


ASSIGNMENT 1 FRONT SHEET

Qualification	BTEC Level 5 HND Diploma in Business		
Unit number and title	Unit 30: Application Development		
Submission date	13/10/2021	Date Received 1st submission	
Re-submission Date		Date Received 2nd submission	
Student Name	Nguyen Thi Lan Anh	Student ID	GCH190601
Class	GCH0804	Assessor name	Do Quoc Binh
Student declaration I certify that the assignment submission is entirely my own work and I fully understand the consequences of plagiarism. I understand that making a false declaration is a form of malpractice.			
		Student's signature	

Grading grid

P1	P2	P3	M1	M2	D1

☐ **Summative Feedback:**

☐ **Resubmission Feedback:**

Grade:

Assessor Signature:

Date:

Internal Verifier's Comments:

Signature & Date:

Contents

I. INTRODUCTION	6
II. TASK 1 – SOFTWARE REQUIREMENTS SPECIFICATIONS AND SOFTWARE DESIGN	7
Revisions.....	8
1. Introduction (P1)	9
1.1 Document purpose.....	9
1.2 Product scope	9
1.3 Intended audience and document overview	9
1.4 Definitions, Acronyms and Abbreviations.....	10
1.5 Document conventions	11
1.6 References and Acknowledgments	11
2. Overall Description (P1)	11
2.1 Product overview	11
2.2 Product Functionality	11
2.3 Design and Implementation Constraints.....	12
2.4 Assumptions and Dependencies.....	12
3. Specific Requirements (P1 & M1)	13
3.1 External Interface Requirements.....	13
3.2 Functional Requirements (P1)	20
3.3 Use Case Model (P1)	22
4. Technical Design (M1)	30
4.1 Sitemap Diagram	30
4.2 MongoDB schema design.....	31
4.3 Class Diagram	32
4.4 Activity Diagram	33
4.5 Trello.....	40
5. Risk Management (P2)	41
6. Other Requirements.....	43

6.1	UI Requirements.....	43
6.2	Performance Requirements.....	43
6.3	Safety and Security Requirements	43
III.	TASK 2 – TECHNOLOGIES EVALUATION	44
1.	Design Tools.....	44
1.1	Tools to design UML.....	44
1.2	Tools to design UI	45
1.3	Team’s choice	46
2.	Front End technology stack.....	46
2.1	Programming language	46
2.2	HTML/CSS	47
2.3	JavaScript Library	48
2.4	CSS Framework.....	49
2.5	Team’s choice	49
3.	Back End technology stack.....	50
3.1	Programming language	50
3.2	Operating System	51
3.3	Database	51
3.4	Hosting.....	52
3.5	Frameworks.....	53
3.6	Team’s choice	54
4.	Tools for source control management	55
5.	Software Development Models.....	55
5.1	Waterfall.....	55
5.2	Scrum	55
5.3	Team’s choice	56
	Reference.....	57

List of figures

Figure 1: Login page.....	14
Figure 2: Staff index.....	14
Figure 3: Manage Trainee page.....	15
Figure 4: Add new trainee page.....	15
Figure 5: Edit trainee page.....	16
Figure 6: Search trainee page.....	16
Figure 7: Course category page.....	17
Figure 8: Add new category page.....	17
Figure 9: Edit category page.....	18
Figure 10: Search category page.....	18
Figure 11: Update profile.....	19
Figure 12: Change password.....	19
Figure 13: Use case diagram.....	22
Figure 14: Screen Flow Diagram.....	30
Figure 15: MongoDB schema design.....	31
Figure 16: Class Diagram for MVC.....	32
Figure 17: Activity Diagram for Login.....	33
Figure 18: Activity Diagram for Add Trainee.....	34
Figure 19: Activity Diagram for Add Category.....	35
Figure 20: Activity Diagram for Update Trainee.....	36
Figure 21: Activity Diagram for Update Category.....	37
Figure 22: Activity Diagram for Search Trainee.....	38
Figure 23: Activity Diagram for Search Category.....	39
Figure 24: Trello.....	40
Figure 25: Draw.IO.....	45
Figure 26: Visual Paradigm.....	45

I. INTRODUCTION

Due to the fast rise of technology in today's world, FPT Co. wants to create a culture of continuous within the company. It is required to create a system that controls the "Training" activity for the company's internal training program. As an FPT company developer, we must create a solution that fits the users' requirements. This system may be used to keep track of trainees, trainers, courses, categories, and so on. In the following section of the report, I will offer a more detailed description.



II. TASK 1 – SOFTWARE REQUIREMENTS SPECIFICATIONS AND SOFTWARE DESIGN

Software Requirements Specification

for

FPT Co. Application

Version 1.0

Prepared by

Group Name: Group 1

Nguyen Thanh Hung	GCH190704	hungntgch190704@fpt.edu.vn
Nguyen Thi Lan Anh	GCH190601	anhntlgch190601@fpt.edu.vn
Dinh Huy Hoang	GCH190440	hoangdhgch190440@fpt.edu.vn
Do Duc Tai	GCH190834	taiddgch190834@fpt.edu.vn
Hoang Duong Ngoc Thao	GCH190302	thaohdngch190302@fpt.edu.vn

Instructor: Do Quoc Binh

Course: Application Development

Date: 11/10/2021

Revisions

Version	Primary Author(s)	Description of Version	Date Completed
1.0	Nguyen Thi Lan Anh	Initialize the SRS, research the related fields and write the Introduction.	30/09/2021

1. Introduction (P1)

1.1 Document purpose

The purpose of this document was to build an online system to manage the training-related activities of the FPT company. Through it, staff and admin can easily use this system to manage Accounts, Trainer, Trainee, Course Category, Courses....

1.2 Product scope

The purpose of this online course management system is to easily manage courses, trainers, and trainees. Besides, the system also helps users easily manage personal information and update their information. In conclusion, this system is used exclusively for FPT Education, and FPT Company workers can use it as trainers, trainers, trainees, and system administrators.

1.3 Intended audience and document overview

1.3.1 Intended audience

This project is a prototype for the management system of the activity of “Training” the for internal training program of the company and it is limited to the campus of the FPT company. The project was built and completed step by step with the mentor's guidance. As we mentioned above, this product is very useful for administrators, staff, trainers, and trainees. There are three types of objects in this document:

- **User:** They are admin, staff, trainers, trainer of FPT Co. This document will help user use product and understand features inside.
- **Developer:** They are developers of project. This document will help they understand project's requirements and directions. In addition, they also need to extend more features or remove duplicate tasks. Summary, they have to analyze the tools and technologies for project to implement. Then, note them in report document in detail and carefully for others read and use
- **Mentor/professor:** They are who understand and got large experience in building a project. This document will help they understand give instructions, suggestions that are very import for improve product.

1.3.2 Document overview

In general, the document will cover some domains such as the user, device hardware, product data, and functional specifications. We will provide detail below.

Each role and task in the project, in particular, will have its own task. As a basis, we will give and discuss them in detail below as functional requirements and assumptions while designing the project's HR management website. We also discuss and give product requirements, as well as requirements for external interfaces.

Directions for reading document:

- Must be officer, staff, trainer, trainee of FPT Co.
- No copy or bring out document out of organization.

1.4 Definitions, Acronyms and Abbreviations

To be more clearly while reading document, we will provide a table includes definitions, acronyms and abbreviations that we will use in document.

Table 1: Definitions, Acronyms

Acronyms	Meaning	Definition
MVC	Model-View-Controller	A software design pattern commonly used for developing user interfaces that divide the related program logic into three interconnected elements
UI	User interface	In the industrial design field of human-computer interaction, a user interface (UI) is the space where interactions between humans and machines occur
UX	User experience	The process design teams use to create products that provide meaningful and relevant experiences to users
UML	Unified Modeling Language	A modeling language consisting of graphic symbols that are object-oriented methods use to design information systems quickly

1.5 Document conventions

In this document, we decided to choose IEEE format paper to write. Font-size: 12 Calibri, italics text font for table titles, figure titles, comments. Document text has a single spacing and a 1.5 margin. Bookmarks are indicated on each portion of the plate. The headings and subsections are patterned.

1.6 References and Acknowledgments

<https://dzone.com/articles/how-to-write-the-system-requirements-specification>

<https://www.perforce.com/blog/alm/how-write-software-requirements-specification-srs-document>

2. Overall Description (P1)

2.1 Product overview

The web will fix the difficulties that remain with the old system's deposition now that the new system has been enhanced and improved. In addition, additional features and functionalities will be added to the new system to improve the user experience. The new system will also make it easier for employees and administrators to manage accounts, subjects, and courses. The interface, in particular, will be entirely new, rebuilding the usefulness for consumers in keeping with the company's vision. It will establish a distinct place for users when operating on the system, in addition to the decentralization of work upon signing in.

2.2 Product Functionality

Administrators, training staff, trainer, and trainee are the four main roles in this system which is employed by the university's human rights department. Furthermore, each role will have different access rights to ensure that the system is suitable for FPT Co's workflow.

- **With the admin:** They can add, edit, search, delete, and view all staff and trainer accounts.
- **With the training staff:** They can add, update, view, delete, search for trainee account, course category, course, assign trainer or trainee to course, update their profile and password.
- **With the trainer:** They can update, view their profile and update their password, can view and search all trainee in the course they are assigned.
- **With the trainee:** They can update, view their profile and update their password, can view and search all trainee in the course they are assigned.

In this project, I take on a part of the staff's functions including: add, update, view, delete, search for trainee account, course category and update staff's profile and password.

2.3 Design and Implementation Constraints

2.3.1 Hardware design constraints

The hardware system for our project meets the following minimum system requirements:

- Microsoft Window 7 or higher
- X86 Dual Core Processor or higher
- Minimum 2GB RAM
- Minimum 5GB free space

2.3.2 Software constraints

For the software system for our project will have to meet the following minimum requirements:

- NodeJS and MongoDB
- Use framework Bootstrap for the Front-end design
- Use Visual Studio Code to code for the project

2.4 Assumptions and Dependencies

2.4.1 Assumption

The first assumption is that the computer running the website will be able to run and use the most recent version of the most popular internet browser. Because outdated web browsers do not support the latest version of MongoDB, HTML, or NodeJS, the website will not work optimally and will not display the desired form.

