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1. Introduction

1.1. Background

These days, people tend to forget underestimate the meaning of education and forget to educate and train themselves, especially when smartphones is the new era for people. People just staring at phones to read news, play games, or just chatting with friends. This kind of attitude can lead people to become lack of education and the lack of education is a serious problem because it can lead to unemployment. The other problem is some people do realize that education is important, but they don't have enough resources to study and learn. When people attend some training session, there will be a participant listening to trainer and then go home. This means that participant of the lecture can't really ask any further question. On the other hand the lecturer or trainer have to see how effective their method of training. One of the solutions is to give a questionnaire about their lecture to the participant.

This project called WeiXunWang to educate and train young people from students to young employee or unemployed so they can learn electronically. E-Learning (Educational technology) is defined by the Association for Educational Communications and Technology as "the study and ethical practice of facilitating learning and improving performance by creating, using, and managing appropriate technological processes and resources."[1] Educational technology refers to the use of both physical hardware and educational theoretics. It covers several domains, that including online learning, computer-based training, learning theory and where mobile technologies are used, m-learning.

1.1.1. E-Learning History

The history of E-Learning or educational technology starts from a very long time. The main reason for educational technology is to help people learn in a ways that are easier, surer and less expensive,

for example from the very early days, people teach using paintings on cave walls. And then it keeps growing, from using slide projector (1950s), a linked computer terminals (1960s), and the one that inspired E-Learning is in 1971. Ivan Illich published an influential book called “Deschooling Society” in which he envisioned “learning webs” as a model for people to network the learning they needed. In 1994, the first online high school had been founded. This is the first era for E-Learning that doesn’t make the participant to come to some place and take the courses. In 1997, Graziadei described criteria for evaluating products and developing technology-based courses that include being portable, replicable, scalable, affordable, and having a high probability of long-term cost-effectiveness.[2]

According to a 2008 study conducted by the U.S Department of Education, during the 2006-2007 academic year about 66% of postsecondary public and private schools participating in student financial aid programs offered some distance learning courses; records show 77% of enrollment in for-credit courses with an online component.[3] In 2008, the Council of Europe passed a statement endorsing E-Learning's potential to drive equality and education improvements across the EU. E-Learning authoring tools are software or online services that enable users to create courses, simulations, or other educational experiences. These tools typically support conventional, presentation-like courses, and may enable screen recording, multimedia, interactivity, quizzes, and non-linear or adaptive approaches.[4] In this case, the WeiXunWang project choose to use an online services for creating courses and other educational experiences for users as a web-based application.

1.1.2. E-Learning Benefits

The benefits of using E-Learning as a general is using computers or other forms of technology can give students practice while the teacher can perform other activities that can help students in other field. By using technology, education is able to be individualized for each student allowing for better differentiation and allowing students to work for mastery at their own pace. Modern educational technology can improve access to education, including full degree

programs. It enables better integration for non-full-time students, particularly in continuing education, and improved interactions between students and instructors. People can learn from long distance and learning materials are accessible to a wider audience. Learning materials are easy to access. Students can study and learn with numerous online resources at home. Using online resources such as Khan Academy or TED Talks can help students spend more time on specific aspects of what they may be learning in school, but at home. Schools like MIT have made certain course materials free online. Although the atmosphere and environment of a classroom setting are missed by using technologies, but these resources are helpful tools that can add additional support to educational system. Students like the idea of E-Learning it feels convenience for student to learn using this system. The use of E-Learning system has positive effect on learning for majority. Before and after tests reveal that the use of apps on mobile devices reduces the achievement gap between struggling and average students. The courses in this project are from famous author or trainer that has been in training education field for a long time. It means that the courses in the project has a really good quality and the quantity too because there will be many courses for users to choose.

1.1.3. E-Learning Disadvantages

Beside benefit, there are some disadvantages for using E-Learning system too, especially the one who making the E-Learning projects. Most of the disadvantage is about money and new technologies. Many states from US spend large amounts of money on technology. However, as of 2013, none were looking at technology return on investment (ROI) to connect expenditures on technology with improved student outcomes.[5] Usually new technologies are accompanied by unrealistic hype and promise regarding their power to change education for the better or in allowing better educational opportunities to reach the masses. Examples include silent film, broadcast radio, and television, none of which have maintained much of a foothold in the daily practices of

mainstream, formal education.[6] Technology itself does not necessarily result in fundamental improvements to education.

1.2. Purpose

The purpose of this document is to provide a brief explanation and analysis about WeiXunWang requirements, design and implementation, and architecture. How and why we need all those features in this project.

The project itself is considerable big and still in early stage of development. The expected results of this project is people will learn many things and make a different opportunity when it comes to training and learning. They can learn fast from our project without any obstruction and can participate anywhere anytime to learn and train themselves.

1.3. Project Description

This section will cover the general overview of the project itself, from perspective, functions that will be used in the project, type of user, the operating environment that used to build and develop the project, and the constraint that will obstruct the development.

1.3.1. Perspective

WeiXunWang provide many function to help users get knowledge and education that they want with great UI for both mobile and pc site. WeiXunWang divide many courses with categories so users can easily find something that they need without any problem.

Figure 1.1 shows general overview about the system and how users interact with the application. Users choose what they need in the clients (both pc and mobile) and pc will transfer the data to server then retrieve the specific data for the users.

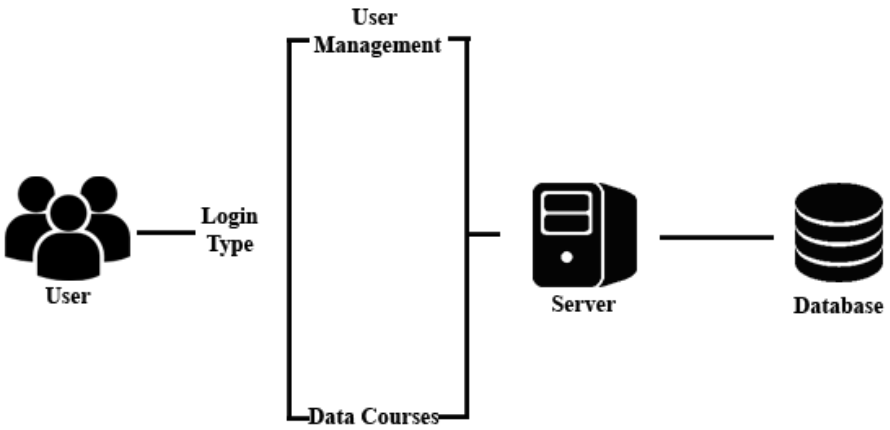

Figure 1.1: System Overview

1.3.2. Functions

E-Learning system is about making a system where people can learn and train with "electronically" way which means with using computer and internet, anywhere anytime and without need to go to certain place. All of the functions that this system provides are:

- User Authentication.
- Data Courses
- User Management

Most of these functions already been developed and can be implemented on the hosted website. And others function is still under development.

1.3.3. User Types

There are 3 types of user in this system:

- Guest user: This user doesn't need to login or register their information on our system. They just can see or use a limited service on the website that is provided for guest user. This user just can see or strolling through the website.
- Employee/Trainer user: They can use most of the function. They can add and submit questionnaire, task

function, use assessment, see answer, see reports and download excel function without any limitation. They do not need to have any knowledge to use the function as the function is easy to use.

- Admin: This user is the one who manage all the system and database of the website. Admin cannot edit the user management part because it is confidential and private. Admin can add, delete and edit any courses, article, and questionnaire especially if admin find it is inappropriate. This user must be able to answer any question about the system if others user need some help or advice about it.

1.3.4. Operating Environment

The operating environment to develop this project:

- Eclipse (Java EE IDE for Web Developers) Version Mars.2 Release (4.5.2).[7] The java language platform that used for web developing. This project use eclipse because Java EE IDE because it has editors from HTML to JSP/JSF, Javascript which is very useful for developing web project.
- Hibernate framework. Hibernate is an object-relational mapping framework for the Java language. It provides a framework for mapping an object-oriented domain model to a relational database. Hibernate solves object-relational impedance mismatch problems by replacing direct, persistent database accesses with high-level object handling functions. There are many reasons why this project use hibernate, one of them because it is portable. Portable means is it will be easy to use between different SQL database.
- Apache struts 2 framework. This is an open-source web application framework for developing Java EE web applications. It uses and extends the Java Servlet API to encourage developers to adopt a model–view–controller (MVC) architecture.