The second assumption is that the computer running the website has a appropriate screen to support the website's user interface output. A computer with an old-fashioned screen, for example, may present unfavorable results for the user, leading in the website's original form being lost.

The third assumption is that the website will run on different types of operating systems in the same way. Because the site only runs tests on Windows and MacOS operating systems. Therefore, the assumption is that it can still run smoothly on operating systems like Linux, Ubuntu, etc.

2.4.2 Dependencies

The system depends on:

- **HTML for UI:** HTML is a standard markup language that is used for website frontend development. It is widely known and used on several important websites, making it a safe choice for the front end of the website.
- **MongoDB Database:** MongoDB is a document-oriented database (document), a type of NoSQL database. It uses data storage in the form of Document JSON, so each collection will have different sizes and documents. The data is stored in a JSON document so the query will be very fast. However, the data size is limited so the system may be affected in the future.
- **NodeJS for Backend:** NodeJS is a programming language for creating scalable web applications, especially web servers. When used with Visual Studio Code, it is currently free of cost. This makes it an excellent option for project, but it is creating some Fundamentals Courses to generate additional revenue, so it is unclear whether it will remain free in the future.
- **GitHub:** Although the group only has a five-person but we be unable to hold meetings because of the current global situation, which includes a Covid 19 epidemic. As a result, engineers will be able to share and integrate code using GitHub as a software collaboration platform for project development. Furthermore, GitHub makes it much easier for everyone on the team to share, edit, and submit code, giving us a better experience than similar apps. As a result, GitHub is an important factor of the project's success.

3. Specific Requirements (P1 & M1)

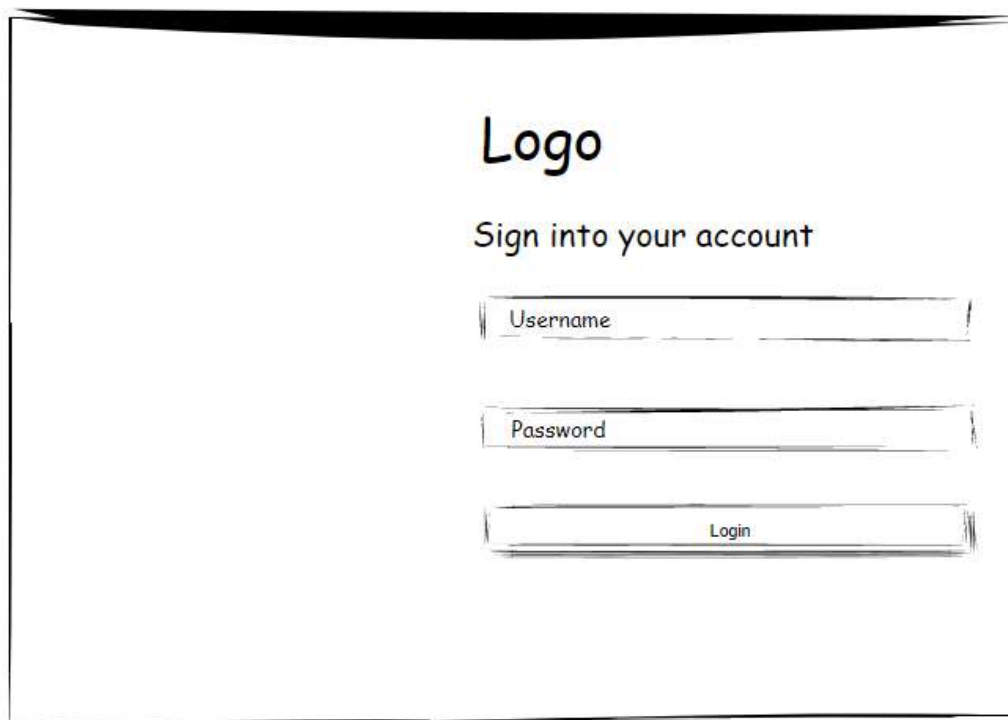
3.1 External Interface Requirements

3.1.1 User Interfaces (P1)

This app is aimed at users who are trainer, trainee, staff, admin. So, we need to build the interface for 4 roles. Users need an easy-to-see and logical interface, which makes management easier. The components need a clean and easy-to-use layout.

Here are the UI designs of the parts I take on

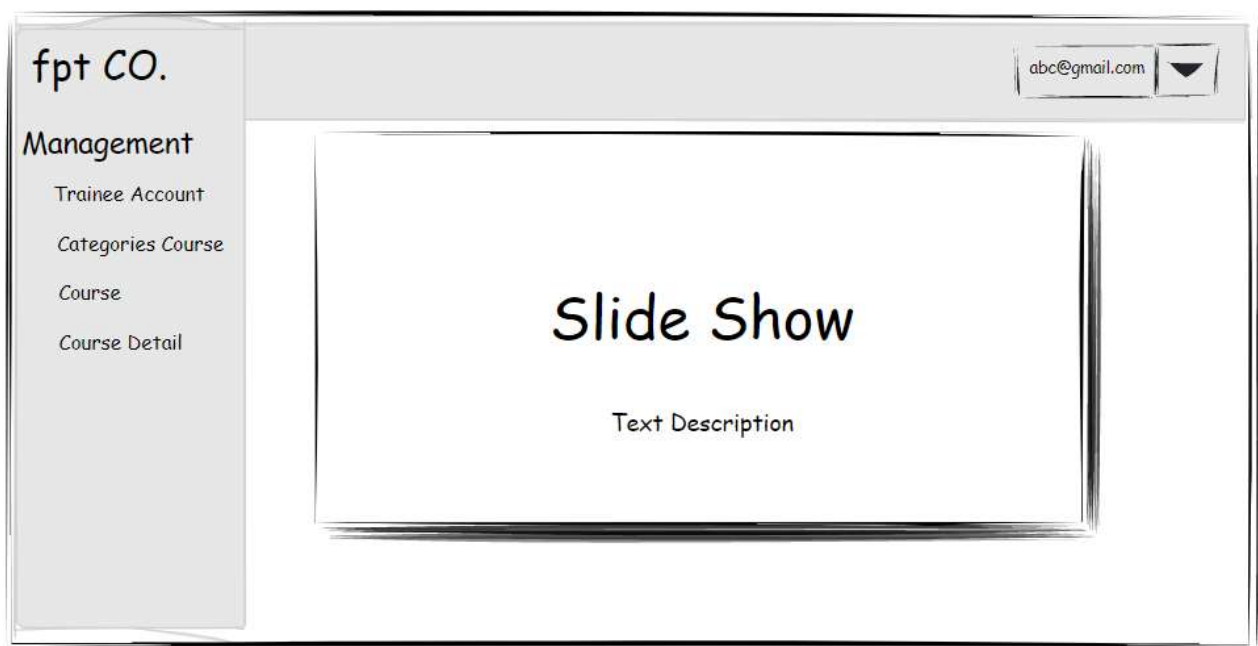
➤ **Login page**



The login page features a central area with the text "Logo" at the top. Below it is the instruction "Sign into your account". There are three input fields: the first is labeled "Username", the second is labeled "Password", and the third is a button labeled "Login".

Figure 1: Login page.

➤ **Staff index**



The staff index page has a header bar with "fpt CO." on the left and a user profile "abc@gmail.com" with a dropdown arrow on the right. A left sidebar contains a "Management" section with links to "Trainee Account", "Categories Course", "Course", and "Course Detail". The main content area displays "Slide Show" in large text, with "Text Description" below it.

Figure 2: Staff index.

➤ Manage Trainee page

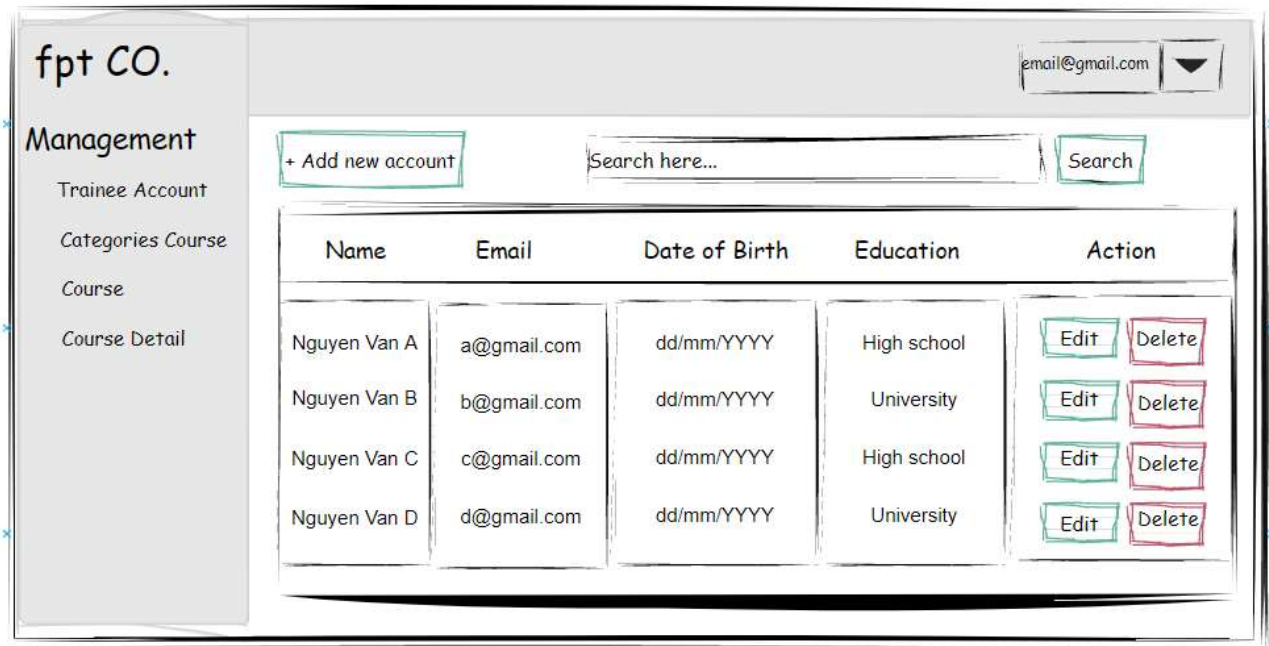


Figure 3: Manage Trainee page

➤ Add new trainee page

Click [+ Add new account](#) then

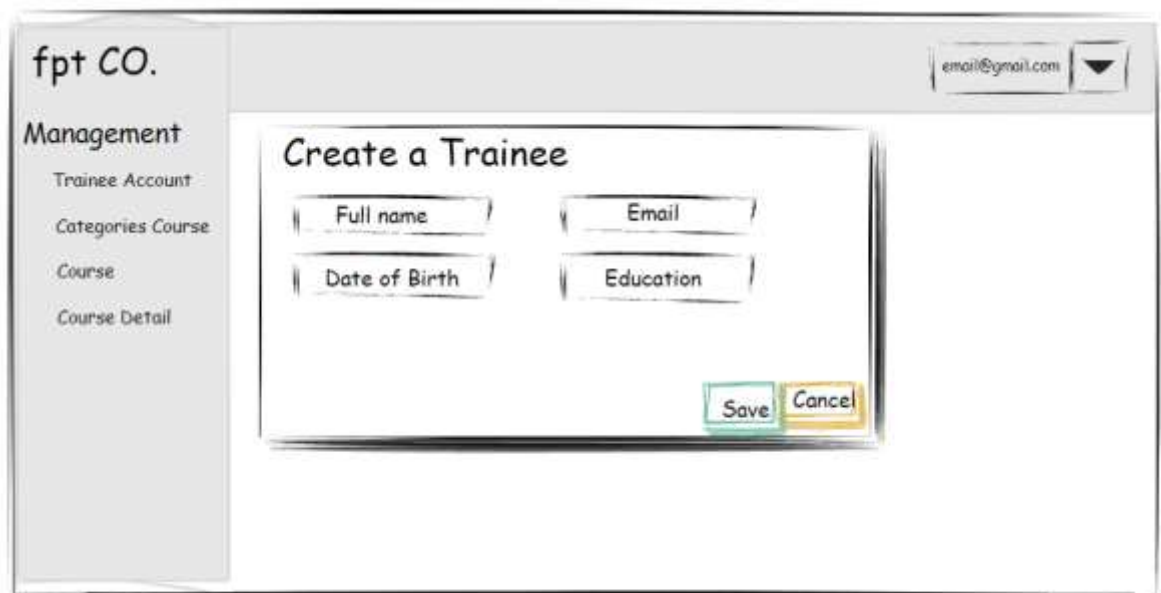


Figure 4: Add new trainee page.

➤ Edit trainee page

Click  then

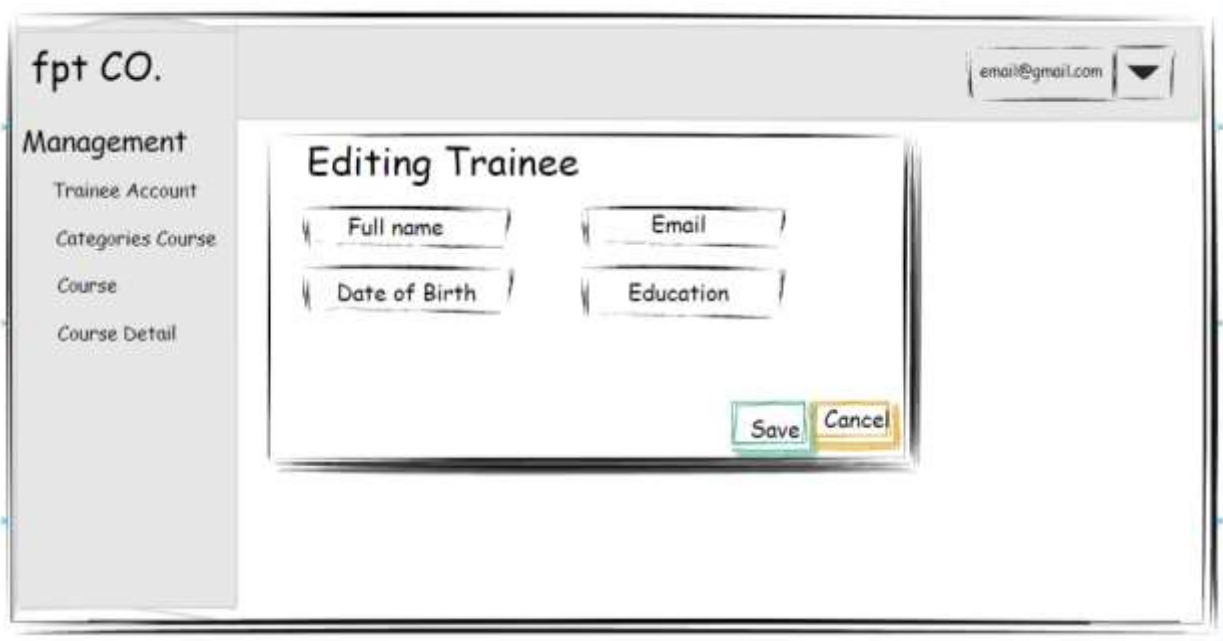
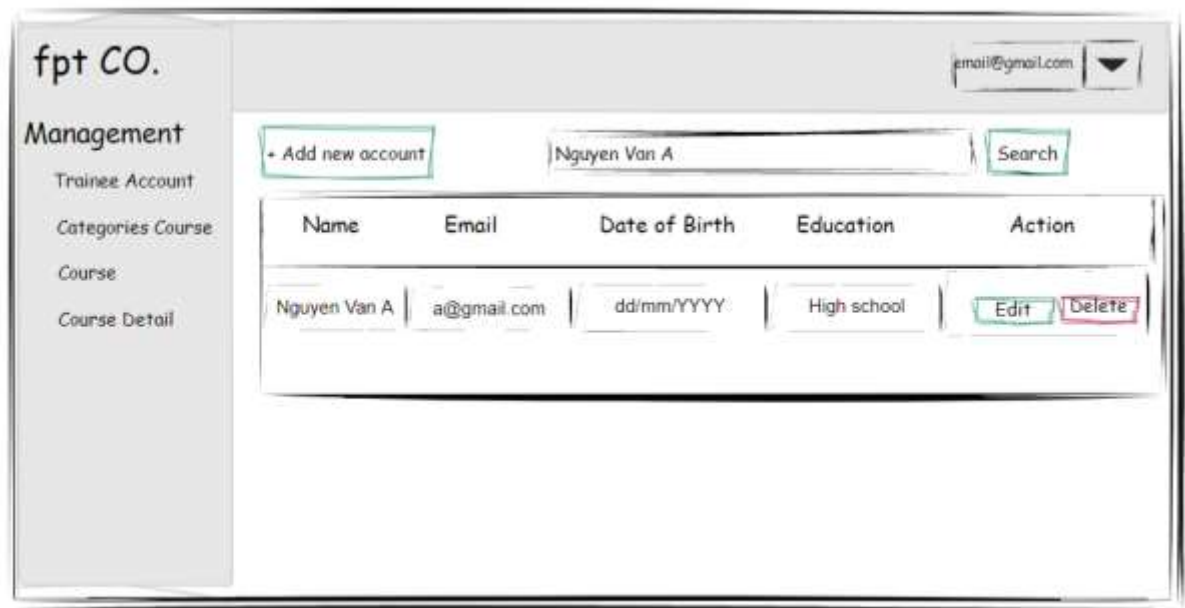


Figure 5: Edit trainee page.

➤ Search trainee page

Enter keyword in  then enter or click  then



Name	Email	Date of Birth	Education	Action
Nguyen Van A	a@gmail.com	dd/mm/YYYY	High school	Edit Delete

Figure 6: Search trainee page.

➤ **Course category page**

fpt CO. Management

Trainee Account

Categories Course

Course

Course Detail

abc@gmail.com

+ Add new Category

Search here...

Search

Course Category name	Description	Action
Design	abc...	Edit Delete
Marketing	abc.....	Edit Delete

Figure 7: Course category page.

➤ **Add new category page**

Click [+ Add new Category](#) then

fpt CO. Management

Trainee Account

Categories Course

Course

Course Detail

email@gmail.com

Create a Course Category

Course Category Name

Description

Save Cancel

Figure 8: Add new category page.



➤ **Edit category page**

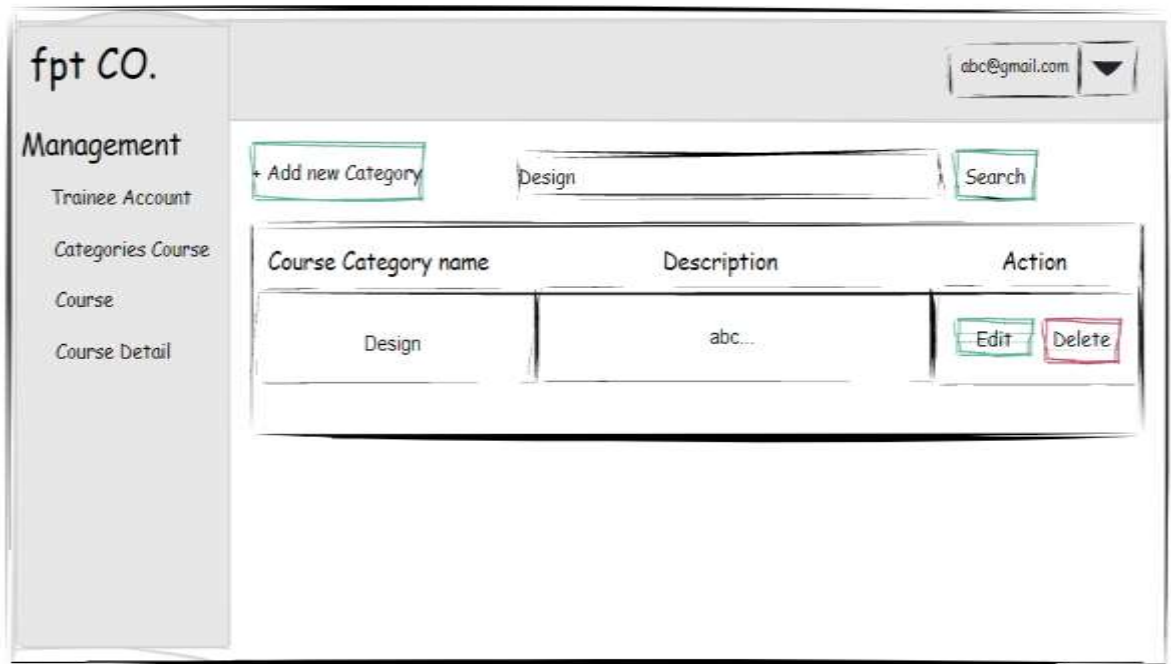
Click  then



Figure 9: Edit category page.