- Freemarker, is a template engine: a Java library to generate text output based on templates and changing data. Freemarker used to present the data and print it out on the html file.[8]
- Apache Tomcat. The Apache Tomcat® software is an open source implementation of the Java Servlet, JavaServer Pages, Java Expression Language and Java WebSocket technologies. The Java Servlet, JavaServer Pages, Java Expression Language and Java WebSocket specifications are developed under the Java Community Process. The project use apache tomcat version 6 to maintain the stability.[9]

1.3.5. Design and Implementation Constrains

The lack of training is different from each person. Everyone has their own weakness and strength, because of this it hard to make a good course that can help every people. Creating a course that can teach everything is nearly impossible because course has its own categories too. It will be a big challenge to make a great data that can fit all the categories for every people so they can learn their weakness and overcome the weakness.

Another constraint is the need of trainer and user may vary from one to another. The design for the system will include their need but it will be a great task to make 3 different systems.

2. Requirement Analysis

This chapter discuss about any requirement that needed by the project, specific feature expectations, resolution of conflict or ambiguity in requirements as demanded by the various users or groups of users, avoidance of feature creep and documentation of all aspects of the project development process from start to finish. Requirement analysis is important to make sure the whole system can be used by users without any complication or error. Requirement analysis includes two types of requirement, the first one is be functional requirements, and the second one is nonfunctional requirements.

Functional requirements will focus on the function that the system need as a whole so this project functionality will be good as user and developer expected. As for non-functional requirements is more for users side, to make sure that users feels comfortable when using the system and make sure the system is good enough to run for a long time.

2.1. Functional Requirements

Functional requirements for this project will include User Authentication, Data Courses and User Management. All of these functions will include another function that crucial to make sure that this project run as expected and the goal of this project reached.

2.1.1. User Authentication

This project needs a way to identify a user and there are types for user. Because this project deals with personal information and any action that can be done in this project depends on user types. The authentication part can be done by giving user a username, password and user types. The other way is to login using Wechat(微信)[10] so user can easily do the authentication part. This can help the system to recognize what action can be done by user and can prevent personal information being accessed by someone else.

The system will need to deal with many accounts from user because the target of this project is to make a system where the system can distinguish all type of users that using the system concurrently. The data will be massive and the system has to be able to handle the authentication part.

User Authentication will include two functions that will be Sign in and Sign out. The sign in part divided by two section, one is the normal way to sign in and the other one is using Wechat(微信) application to sign in.

2.1.2. Data Courses

This will be the main function for the system to have. As the project is about E-Learning system, the project itself need data about courses so users can learn and train using the project. Data courses will include many functionality that user can use.

Users can choose what function they want to use in data courses. They can create new courses, edit the courses they created, and view courses and answer courses. To view the courses, the system will list all available data courses for user and user can choose to view the courses. Some of the function will have restriction over authorization of user type that includes create, edit and answer courses. Guest user will be restricted and can't use those three functions.

2.1.3. User Management

There are 3 types of user and each of them has their own authorization. To gives each user their own functionality, the system need to manage user type and their personal information. Personal information will be used for the courses and questionnaire data. This function will include method for registering new user, edit profile and view the profile of user.

This function is pretty important because the project itself deals with many accounts of users and need to be able to distinguish the type of each user to make sure some confidential data can't be access by certain users.

2.2. Nonfunctional Requirements

Nonfunctional requirements will cover criteria that needed by the system. The requirements will include the qualities to make sure the system will run smoothly without any problems.

2.2.1. Security

Security in this case is for manage sensitive data that can't be accessed by third party or wrong person. The system has to secure all data including courses, article and personal information of users. No users can change or edit courses that aren't meant for them or change personal information of other users.

Because the system has to handle a massive amount of data, the system needs a security method. One way is to gives authentication method for user like username, password and authentication code. Users need to remember their own username and password and fill the authentication code before using the system. This way system can tell and gives the right data for the user.

2.2.2. Availability

E-Learning system is away to learn and train someone without any restriction like time. The advantage of E-Learning is the user of the system can learn and train anytime they want. This is the main point of using E-Learning system.

That's why the system should be available for 24/7 because users need to be able to access the system anytime they want. There will be maintenance for the system but it shouldn't impact the availability of the system which can be a problem if user can't access the system when they need it.

2.2.3. Performance

The nonfunctional requirement of performance will focus on how well the system process the data, the speed of the processing and

analyzing, and the amount of data that can be handled by the system concurrently.

The system will have to contain many data and can manage many concurrent users that will use the system at the same time. It is highly expected to have a good server that can handle massive data and users at the same time. Performance is relevant because if there is any problem with the performance, it will slow down the learning pace of users when they use the system. Performance is not the most important aspect but it can be one of the aspect that determine whether the system is good or not for the user.

2.2.4. Reliability

E-Learning main function is to gives education that accurate and can really help people to gain knowledge. The courses, article, and all the data that user need should be reliable from the source that user can trust. Most of our courses will be from the trainer itself and some of the courses will be from a famous trainer.

The reliability is important for E-Learning especially to make sure user will use this project as their main education learning system. The data should not be fake and the quality of the course should be high too as the user will try to find the best courses for them.

2.2.5. Maintainability

The system should be flexible, means that can be easily maintained to make sure there are no problems on the system or to upgrades, add additional function into the system, can run smoothly without any problems and doesn't have any impact to the main system if there is additional function.

2.3. Use Cases

In this system there are 3 types of user, so there will be 3 different use cases for each user. Not every user will have access to the same functionality, there is guest user that doesn't need registration, there is employee/trainer user that required normal

registration and the last one is admin that will configure and manage data from the inside.

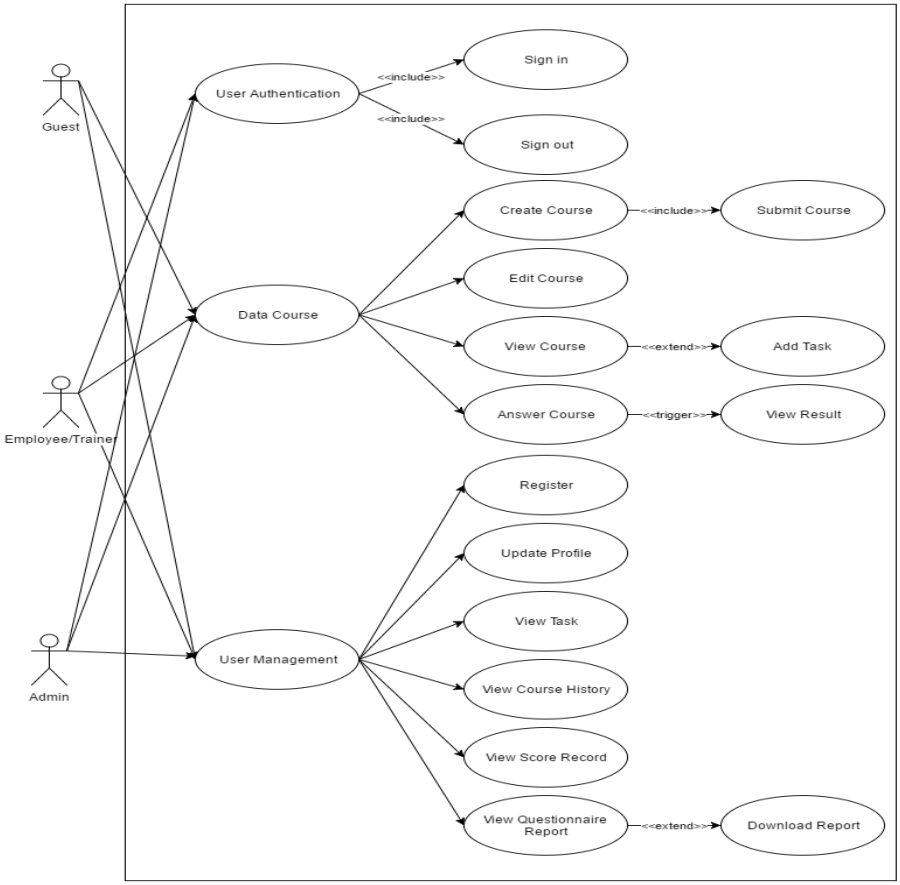

Figure 2.1: Use Case Diagram

Figure 2.1 shows use case diagram of WeiXunWang project. This diagram shows the different use cases for different users. This diagram provides a general overview of the system and the functionality of each user. Not every user will have access to the same functionality. Most of them have the same function but some function can only be accessed by certain type of user. For Guest user, they really have a limited access to the system as they can just use 2 functions from the system.

This use case will give developers the idea to design the function for each of the user and making it possible to make a secure system

so there will be no unauthorized action in the system. The system need to be able to differentiate the type of user and make appropriate decision for each of the user, because some of the data is confidential and can't be access by different user.

For better understanding the interaction between user and modules is shown and sample functions that are being implemented for the system are also indicated.