➤ **Search category page**

Enter keyword in  then enter or click  then





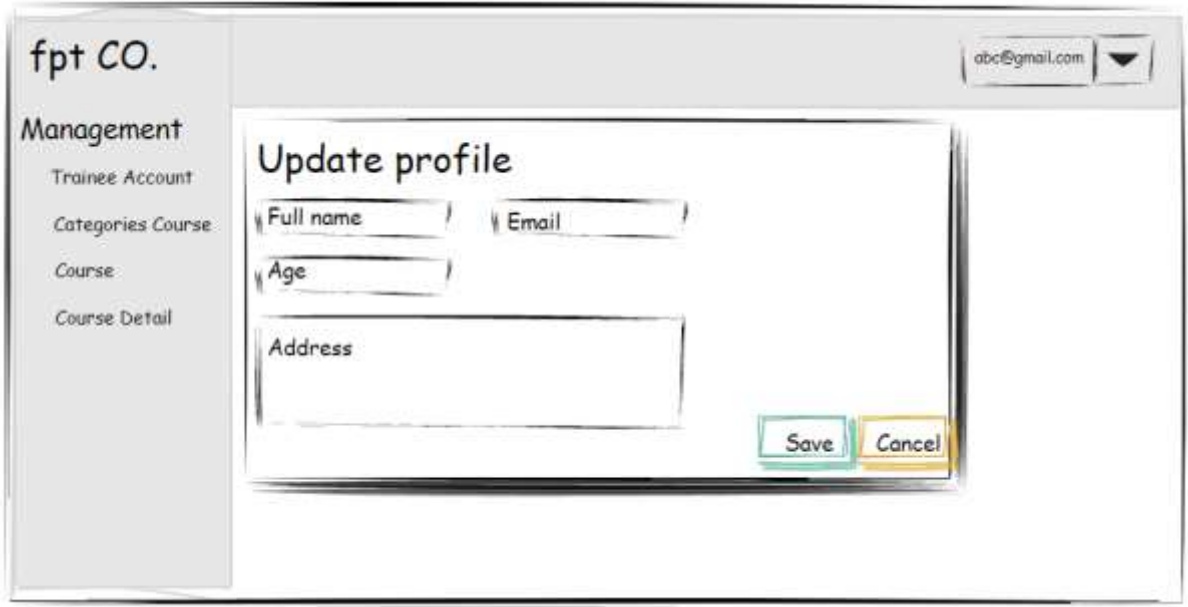
Course Category name	Description	Action
Design	abc...	 

Figure 10: Search category page.

➤ **Update profile**

Press dropdown button  and choose  then

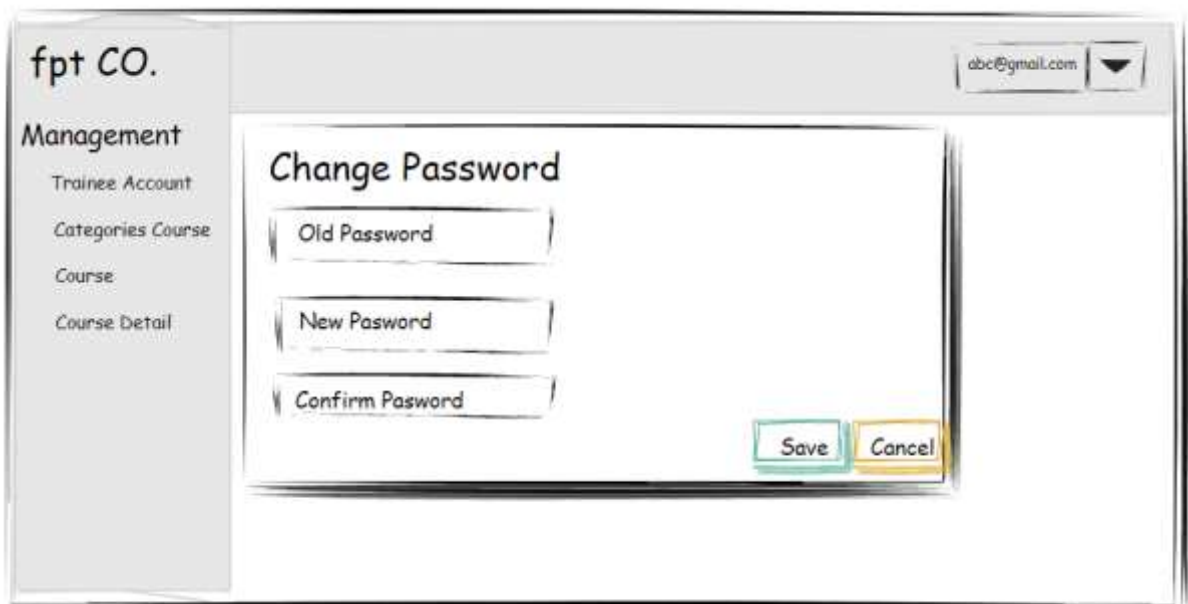


The screenshot shows a web application window titled 'fpt CO.' with a 'Management' sidebar. The sidebar contains links: 'Trainee Account', 'Categories Course', 'Course', and 'Course Detail'. The main content area is titled 'Update profile' and contains four input fields: 'Full name', 'Email', 'Age', and 'Address'. At the bottom right of the form are 'Save' and 'Cancel' buttons. A dropdown menu in the top right corner shows 'abc@gmail.com'.

Figure 11: Update profile.

➤ **Change Password**

Press dropdown button  and choose  then



The screenshot shows the same web application window as Figure 11, but the main content area is titled 'Change Password'. It contains three input fields: 'Old Password', 'New Password', and 'Confirm Password'. At the bottom right of the form are 'Save' and 'Cancel' buttons. The dropdown menu in the top right corner still shows 'abc@gmail.com'.

Figure 12: Change password.

3.1.2 Hardware Interfaces (M1)

Software PC is used by supported devices. The software consists of a website where all data is uploaded using web browsers installed on PCs and other gear that allows data to be sent from the server. As a result, we may make a list of the relationships between the software product and the system's physical components.

The software is written as a web application, which is a computer program that performs tasks over the Internet using web browsers and web technology. So, it supports terminals like PC, laptop. The website can be accessed by machines running Windows 7 or later, MacOS, and web browsers such as Chrome, Firefox, and Opera, as long as they are connected to the Internet.

The app does not run on mobile wearable devices such as smart watches, phones.

3.1.3 Software Interfaces (M1)

To start web browsers, terminals such as PCs and laptops require operating systems such as Windows, MacOS, and Linux. Web browsers such Google Chrome, Microsoft Edge, and Firefox are apps that can run on the internet.

Window is the platform on which this website was developed. We've decided on MongoDB as our database of choice.

Development-language: HTML, JS, CSS -> There are several opensource languages that can be used to develop websites.

Development-software: Visual Studio Code -> This is a ERD developed by Microsoft and it very fit with window platform.

3.2 Functional Requirements (P1)

3.2.1 Login page

Users can access the login page. The system will verify the inserted email and password to allow user enter the system.

3.2.2 Register page

Admin add a new user:

- Training staff account by entering details like: Full Name, Email, Age, Address.
- Trainer account by entering details like: Full Name, Email, Specialty, Age and Address.

Training staff add a new user:

- Trainee accounts by entering details like Trainee Name, Trainee Email, Date of birth, Education.

3.2.3 Add, update, delete, view

Users can modify the information of the database. The limit of the modification is based on the user's role. There will be conditions for each individual role to complete its own work.

- **Admin:** create new trainer, edit/delete Trainer account, view Trainer account; create new training staff, edit/delete training staff account, view training staff account.
- **Training staff:** create trainee accounts, update, delete, view trainee accounts information; adding, updating and deleting course categories; adding, updating and deleting courses.
- **Trainer:** view assigned courses, view all trainees.
- **Trainee:** view assigned courses, view all students in the same course.

3.2.4 Searching/ reporting requirements

This section of requirements will determine how users can search courses, course categories, profile.

3.2.5 Database

Storage data of account, staff, trainer, trainee, course category, course, course detail.