2.3.1. Sign in

Sign in is the process by which an individual gains access to the system by identifying and authenticating themselves. The user credentials are typically some form of username and a matching password and these credentials themselves are sometimes referred to as a login.

Another form that user has to fill is CAPTCHA.[10] CAPTCHA is a type of challenge-response test used in computing to determine whether or not the user is human. The CAPTCHA design in this system is a combination of numbers and alphabets.

Sign in is the function that user has to call if they want to use the system fully. This function will create a session and allow users to interact with data inside the system. This is an important function for the system to distinguish the type of user and gives authorization over their action in the system.

Table 2.1: Use case for the Sign in function

Use Case Name	Sign in
Main Actor	Employee/Trainer, Admin
Actor Interests	The user wants to use the system.
Description	This is the first step that user has to do before fully using the system.
Pre-conditions	1. The user has been register in the system and has username and password. 2. The user doesn't have an open session. 3. The user hasn't been blocked by the system.
Trigger	The user enter their username and password then click 登录(Sign in)

Basic Flow	Actor	System Response
	1. The user wishes to use the system. 2. Types the account information and CAPTCHA code (username and password). 3. Click 登录(Sign in).	1. The system displays form to input username, password and CAPTCHA. 2. The system receives the authentication and validates the given information. 3. If the validation fails then the system will return error message to user and user need to re-input their account information. If it success, then the page will return to the previous page user try to reach and the session begin.

If the user does or creates something on the system that is forbidden by the system, the account of the user will be blocked and all authorization that the user has will be nullified.

The other way to sign in is using Wechat(微信) which is largely use in China.

Table 2.2: Use case for the Sign in with Wechat function

Use Case Name	Sign in with Wechat
Main Actor	Employee/Trainer
Actor Interests	The user wishes to use the system through Wechat application.
Description	This is another way to sign in if user has Wechat

	account and Wechat application.	
Pre-conditions	1. The user has and using Wechat. 2. The user doesn't have an open session. 3. The user hasn't been blocked by the system.	
Trigger	The user click 登录 (Sign in) while using Wechat.	
Basic Flow	Actor	System Response
	1. The user wishes to sign in using Wechat. 2. The user clicks 登录 (Sign in) button while using Wechat.	1. The system validates user account information. 2. If the system doesn't have any previous information about the user's account then the system will create a new one in the database.

Both of the sign in function encrypt user password to offers more security for users.

2.3.2. Sign out

Sign out is a process of disconnecting from a network or what occurs when your connection lost. This function is one way to keep user account secure. Sign out function will close all session and cookies which is important to make sure no one can break in to someone else account.

This function will be called to end the user session and closed all activity from the user in the system. The user has to end the session to make sure their data cannot be accessed anymore and to help the system maintain and secure the data.

Table 2.3: Use case for the Sign out function

Use Case Name	Sign out
Main Actors	Employee/Trainer, Admin
Actor Interests	The user want to end the session on the system
Description	This is the function that will be called to end

	session for the user	
Pre-conditions	1. The user has been register in the system and has username and password. 2. User in open session.	
Trigger	Click 登出(Sign out) to end session.	
Basic Flow	Actor	System Response
	1. The user wishes to end session. 2. The user clicks on 登出(Sign out) button.	1. The system validates user session. 2. The system terminates the session.

Sign out function is the same for both sign in function, using single method to end the session.

2.3.3. Answer Course

Answer Course is a function where the user can answer the question on the courses that he/she choose. This function is the main function of E-Learning system because users need to be able to learn and educate themselves by using this system. Answer course function will provide users with the correct answer after users finish answering the question.

This function will let user to answer courses that available on the system. Only registered users can use this function as guest user has limited or restricted action on the system. The system will validates the authentication of the user and manage the action they can take.

Table 2.4: Use case for the Answer Course function

Use Case Name	Answer Course
Main Actors	Employee/Trainer, Admin
Actor Interests	The user wants to answer courses on the system.
Description	This is how user can answer the courses in the system.
Pre-conditions	1. The user has been register in the system and has username and password. 2. The user already in open session. 3. The user hasn't been blocked by the system. 4. The user hasn't answered the course that

	he/she choose.	
Trigger	The user goes to course page and click on a course.	
Basic flow	Actor	System Response
	1. The user wants to answer a course. 2. The user goes to course page and click a course. 3. The user answers the question on the course.	1. The system display course page. 2. The system display article and question from the course. 3. The system validates the user information and authorization. 4. If the user had answered the course before then the system shows error about detailing problems.

After answering the question, the system will analyze the answer and bring user to the next page.

2.3.3.1. View Result

After user answer all questions on some courses and click submit, it will automatically call view result function. This function will let users see their answer and the correct answer.

Table 2.5: Use case for the View Result function

Use Case Name	View Result
Main Actors	Employee/Trainer, Admin
Actor Interests	The user wants to see the correct answer for the question.
Description	This is the last step for answer course function that will automatically trigger after submit the answer.
Pre-conditions	1. The user has been register in the system and has username and password. 2. The user already in open session. 3. The user hasn't been blocked by the system.

	4. The user filled all required space for answering the question.	
Trigger	The user finish answering the question and click submit.	
Basic Flow	Actor	System Response
	1. The user finished answering the question. 2 The user click submit button.	1. The system validates the answer from user and analyzes the answer. 2. The system display score and the correct answer for each questions.

2.3.4. Register

Before users can fully access the system, they need an account to provide some sort of credentials (such as a username or e-mail address and a password) to the system in order to prove their identity. Register is a way for users to get themselves an account so they can use the system. In this project there are 2 ways of registering a user. One is by administrator and the other is by user itself.

Administrator can fill all the needed information for users if they want to create an account through admin. This can be dangerous as admin can know all credential information of the user. But it is one way to provide an easy registration process for some people that don't know how to register. The use case that provided by Table 2.6 is the way of registration by user itself.

Table 2.6: Use case for the Register function

Use Case Name	Register
Main Actors	Employee/Trainer, Guest User, Admin
Actor Interests	A new user wants to use the system
Description	This is the first step before user can sign in and use the system without restriction.
Pre-conditions	1. The user does not have an account in the

	system.	
Trigger	The user click on Register(注册) button.	
Basic Flow	Actor	System Response
	1. The user clicks on Register(注册) button. 2. The user input username and password he/she want.	1. The system display registration box. 2. The system validates the given information. 3. The system will see whether all necessary information is filled. If some problems occur, the system will show an error message detailing the problems. 4. If there is no error, the system registers the data into the database.

Before users can fully use the system, they need to use register function to make an account.

2.3.5. View Questionnaire Report

A report is an informational work made with the specific intention of relaying information or recounting certain events in a widely presentable form. In this project report will be projected as a diagram that includes pie chart and bar graph. Pie charts will display the multiple choice part as bar graph will display the score part.

View questionnaire report is a function that let users to see the report of the questionnaire they made. Only registered users can use this function. This function will only be available for questionnaire part, not for the courses that include case courses, video courses, and standard courses. Only users who make the questionnaire can see the report.

Table 2.7: Use case for the View Questionnaire Report function

Use Case Name	View Questionnaire Report
Main Actors	Employee/Trainer, Admin

Actor Interests	The user wants to see the report of his/her questionnaire.	
Description	This function will include Highcharts Javascript for making the pie chart and bar graph. Mainly to make the report easy to use.	
Pre-conditions	1. The user has been register in the system and has username and password. 2. The user already in open session. 3. The user hasn't been blocked by the system. 4. The user had created questionnaire. 5. The questionnaire had been answered by other users.	
Trigger	The user goes to member page and click My Report(我的报告).	
Basic Flow	Action	System response
	1. The user wishes to see his/her report of questionnaire. 2. The user click My Report(我的报告) on member page.	1. The system validates account session and information. 2. The system display report page.

The flow of this function has a lot of similarities with View Task, View Point and View Course Record function, which transfer the data from the courses to the member area.

2.4. Dataflow Model

The general idea for how the data is processed is important in this project and system. The speed of processing the data will impact the system and the user. If the flow of the data is interrupted or doesn't work smoothly then it will take user's time. Because this project scale is pretty large, so the data that will be transferred from time to time will be massive too, especially after the project runs for a long time.

Figure 2.2 shows the general flow of this project. All the functions that users want to use will connect to the database and return the data they needed. There will be many connection between

process and database, and the last flow will always go to database to make sure all the data that submitted or requested by the users will be validate first, checked at the database and then returned to the user. This flow will let users choose the action they want and the system will process it faster because there will be no redundancy when processing the user needs.