3.3 Use Case Model (P1)

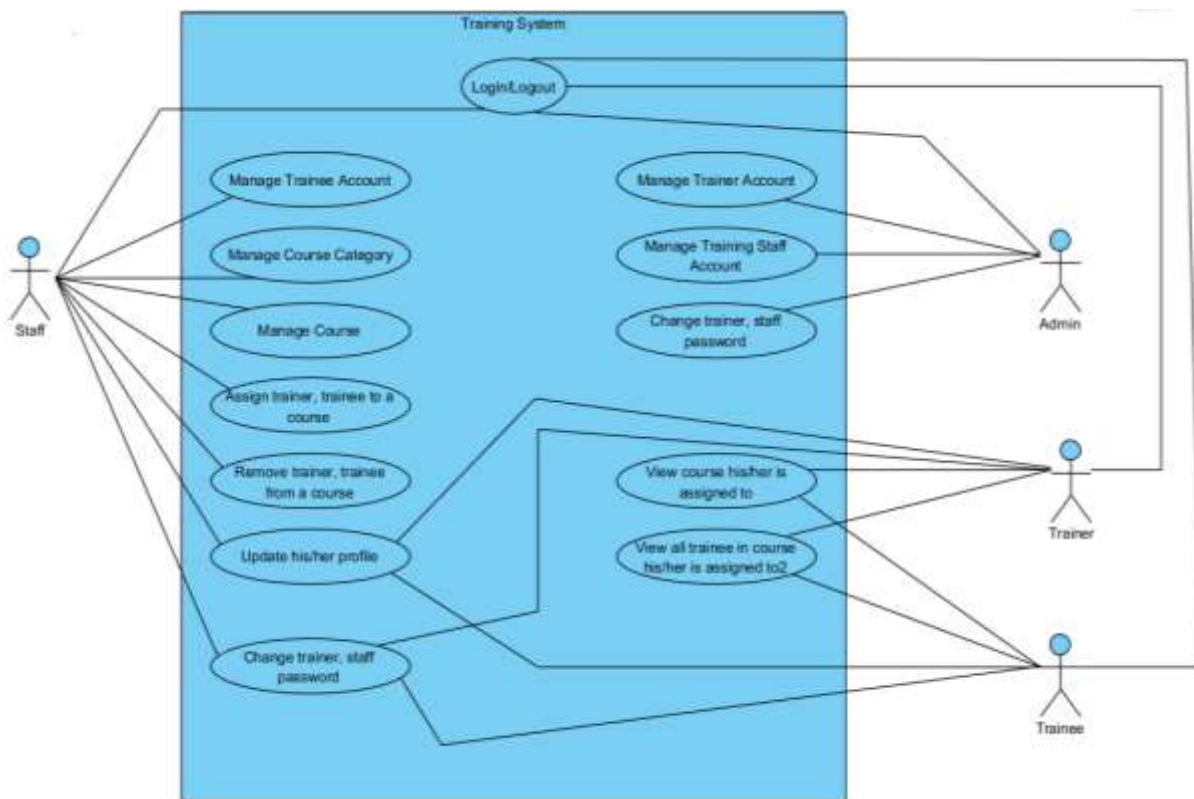


Figure 13: Use case diagram.

Explanation

In the Use Case diagram, the system will include 4 roles: *admin*, *staff*, *trainee* and *trainer*. Each role will have similar and different functions.

The first is the login and logout functionality. All users have these two functions.

To use the system, users need to log in first. Then the system will rely on the user's role to assign functions to the user:

- Admins can view, search, add, edit and delete trainers and staff, create accounts for them and edit password.
- Staff can view, search, add, edit and delete trainee, course category, course. In addition, they also assign and remove a trainer or trainee to a course. They also can update their profile and password.
- Trainer can view course they are assigned to and view all trainee in this course. They also can update their profile and password.
- Trainer can view course they are assigned to and view all trainee in this course. They also can update their profile and password.

3.3.1 Use Case #1

Use Case ID	UC-1.1
Use Case Name	Login
Description	As a user, I must be able to login into the system to use its functions.
Actor(s)	User (Staff, Admin, Trainee, Trainer)
Priority	Must Have
Trigger	The user clicks on the login button.
Pre-Condition(s):	<ul style="list-style-type: none"> The account has been created. The account is authorized. The device is connected to the Internet.
Post-Condition(s):	<ul style="list-style-type: none"> The user logged in successfully. The system records the activity.
Basic Flow	<ol style="list-style-type: none"> The user goes to the login page via URL. The user enters the username and password in the login field. The user presses the login button to send information to the server. The server checks for the login information and give user permission for their account-related action. The server record the action on the activity log.
Alternative Flow	Empty
Exception Flow	<ol style="list-style-type: none"> The system report unsuccessfully login. The user cancels the login or turned off the browser, the user case break.
Business Rules	BR1.1-1: The login function will be postponed for 15 mins after 5 times user enters the wrong name and password.
Non-Functional Requirement	<p>NFR1.1-1: After 120 seconds, the login will be timed out.</p> <p>NFR1.1-2: User passwords must be encrypted during transportation.</p>

3.3.2 Use Case #2

Use Case ID	UC-1.2
Use Case Name	Create Trainee Account/ Course Category
Description	As a staff, I must be able to add the trainee accounts and course category.
Actor(s)	Staff
Priority	Must Have
Trigger	Staff wants to add the trainee account or course category.
Pre-Condition(s):	<ul style="list-style-type: none"> The staff account is created. The staff account is logged. The staff account status is activated. The device must be connected to the system with the Internet or cable.
Post-Condition(s):	<ul style="list-style-type: none"> Information on the course in the database is updated.
Basic Flow	<ol style="list-style-type: none"> The user login as staff. The staff chose management trainee account. The staff presses the add a new trainee button. The staff fill trainee's information. The staff presses the save button. The system will check data. The system saves the trainee information in database.
Alternative Flow	<ol style="list-style-type: none"> 2a. The staff chose management course category. 3a. The staff presses the add a new category button. 4a. The staff fill course category's information. 7a. The system saves the category information in database.
Exception Flow	<ol style="list-style-type: none"> 6a. The system validates invalid data, the system does not save data to the database and displays a message. 7a. The system is down after information is updated, information is reverted to the point before the change.
Business Rules	BR1.1-2: The account is automatically logged out after idling for 30 mins.
Non-Functional Requirement	<p>NFR1.1-1: User passwords must be encrypted during transportation.</p> <p>NFR1.1-2: If the server is down after the modify, revert the system to the previous process with a backup file.</p>

3.3.3 Use Case #3

Use Case ID	UC-1.3
Use Case Name	<i>Edit Trainee Account/ Course Category</i>
Description	<i>As a staff, I must be able to edit the trainee accounts and course category.</i>
Actor(s)	<i>Staff</i>
Priority	<i>Must Have</i>
Trigger	<i>Staff wants to edit the trainee accounts or course category.</i>
Pre-Condition(s):	<ul style="list-style-type: none"> <i>The staff account is created.</i> <i>The staff account is logged.</i> <i>The staff account status is activated.</i> <i>The device must be connected to the system with the Internet or cable.</i>
Post-Condition(s):	<ul style="list-style-type: none"> <i>Information on the course in the database is updated.</i>
Basic Flow	<ol style="list-style-type: none"> <i>The user login as staff.</i> <i>The staff chose management trainee account.</i> <i>The staff presses the edit button in line of the trainee want to edit.</i> <i>The staff change trainee's information.</i> <i>The staff presses the save button.</i> <i>The system will check data.</i> <i>The system saves the trainee information in database.</i>
Alternative Flow	<ol style="list-style-type: none"> <i>2a. The staff chose management course category.</i> <i>3a. The staff presses the edit button in line of the category want to edit.</i> <i>4a. The staff change course category's information.</i> <i>7a. The system saves the category information in database.</i>
Exception Flow	<ol style="list-style-type: none"> <i>6a. The system validates invalid data, the system does not save data to the database and displays a message.</i> <i>7a. The system is down after information is updated, information is reverted to the point before the change.</i>
Business Rules	<i>BR1.1-2: The account is automatically logged out after idling for 30 mins.</i>
Non-Functional Requirement	<i>NFR1.1-1: User passwords must be encrypted during transportation.</i> <i>NFR1.1-2: If the server is down after the modify, revert the system to the previous process with a backup file.</i>

3.3.4 Use Case #4

Use Case ID	UC-1.4
Use Case Name	<i>Delete Trainee Account/ Course Category</i>
Description	<i>As a staff, I must be able to delete the trainee accounts and course category.</i>
Actor(s)	<i>Staff</i>
Priority	<i>Must Have</i>
Trigger	<i>Staff wants to delete the trainee accounts or course category.</i>
Pre-Condition(s):	<ul style="list-style-type: none"> <i>The staff account is created.</i> <i>The staff account is logged.</i> <i>The staff account status is activated.</i> <i>The device must be connected to the system with the Internet or cable.</i>
Post-Condition(s):	<ul style="list-style-type: none"> <i>Information on the course in the database is updated.</i>
Basic Flow	<ol style="list-style-type: none"> <i>The user login as staff.</i> <i>The staff chose management trainee account.</i> <i>The staff presses the delete button in line of the trainee want to edit.</i> <i>The system delete the trainee information in database.</i>
Alternative Flow	<ol style="list-style-type: none"> <i>2a. The staff chose management course category.</i> <i>3a. The staff presses the delete button in line of the category want to edit.</i> <i>4a. The system deletes the category information in database.</i>
Exception Flow	<i>4a. The system is down after information is deleted, information is reverted to the point before the change.</i>
Business Rules	<i>BR1.1-2: The account is automatically logged out after idling for 30 mins.</i>
Non-Functional Requirement	<p><i>NFR1.1-1: User passwords must be encrypted during transportation.</i></p> <p><i>NFR1.1-2: If the server is down after the modify, revert the system to the previous process with a backup file.</i></p>

3.3.5 Use Case #5

Use Case ID	UC-1.5
Use Case Name	<i>Search Trainee Account/ Course Category</i>
Description	<i>As a staff, I must be able to search the trainee accounts and course category.</i>
Actor(s)	<i>Staff</i>
Priority	<i>Must Have</i>
Trigger	<i>Staff wants to search the trainee accounts or course category.</i>
Pre-Condition(s):	<ul style="list-style-type: none"> <i>The staff account is created.</i> <i>The staff account is logged.</i> <i>The staff account status is activated.</i> <i>The device must be connected to the system with the Internet or cable.</i>
Post-Condition(s):	<ul style="list-style-type: none"> <i>Information on the course in the database is updated.</i>
Basic Flow	<ol style="list-style-type: none"> <i>1. The user login as staff.</i> <i>2. The staff chose management trainee account.</i> <i>3. The staff enter key word in the search bar.</i> <i>4. The staff presses the search button.</i> <i>5. The system find information and return it.</i>
Alternative Flow	<i>2a. The staff chose management course category.</i>
Exception Flow	<i>Empty</i>
Business Rules	<i>BR1.1-2: The account is automatically logged out after idling for 30 mins.</i>
Non-Functional Requirement	<i>NFR1.1-1: User passwords must be encrypted during transportation.</i> <i>NFR1.1-2: If the server is down after the modify, revert the system to the previous process with a backup file.</i>