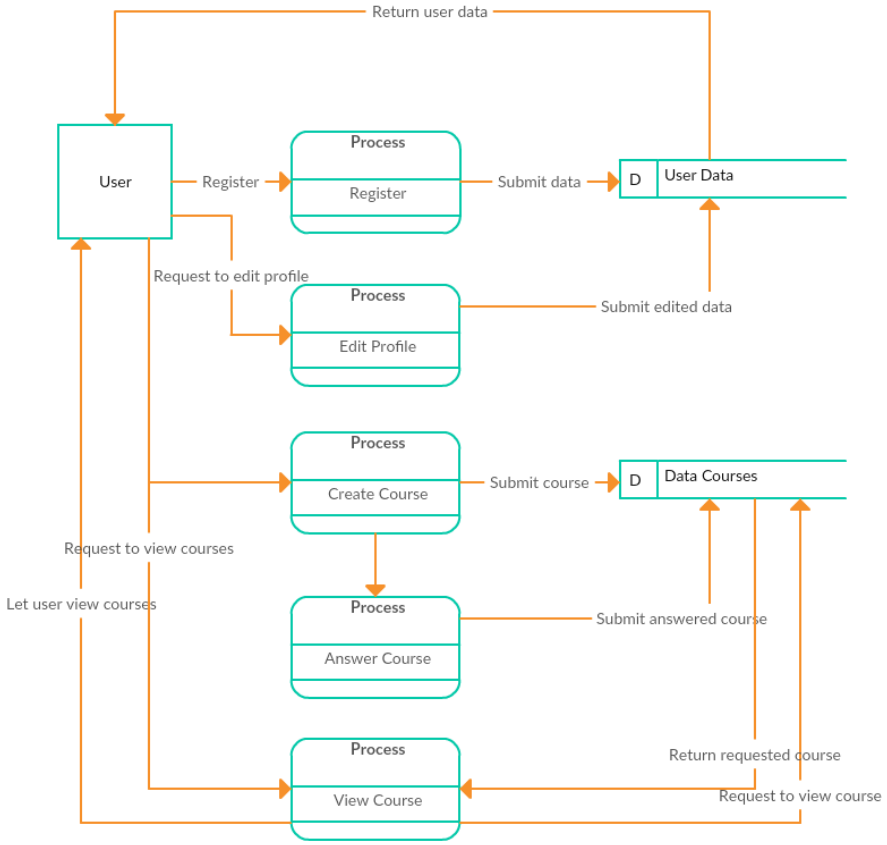

Figure 2.2: Dataflow Model

The process for users when they want to register is users request to register to the system and submit all the required information, and then the system will validates it and take it to the database where it will return the registered data to users. The same will apply to edit profile, users request to edit their profile and the system will validates and submit it to the database of user data, and then return all the information to users.

All the requested action for course will go to data course database and it will be processed before the data reach the database. This flow is pretty straight forward as users just need to request some action and system will return the needed data to users.

3. Architecture Design and Implementation

This section will cover anything about design and architecture of this project. There will be many diagram including class diagram and sequence diagram that will determine how the system works and why the system will be good for users to use it.

3.1. Architecture Layer

A multilayered software architecture is a software architecture that uses many layers for allocating the different responsibilities of a software product. There are 4 common in a logical multilayered architecture for an information system with an object-oriented design, which is presentation layer(UI layer), application layer(service layer), business layer(domain layer), data access layer(persistence layer).

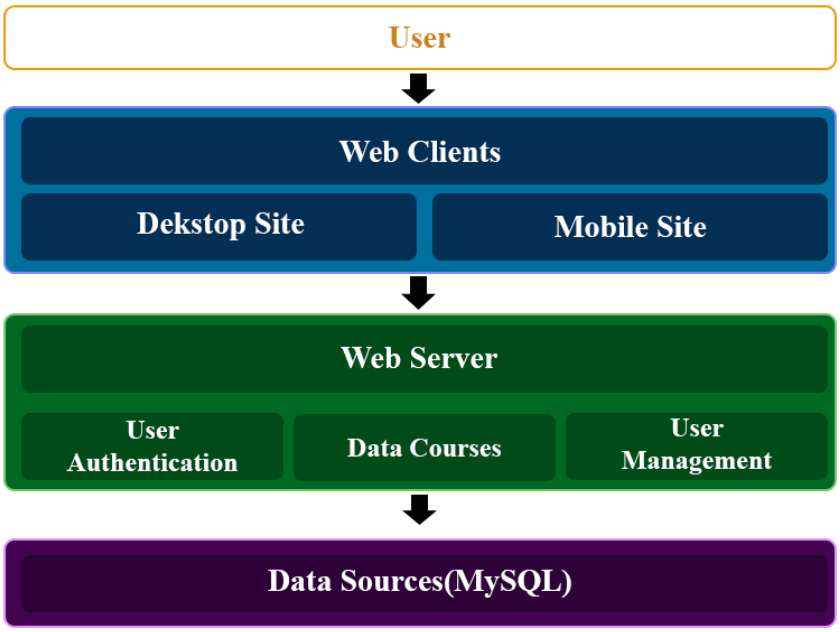

Figure 3.1: Multilayered Architecture

Since this project is about web application, we are trying to make this project that is easy to maintain, upgrade and modify requires

separation between the different modules. This project will have 3-tier architecture style. There will be 3 layers which first layer is presentation layer, second layer is application layer and the last one will be database layer.

3.1.1. Layers

The system will be separated as follow:

- Presentation Layer: This layer will provide users an interface so users can use the system with ease and comfortable. The presentation layer will include web clients, which can be access by different type of devices, one is for desktop(PC) and the other is for mobile(including android and iOS). The web client will be developed by using HTML, CSS, and Javascript.
- Application Layer: This layer will receive all the requested action that user want from the system. All kind of process and function will be in this layer, from analysis to sending data before it going to user or database. This layer will retrieve any information that user need from the database by including the functionality that list, modifies and deletes the information stored in database.
- Database Layer: All data will be stored in here, from user data and courses data. This data will be access by the application layer.

There will be some advantages by using this kind of multilayered architecture. Because three layers is separated then all the components in each layer can be modify without affecting the other layers. It will be easy to maintain the system and gives new interface or functionality to the system.

3.1.2. Interfaces

The different layers will be connected by using these interfaces:

- Web Server: The web server will use the http protocol to transfer information between Presentation Layer (UI layer) and Application Layer. All the requested function

that user need will be process and calculated on the server side, only the result will be sent to the client side for display. The Web Server will be hosted by using Apache Tomcat.

- Data Manager: This interface will connect Application Layer with Database layer, where all the data is stored. All data that has been calculated in Application Layer will go through database layer first and then it will be sent back to application layer where it now can be displayed to the client side.

3.2. Modules

The modules will be created according to the functional requirements from section 2.1. A detailed explanation of how these modules are composed will be given in this section. The idea behind this section is to create a clear view of the structure of the system, the functions provided by these modules and the way in which they interact with each other as well as which data storages they use to retrieve the data to operate or in which one they store the resulting data at the end of their task.

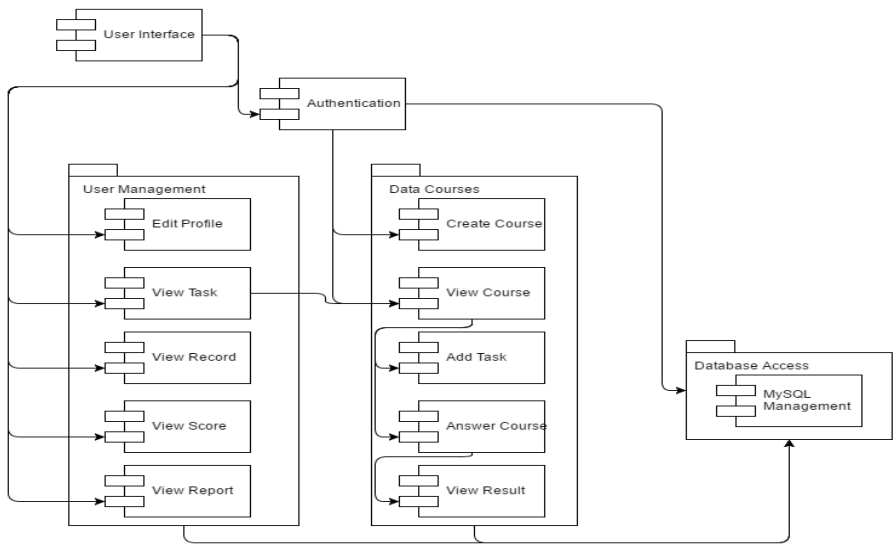

Figure 3.2: Modules Relation

The user interface is the primary way in which users can interact with the system, it provides a way to use the other modules either directly or indirectly. The other modules offer different functions ranging from importing data into the system to analyzing, retrieving and storing data.

3.2.1. User Interface

This section will provide the user interface of this project. User interface is the primary way for users to use the system, it provides a way to use function that available on the system. The provided user interface is already been developed and ready to use by this project.