3.3.6 Use Case #6

Use Case ID	UC-1.6
Use Case Name	<i>Update staff's profile</i>
Description	<i>As a staff, I must be able to my profile.</i>
Actor(s)	<i>Staff</i>
Priority	<i>Must Have</i>
Trigger	<i>Staff wants to update profile.</i>
Pre-Condition(s):	<ul style="list-style-type: none"> <i>The staff account is created.</i> <i>The staff account is logged.</i> <i>The staff account status is activated.</i> <i>The device must be connected to the system with the Internet or cable.</i>
Post-Condition(s):	<ul style="list-style-type: none"> <i>Information on the staff in the database is updated.</i>
Basic Flow	<ol style="list-style-type: none"> <i>The user login as staff.</i> <i>The staff change information.</i> <i>The system updates the course category information.</i>
Alternative Flow	<i>Empty</i>
Exception Flow	<i>4a. The system is down after information is updated, information is reverted to the point before the change.</i>
Business Rules	<p><i>BR1.1-1: The login function will be postponed for 15 mins after 5 times user enters the wrong name and password.</i></p> <p><i>BR1.1-2: The account is automatically logged out after idling for 30 mins.</i></p>
Non-Functional Requirement	<p><i>NFR1.1-1: User passwords must be encrypted during transportation.</i></p> <p><i>NFR1.1-2: If the server is down after the modify, revert the system to the previous process with a backup file.</i></p>

3.3.7 Use Case #7

Use Case ID	UC-1.7
Use Case Name	<i>Update staff's account password</i>
Description	<i>As a staff, I must be able to my password.</i>
Actor(s)	<i>Staff</i>
Priority	<i>Must Have</i>
Trigger	<i>Staff wants to update password.</i>
Pre-Condition(s):	<ul style="list-style-type: none"> <i>The staff account is created.</i> <i>The staff account is logged.</i> <i>The staff account status is activated.</i> <i>The device must be connected to the system with the Internet or cable.</i>
Post-Condition(s):	<ul style="list-style-type: none"> <i>Information on the staff in the database is updated.</i>
Basic Flow	<ol style="list-style-type: none"> <i>The user login as staff.</i> <i>The staff change password.</i> <i>The system updates the password.</i>
Alternative Flow	<i>Empty</i>
Exception Flow	<i>4a. The system is down after password is updated, information is reverted to the point before the change.</i>
Business Rules	<p><i>BR1.1-1: The login function will be postponed for 15 mins after 5 times user enters the wrong name and password.</i></p> <p><i>BR1.1-2: The account is automatically logged out after idling for 30 mins.</i></p>
Non-Functional Requirement	<p><i>NFR1.1-1: User passwords must be encrypted during transportation.</i></p> <p><i>NFR1.1-2: If the server is down after the modify, revert the system to the previous process with a backup file.</i></p>

4. Technical Design (M1)

4.1 Sitemap Diagram

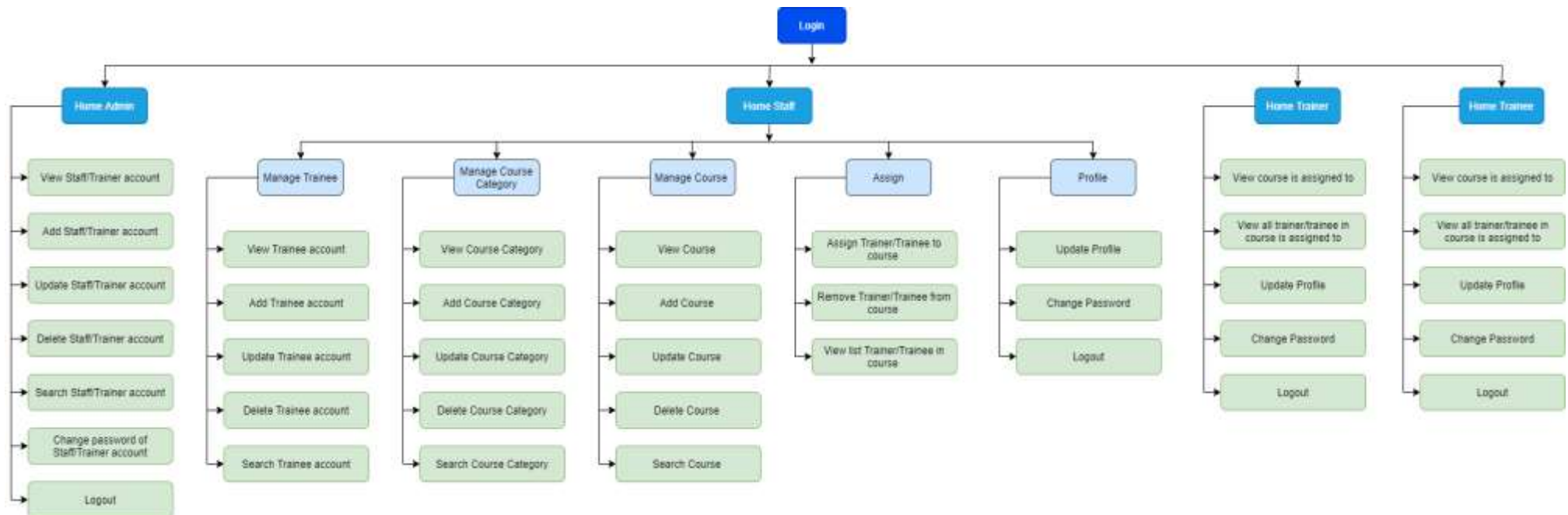


Figure 14: Screen Flow Diagram.

4.2 MongoDB schema design

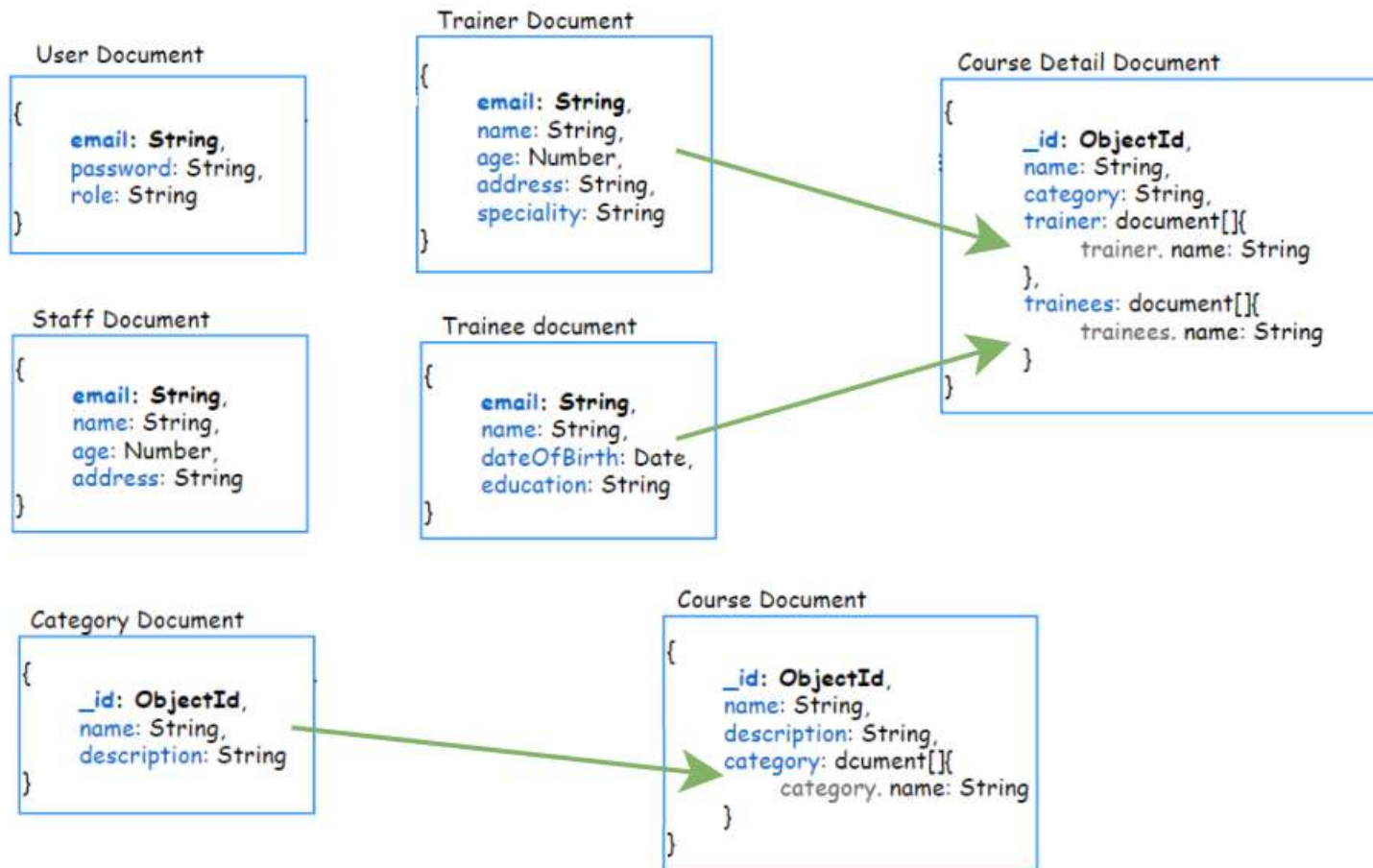


Figure 15: MongoDB schema design.