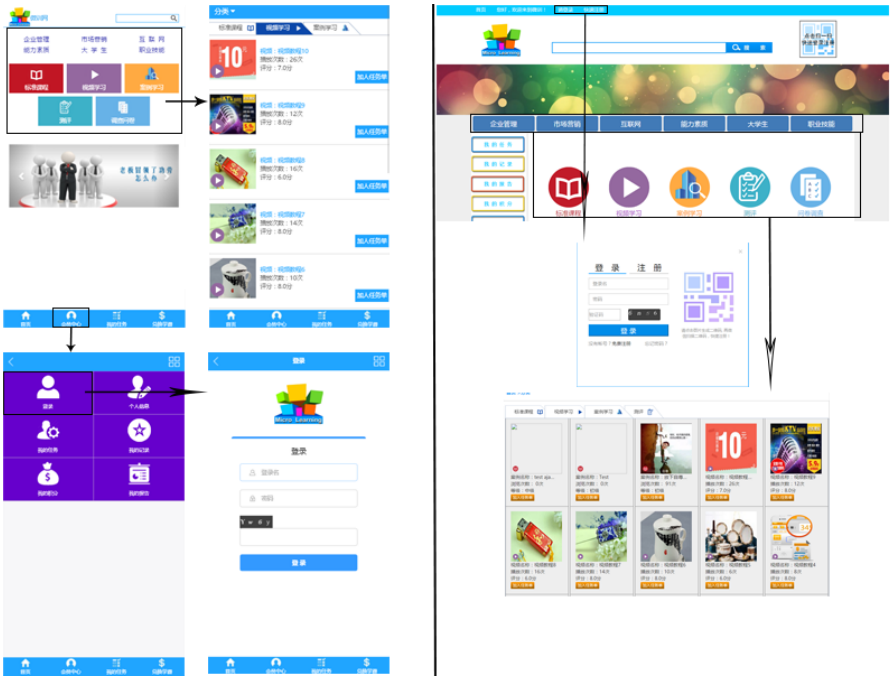

Figure 3.3: Web Client Overview

Figure 3.3 shows the overview of the web client service for both mobile site and dekstop site. All the pages is made using html, javascript and css that include bootstrap css and js. All the action that user take will always be from web client and then will be processed on the server side. Most of the interface that has been developed is

for mobile site, there will be some of the function that will only available for mobile site. The interface will be responsive according to the browser that user use. Most of browser is supported but there will be some browser that still hasn't been done.

3.2.2. Authentication

Authentication modules will include 3 parts which are register, sign in and sign out. Sign in is a way for users to create session in the system so users can fully use the system. Sign out is a way to terminate session.

The login screen will serve when user want to sign in and use the system. It is not a mandatory for user to sign in but there will be a page where user can't access if they are not in session.

Figure 3.4 shows the login page for both mobile site and desktop site. Users can login with Wechat through QR code that provided on desktop site or users can just go to mobile site with Wechat browser and go to login page, it will automatically login using Wechat account.

Figure 3.4: Login Screen

The way login screen works:

- Clicking 登录 blue buttons will submit the account information that inputted on the type box.

- Clicking 注册 will go to register pop up and let users register their account.
- Clicking the QR Code will generate and show QR code that can be used to login using Wechat.

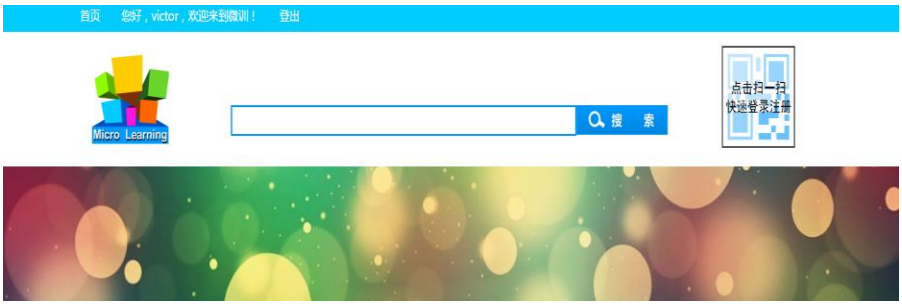

Figure 3.5: Sign Out Screen

Figure 3.5 shows the sign out will be in the same page where the words Login(登录) and Register(注册) will be change into Log out(登出) when the user in session.

3.2.2.1. Authentication Activity Diagram

The authentication activity diagram will show the general flow of the user to use the system. For authentication activity diagram, it will show the register, sign in, and sign out activity.

From Figure 3.6, the activity diagram show how the user will interact with the system before they can fully use the system. They need to register an account. If the account information is already exists, the system will redirect user to re-enter new account information until it success. After user create a new account, they need to enter the account information and CAPTCHA correctly then the system will take user to the home page and user can use the system. After users finish their activity on the website, they can sign out to keep their account safe.

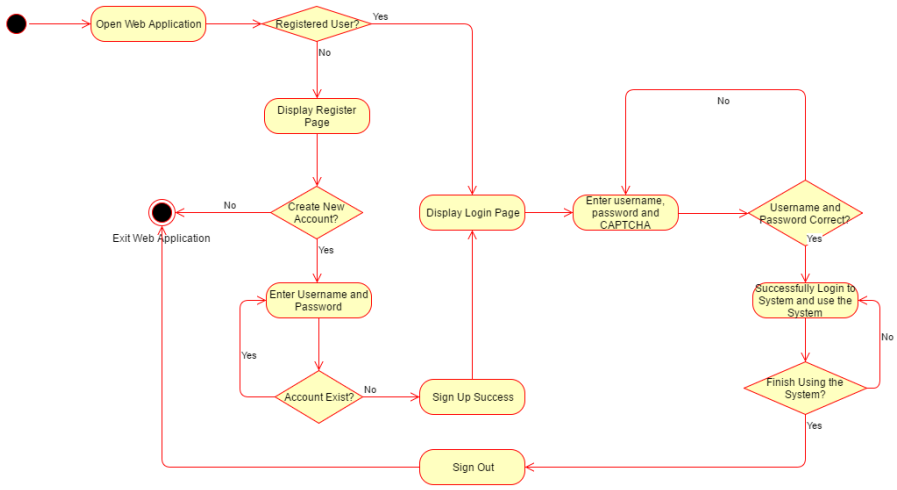

Figure 3.6: Authentication Login Module Activity Diagram

3.2.2.2. Authentication Sequence Diagram

This section will cover the sequence between user and authentication module. Sequence diagram will show the interaction of user with register, sign in and sign out.

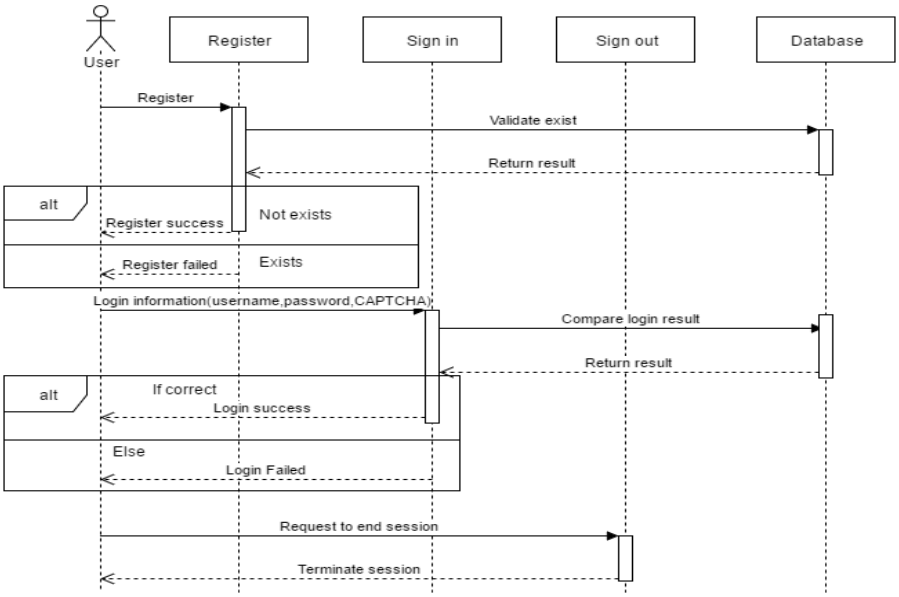

Figure 3.7: Authentication Sequence Diagram

The sequence diagram for authentication is pretty straight forward and this kind of sequence is used by almost every system that need authentication. Even though it is very common sequence diagram, but this is very important for the system to gives the authorization to the correct user and to keep the personal information safe. The sequence will always go through database first to match and validates the information that submitted and if the information is correct and okay, then the system will return it to the user.