4.3 Class Diagram

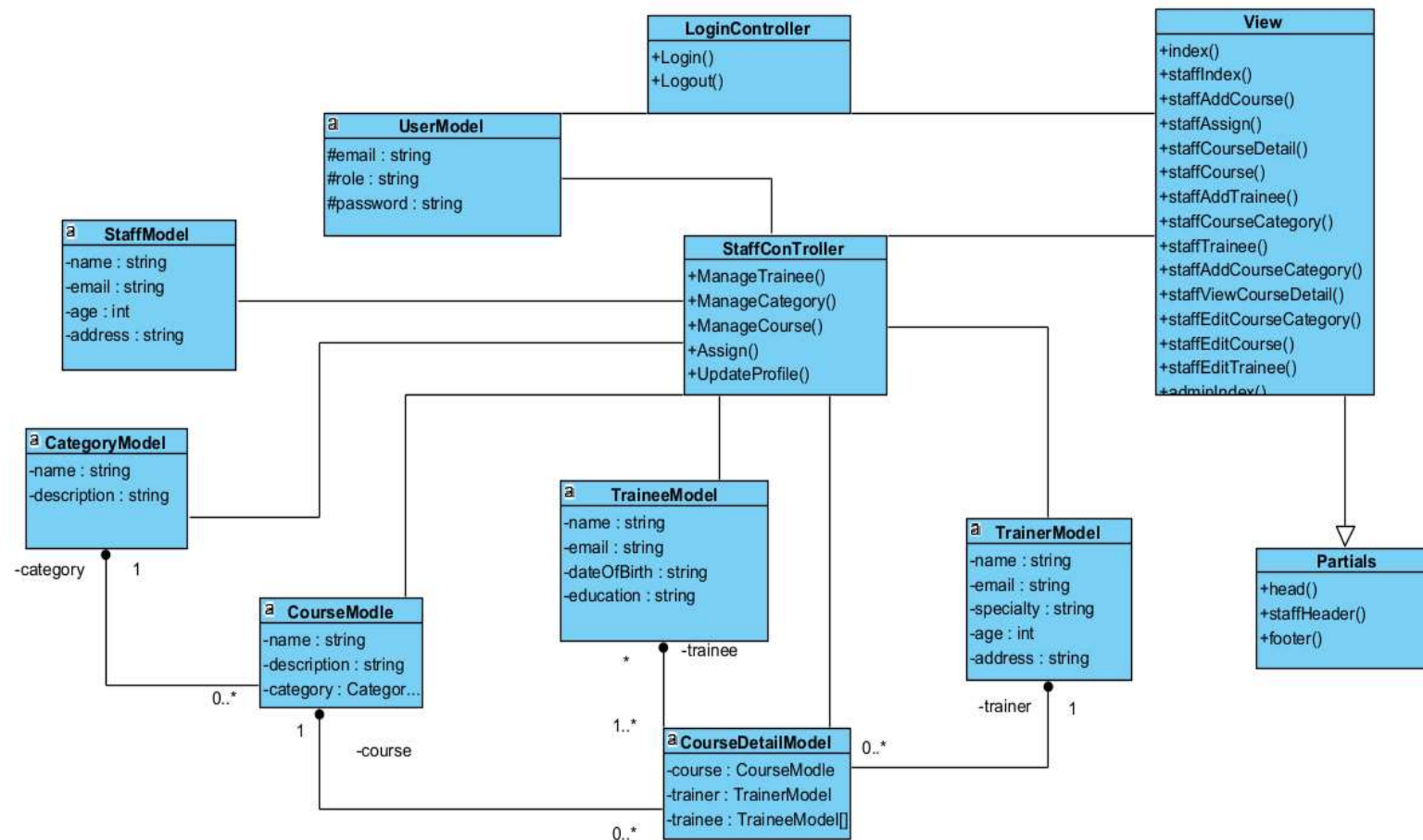


Figure 16: Class Diagram for MVC

4.4 Activity Diagram

4.4.1 Login

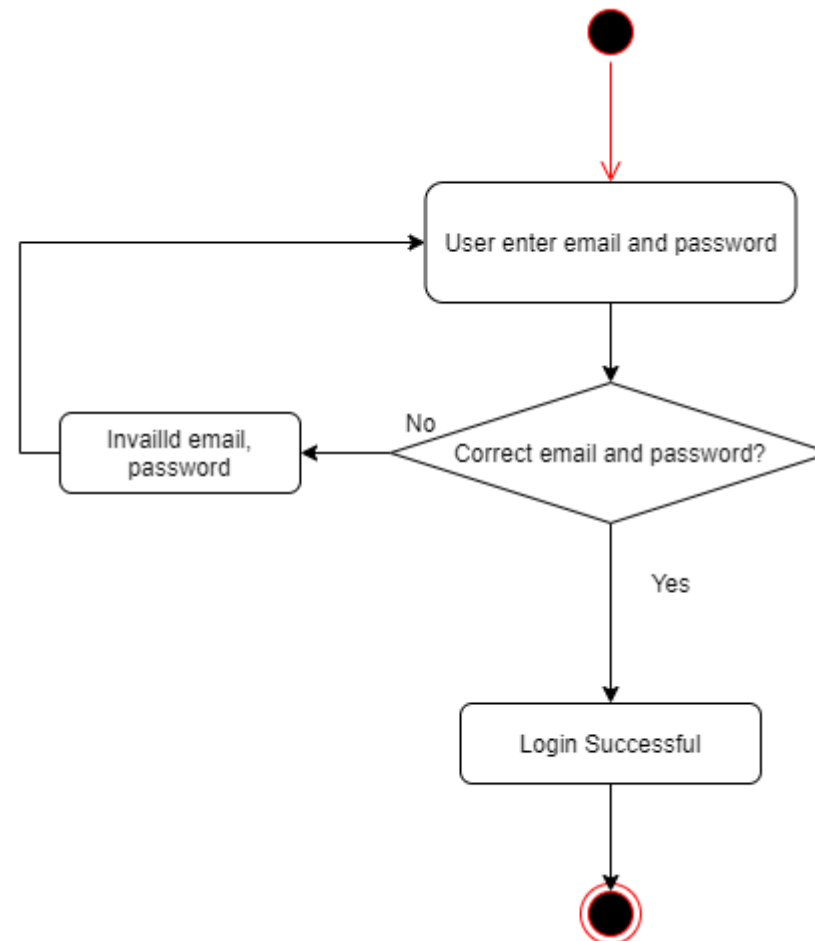


Figure 17: Activity Diagram for Login.

4.4.2 Add Trainee

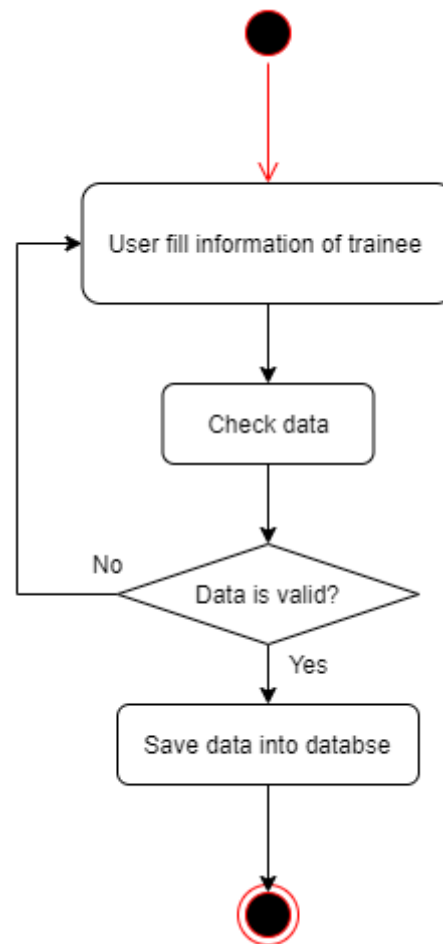


Figure 18: Activity Diagram for Add Trainee.

4.4.3 Add Category

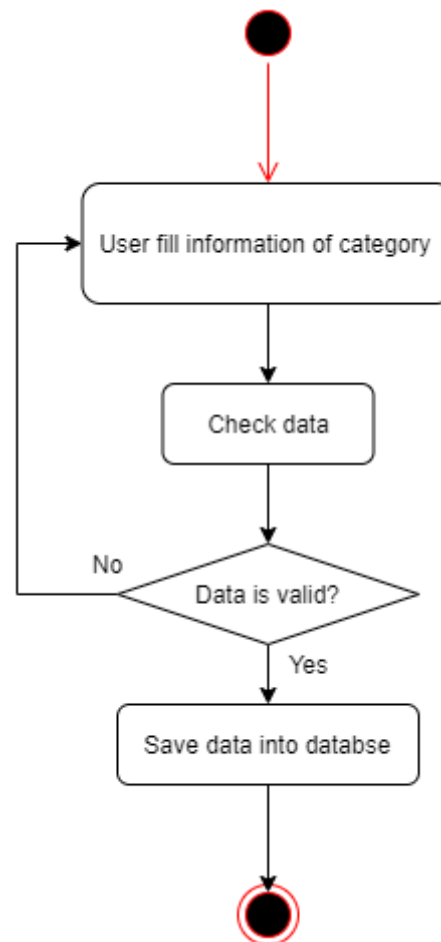


Figure 19: Activity Diagram for Add Category.

4.4.4 Update Trainee

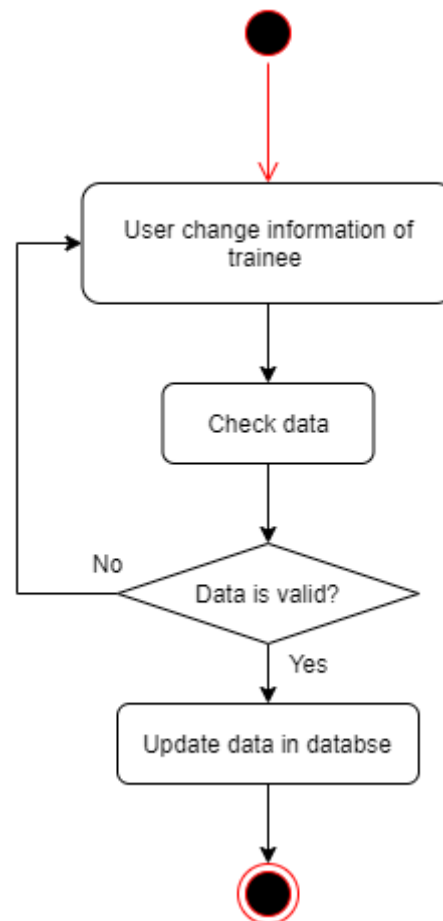


Figure 20: Activity Diagram for Update Trainee.