3.2.3. Data Courses

This section will provide the pages for courses, from listing, answering and the report. The list course page will depends on what course users choose and it will change matching the category of the course.

Figure 3.8 shows the general interface for each of courses page. From left to right, it shows list of questionnaire, answering questionnaire, success page and the report page of questionnaire. All of these pages will be available after users sign in and open a session except list page.

Figure 3.8: Data Course Interface

3.2.3.1. Data Courses Activity Diagram

Data courses will include any kind of activity that corresponding with the courses. From view courses, create courses, answer courses,

add task, and view result. To use those function, users need to be in session.

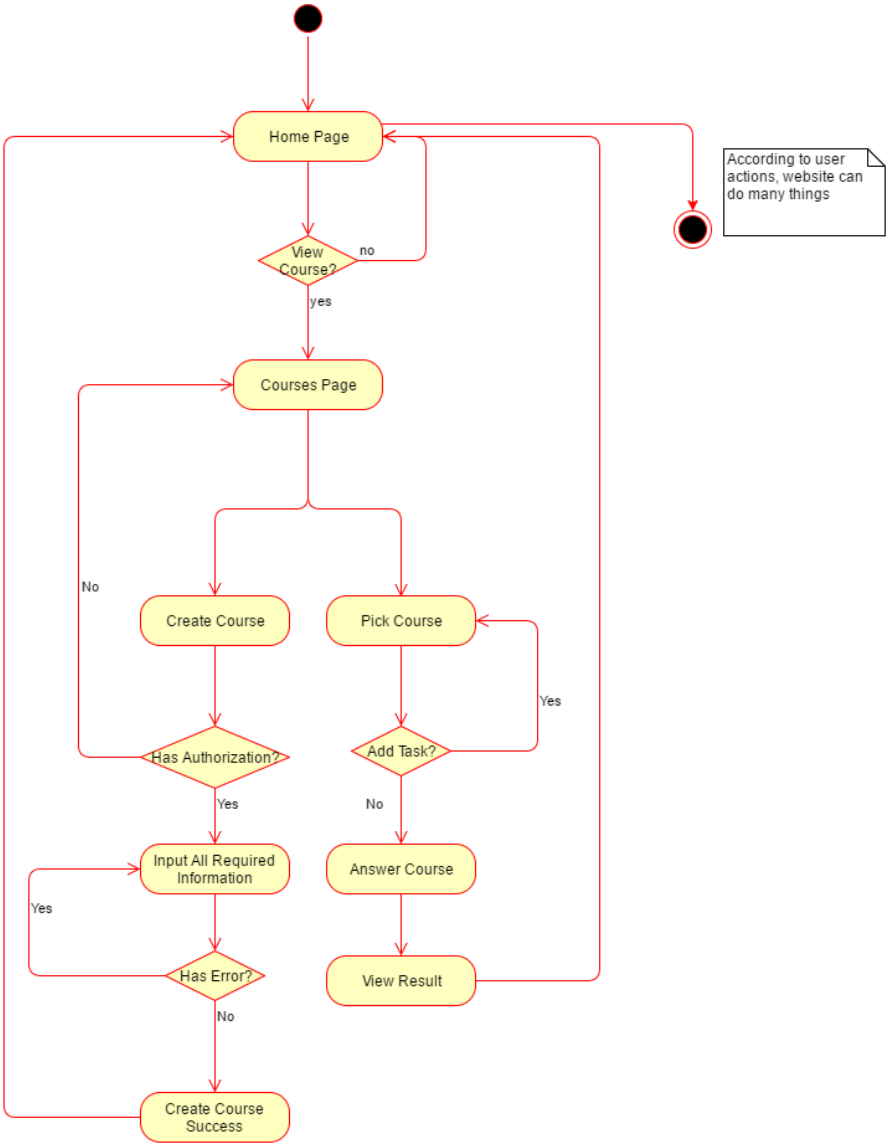

Figure 3.9: Data Courses Activity Diagram

Figure 3.9 shows the activity that users will take in data courses module. When users already in courses page, users can choose to create or view courses. If users choose to create course, they will be a check on user authorization to see if users has the authority to create

a course. If not then the system will take users to courses page again, else users can create a new courses by filling all the required information, which is name, category, level, description and the question for the courses. After successfully create course, the system will redirect users to the home page again. If users choose to view course, users can add the course to task or answer it. By answering the course, the system will take users to result page and then back to home page again. Beside this activity, users can choose to do other kind of activity as visualize in Figure 3.9.

3.2.3.2. Data Courses Sequence Diagram

The interaction between each part of data courses will be shown here. The process will be about view course, create course, add task, answer course and view result. In Figure 3.10, users are under assumption that already registered and in session.

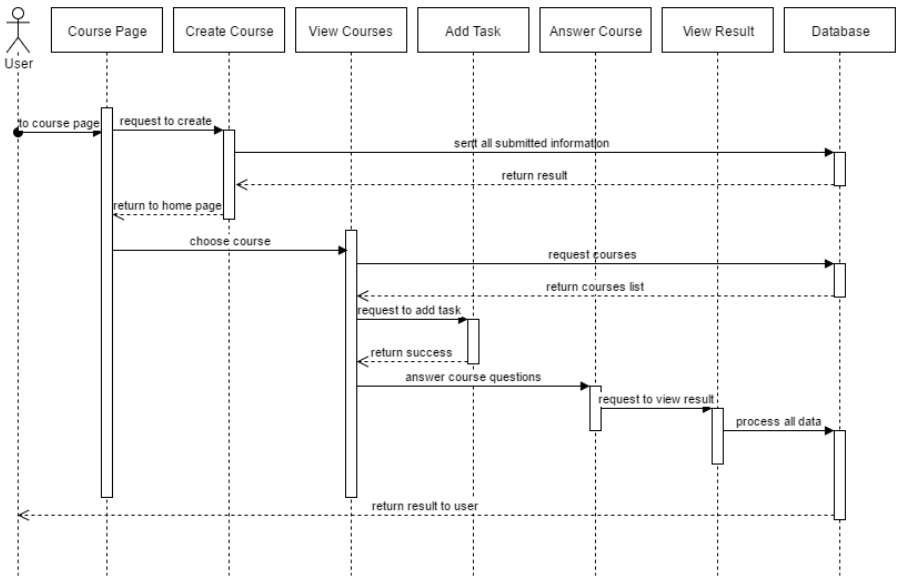

Figure 3.10: Data Courses Sequence Diagram

3.2.4. User Management

This screen will show when users want to manage their profile. There will be 4 functions in this user management interface, which

will show the record and history of user too. All of the action that users take will be shown in user management interface and the data information of users can be edited here.

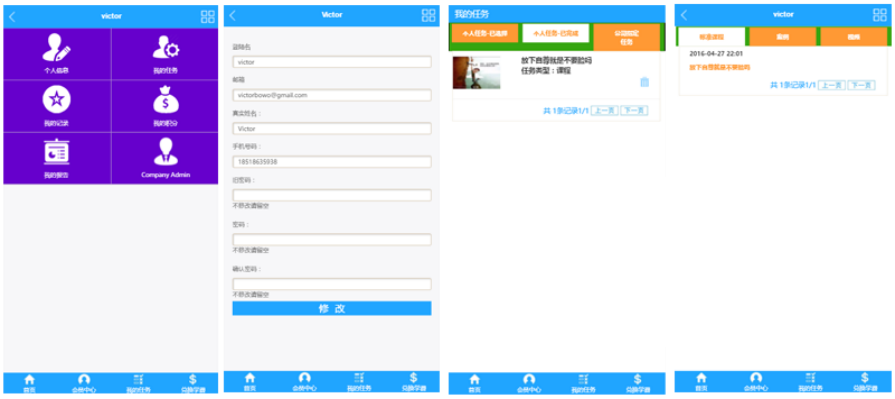

Figure 3.11: User Management Interface

Figure 3.11 shows the user management interface that user can access. The first page is the main window of user management. From there user can access the edit profile page, task list, courses record, courses score and courses report.

3.2.4.1. User Management Activity Diagram

This activity diagram will show the flow when user want to edit profile, see record and report. These activities can only be accessed when users have session and already registered in the system. And most important one is the user hasn't been blocked by the system.

As this project is still in early development stage, there are some functions that don't do anything beside to show a list. Those are view task and view record as visualize in Figure 3.12. Most of the activity is straight forward and at the end will be directed to member page. If users want to edit profile, they need to make sure there is no error when they fill the information. When users want to see their task, they can redirect the page to the specific course and answer it right away. As for view record and view score, the page will show the list of course they have done and the total score of their account. For view report, users can download the report into their local disc.

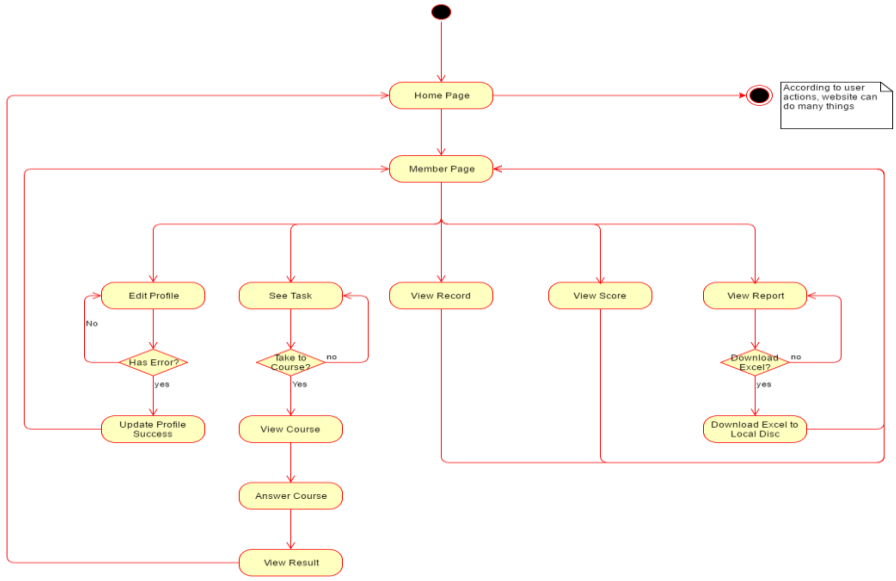

Figure 3.12: User Management Activity Diagram

3.2.4.2. User Management Sequence Diagram

The sequence diagram for user management module will be based on Figure 3.12 which is the activity of users in member page.

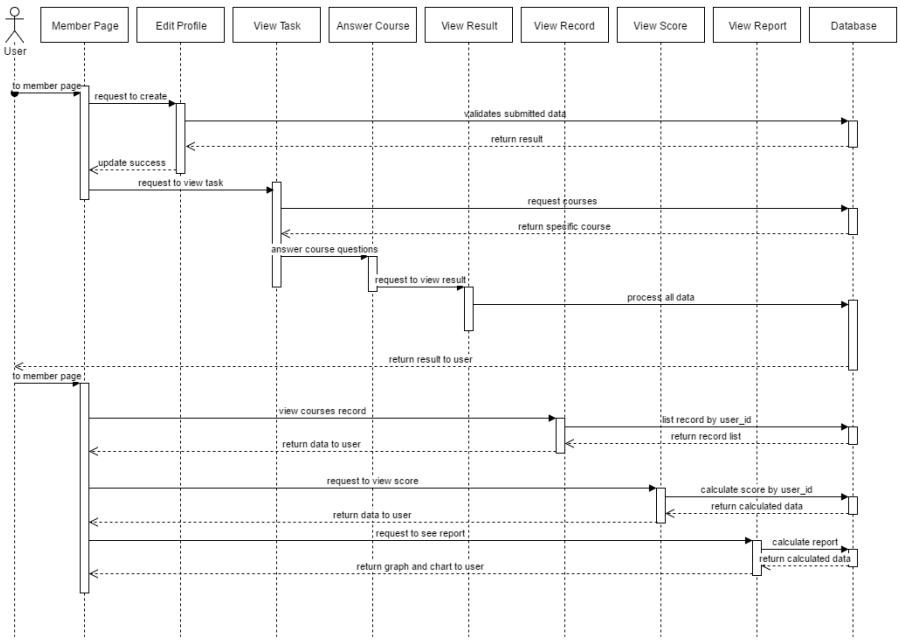

Figure 3.13: User Management Sequence Diagram

3.3. Database Design

This section will provide the database design for this project. There will be ER diagram and class diagram to ensure that the entity, attributes and relation between data is good enough for this project.

3.3.1. Entity relationship

The current stage of development is already pretty big and right now there are so many entity and relationship in the database. The one that will be provided here is the general entity relationship that keeps this project together. Mainly the one that will be important is users and courses.

Users usually take same action when using the website, to use the courses and manage their information. All the data will be connected one to each other in the database, like when users create course, the course section will interchange with user data to make sure that the course is created by that user.

Figure 3.14 show the general ER Diagram of this project. Users can create and view all the courses, record and history of the courses in their profile. In courses, there are point attribute that will be connected to the score history in view section, as for member id in report, it is connected with user to show who is the owner of the report. All the attributes in each entity and relationship are created with consideration of future reference, if there is going to be a modification for the database. Not all attributes from the database show in Figure 3.14 ER Diagram, because the real project already has a huge amount of entity, attributes and relationship.

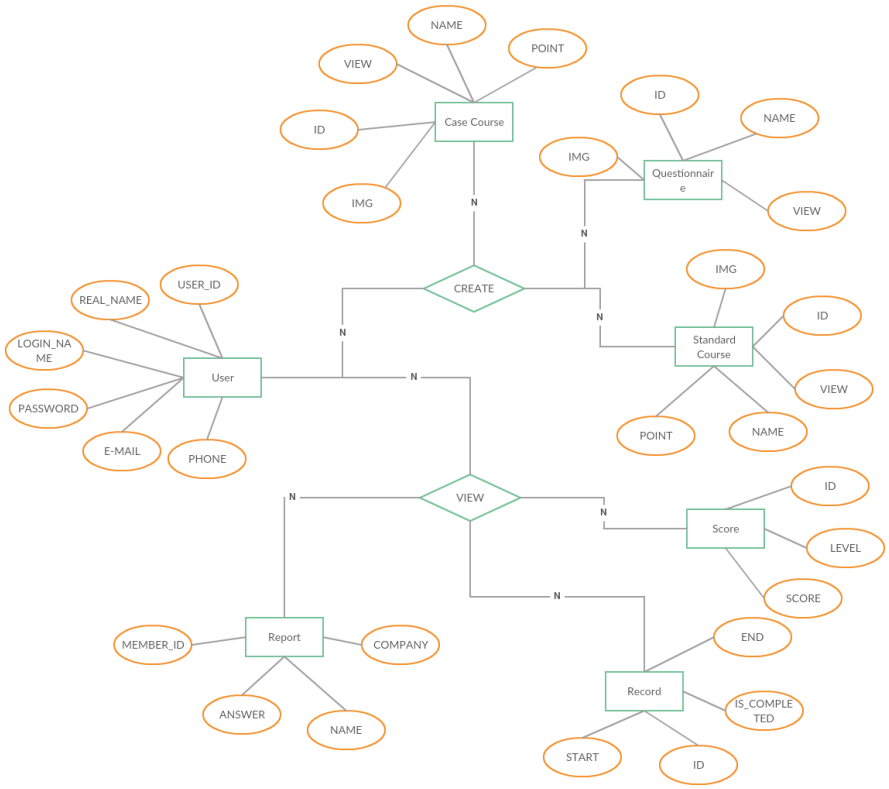

Figure 3.14: ER Diagram

3.3.2. Logical Model

This section provides logical model of the project. Logical model information is gathered from business requirements. Because the project is about E-Learning, then the system should contain data about courses. And users that act as trainer can create a course, as for employee user, they can view, list and answer all courses in the system.

E-Learning system should be able to gives score when users answer, see a report and all other information about users. All that requirements will make the website as E-Learning platform that can actually give education and learning system for users.

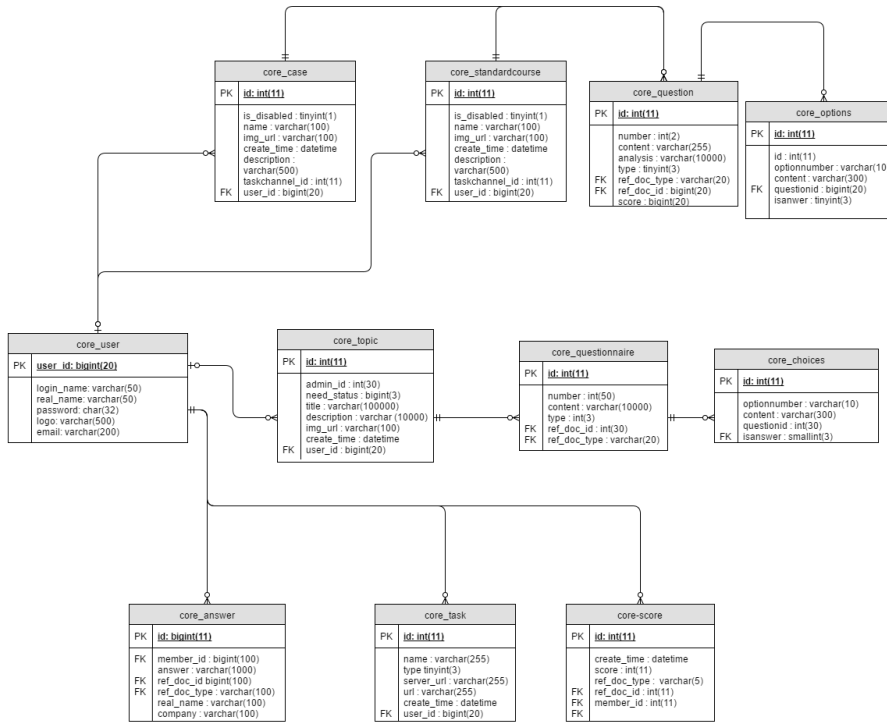

Figure 3.15: Logical ERD

4. Project Testing

These tests were performed before the project release, before each defense, and after the project release to public. Because I join this project later after this project created, I have to test all the cases that I create by myself and from the installation part.

In this section, only the tests I've performed are described. It contains test about running the web project on windows using eclipse, test the browser compatibility for CSS and Javascript and test all the function running correctly.

The tests were performed on Windows XP with Chrome, Android with Chrome and iOS with Safari.

4.1. Testing Process

The process that used to test the project is traditional waterfall development model. The software testing starts at the same moment the project starts and it is continuous process until the project finishes. As the project develops, the test will be done again and again to make sure that the project can be delivered without any problem when it finishes.

4.2. Installation and Working Tests

Installation and working tests include the test for apache tomcat, eclipse and all frameworks that used to make this project. The goal, test and expected results are described in Table 4.1.

Table 4.1: Installation and Working Tests

Goals	Tests to perform	Expected results	Actual results
Eclipse and apache tomcat run perfectly with the project	Install eclipse, run tomcat server with the project	The website can be seen on localhost.	The website can be seen on localhost,

			with some warnings in Eclipse.
Test the project responsiveness for both PC and mobile	Open the project using PC and mobile	There is no error and the site will be different PC and mobile.	The website is responsive (show different style on PC and mobile).
Test the compatibility of CSS for all browsers	Open the project on PC and mobile using different type of browser	There will be no different on the UI	There is no different on the UI on every browser.

The tests from Table 4.1 focus on getting the project runnable on each browser and run smoothly without any different between each browser.

4.3. Courses Tests

Courses tests have to be run to check if the courses part running correctly. These tests will check most of the function that correspond with course part from creating course, view course, answer course and answer result. The tests in Table 4.2 have to be realized after the website running.

Table 4.2: Courses tests

Goals	Tests to perform	Expected results	Actual results
Check the create function on the website works	Create a course through website and check database.	The system shows no error and the data submitted to	The user can create a new course without any

		database.	problem.
Check the list function on the website works.	List all courses on the database into the website.	The website lists every course from database and shows no error.	The system can list all the courses and base on the category.
Check the answer function on the website works.	Answer course questions in website and check database.	The system shows no error and the data submitted to database.	The system submits the answer to database.
Check the result function on the website works.	List the result of answering course in website and check if correct.	The system shows no error, the website show the data from database.	The website shows the result from answering the question

All the tests have to be run on the website to make sure the functions will be working not only on the java itself, but from the website. The tests can be done using debug mode on the server side when running tomcat server.

4.4. User Session Tests

User management tests allow developers to confirm the user profiles work correctly. The tests will include registering, sign in and sign out to make sure the security of the system.

Table 4.3: User Session Tests

Goals	Test to perform	Expected results	Actual results
Check if register on the website works correctly.	Register new account through website and check database.	The system shows a success message and the account data is in database.	The system register the account and automatically sign in.
Check if sign	Sign in using	If the account is	User gets

in works correctly.	an account from database and using a wrong account.	in database, open a session for that account and successfully sign in. If using wrong account, the system shows error message.	session. If the account is wrong then there will be a popup “用户名不存在或密码错误”.
Check if sign out works correctly	Sign out on the website and try using some function that needs session from user.	The system terminates user session and user cannot use some function.	The system terminates user session and user cannot use some function

4.5. User Management Tests

The tests for user management are about user’s profile, task, record and report. The tests have to be performed on the website and when users already registered and sign in. All the tests are using function that corresponds with user database.

Table 4.4: User Management Tests

Goals	Test to perform	Expected results	Actual results
Check editing profile on the website works.	Edit profile and change the information on website.	The data in database updated and the system shows no error.	The user can edit his/her profile and update it.
Check view task function on the website works	View task correspond to the user.	List task corresponds from the database.	The system can list user’s task base on

			course category.
Check view record function on the website works.	View courses record of the user	List record corresponds to the user from database.	The system can list user's record.
Check view report function on the website works.	View questionnaire report of the user	The page display pie chart and bar graph with the data from database.	The page display pie chart and bar graph with the data from database.

4.6. Acceptance Test

The acceptance test consists of a process of verifying that a solution works for the user. This test was conducted by gives some beta testing for some users to test the readiness of the project. The test itself was organized by Micro Learning by advertising the website to some participant in Micro Learning lecture. The testers don't know anything about software engineering and test the function without any knowledge of it. The users tried courses function to create course, list all courses, list courses by category, answering courses, and view the result function and it all run smoothly without any problems. Same for user management, users can use all the function inside without any bugs or problems. The test participants can accept the WeiXunWang project as a web-based E-Learning system with some adjustment and modification on the UI.

5. Result

The project has been running for quite a long time and the expected goals still hasn't been reached. Most of the functions still being developed and some of available function still has bug on it. The project can already be accessed on the website www.wx798.com and most of the users are friends of the Micro Learning.

Micro Learning already advertise the use of E-Learning system like from section 4.6, but not widely, just to some participant in lecture. The user can already use the course on the website and can participate with questionnaire function. They can already create, answer, and see the result of courses. Most important one is the trainer can finally produce some progress by using questionnaire function on the website. Because of the QR code implementation, users can easily access the courses that trainer want them to learn.

Figure 5.1: Create Questionnaire Success

Figure 5.1 shows a page where questionnaire has been successfully submitted. In that page, trainer can show the QR code so the participant of the lecture can scan the QR code and fill the questionnaire with less time consuming and without any problem. This function has greatly increasing the applicant of WeiXunWang users.

The other success function that has been implemented is Wechat login function. Users can login the website using their Wechat account. This function provides convenience for every user especially in China.

Figure 5.2: QR Code for Sign In

This function really helps users when they don't want to create an account on the website. All their Wechat information will be stored on the database, so they do not need to re-input their profile information. The security for this system also guaranteed because this project use MD5 encryption to protect user password. MD5 is an old

way to encrypt password, but it still powerful and can be used as a security method for the system.

Though because the project is still far from perfect, there are no many people that use WeiXunWang website. There are still so many functions that have to be implemented on the project to make the system become a good E-Learning system. There are some function there are still half done like the score function and history function, where there still no use on both of those function.

In the near future, Micro Learning will try to implements many methods and functions that can make WeiXunWang project really useful for Chinese people, for example like payment with Alipay, share on Weibo function, collaboration with Tencent QQ, android application and iOS application. These function and projects already on the development but still on early stage of development as the resource to make these functions still lacking.

6. Conclusion

E-Learning system should make an education system better and much easier to access than before and less expensive too. People can learn during their break, or before sleep, or whenever they have free time. With this, people will have more freedom to choose between entertainment and education. The result that this project expected is that people will actually learn something from E-Learning system and change their way of thinking about education, become much more confident with their abilities and have an easy time increasing their knowledge.

After working on this project for almost 6 months, the project itself has been considered as a big and ambitious project. Making a website with an open source tools is not as simple as someone think. The developers need to be able to design the architecture of the project really carefully and has to be able to see the project as a whole rather than just a small project.

Educate people using a traditional method is not effective anymore when the technology are growing rapidly. Because this technology, people prefer to find some entertainment rather than learn and study. Technologies that most of people use are internet and smartphones, which they access it almost 24/7. That is why Micro Learning tries to create a new method for people to learn and train using the technology that they use.

With this project, users can read useful article, courses and question with their phone or PC. This article, courses and question that this project provides will just take a few minutes to read it and answer it. It will speed up the process of learning and can fill the free time of users.

But the most significant advantages of this is that people doesn’t need to pay or going to some special place just to learn something. They can just open the website and do a little task each time they have free time. This is the advantages of using E-Learning system that can be done by learning with traditional ways.

As the project advances, there will be more function that can help users with their needs of education and better UI design to make it

attractive and interesting. For example there will be a function where users can just edit their profile from gender, IQ, major of education and the system will list all the courses that correspond with the information. This will save users time and will make study more interesting.

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