4.4.5 Update Category

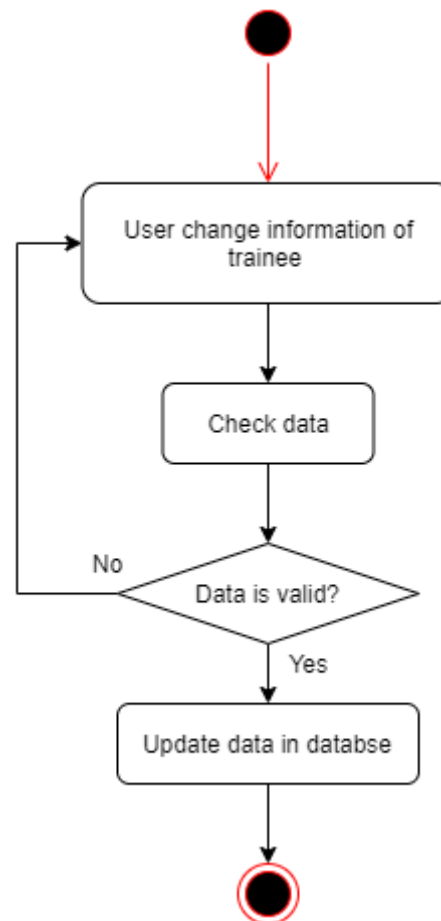


Figure 21: Activity Diagram for Update Category.

4.4.6 Search Trainee

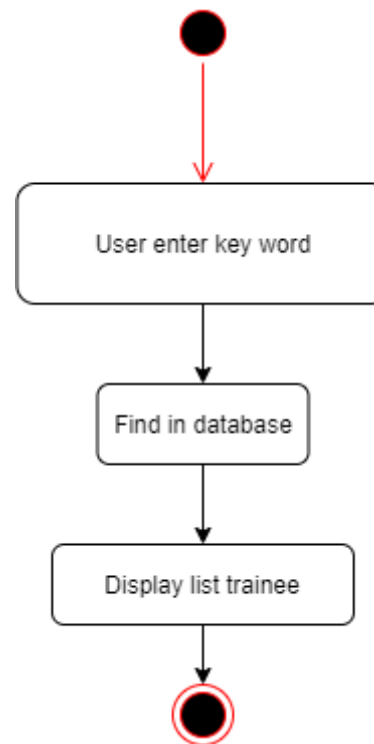


Figure 22: Activity Diagram for Search Trainee.

4.4.7 Search Category

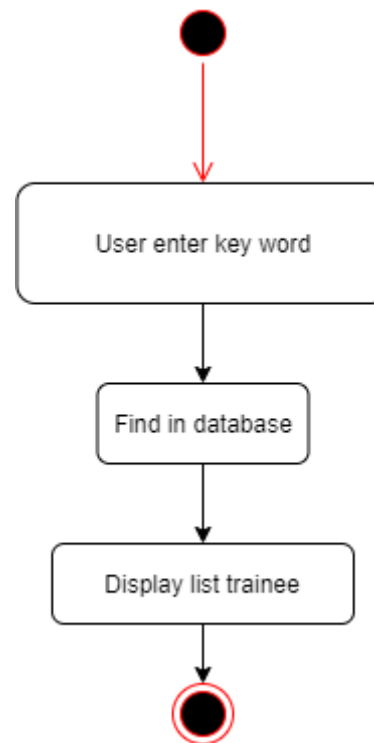


Figure 23:Activity Diagram for Search Category.

4.5 Trello

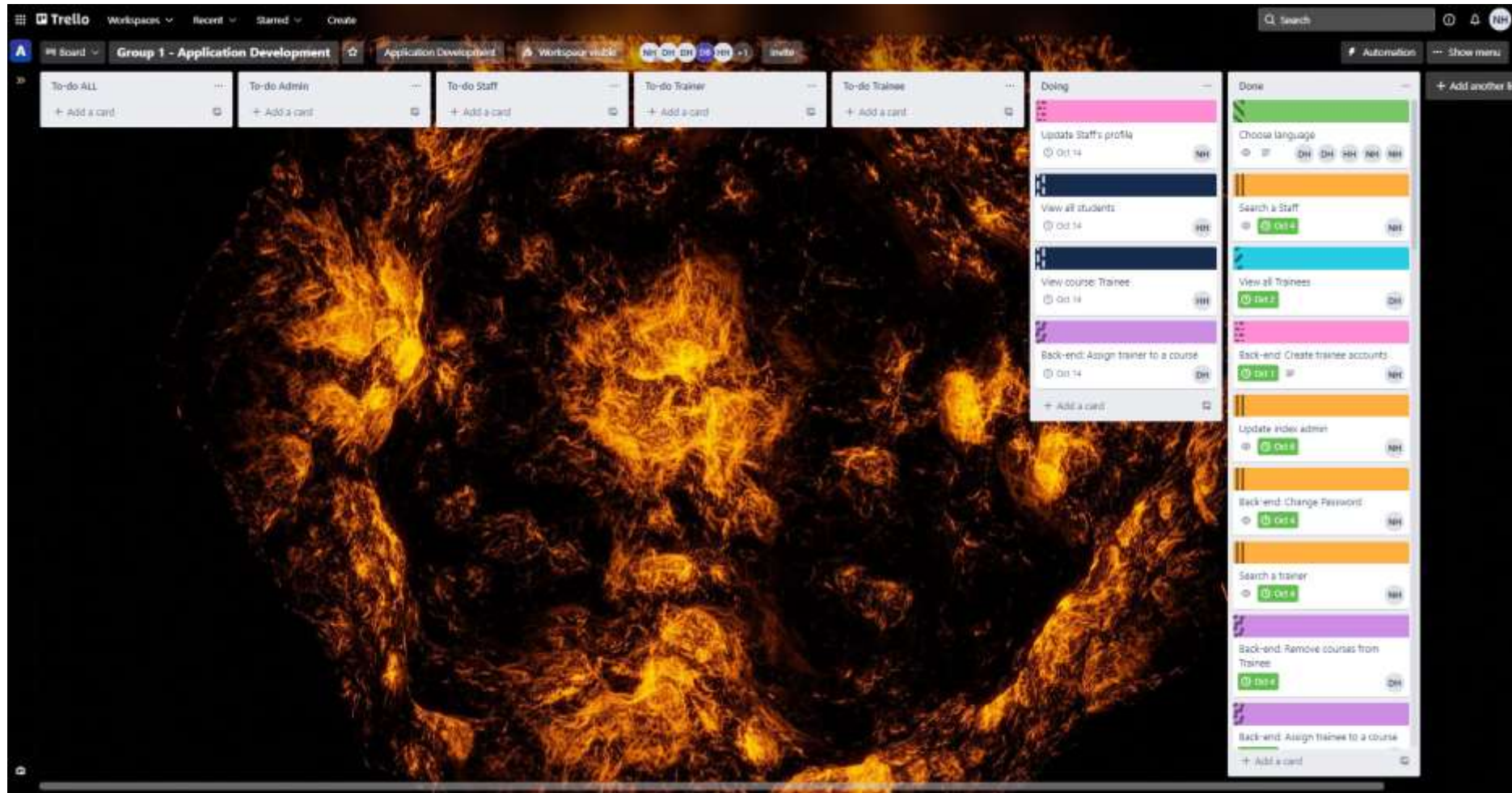


Figure 24: Trello

5. Risk Management (P2)

RISK MANAGEMENT MATRIX

NAME					OBJECTIVE					
REF / ID	PRE-MITIGATION				DEPARTMENT / LOCATION	MITIGATIONS / WARNINGS / REMEDIES	POST-MITIGATION			
	RISK	RISK SEVERITY	RISK LIKELIHOOD	RISK LEVEL			RISK SEVERITY	RISK LIKELIHOOD	RISK LEVEL	ACCEPTABLE TO PROCEED?
		– ACCEPTABLE – TOLERABLE – UNDESIRABLE – INTOLERABLE	– IMPROBABLE – POSSIBLE – PROBABLE	– LOW – MEDIUM – HIGH – EXTREME			– ACCEPTABLE – TOLERABLE – UNDESIRABLE – INTOLERABLE	– IMPROBABLE – POSSIBLE – PROBABLE	– LOW – MEDIUM – HIGH – EXTREME	YES / NO
1	Due to the spread out of COVID, group has to discuss the project indirectly.	Undesirable	Improbable	Medium	Any	The group suggesting contact solution to work and meeting using Google Meeting, Zoom or other meeting apps.	Undesirable	Improbable	Low	Yes
2	Some team members have some difficulties because NodeJS is not their strength programming language.	Intolerable	Possible	Medium	Any	Experienced members can support and guide the other to complete their tasks.	Tolerable	Improbable	Medium	Yes
3	Lack of technical skills, in this project, the team decided to use MVC model to develop the	Tolerable	Possible	Medium	Frontend, Backend, Database	Experienced members can support and guide the other to complete their tasks.	Tolerable	Improbable	Low	Yes

	project. Some members never use this model before.									
4	The user interface design is not suitable for displaying the database's information.	Tolerable	Possible	Medium	Frontend, Database, Designer	The designer has to work with both Frontend and Database departments while designing the website.	Acceptable	Improbable	Low	Yes
5	Team's members get sick because they vaccinated due to Covid19 during working process.	Intolerable	Possible	Medium	Any	Healthy members will support ill member for their tasks if necessary.	Tolerable	Improbable	Low	Yes
6	During work process, group members have many personal works so some meetings and tasks cannot be fulfilled as expected.	Intolerable	Possible	High	Any	Other member should share the work to replace the ill member to complete tasks.	Tolerable	Improbable	Low	Yes
7	Each member has tasks to do while the pandemic spreading out. The team cannot sync their work.	Acceptable	Improbable	High	Any	Using GitHub to manage and source code.	Acceptable	Possible	Low	Yes
8	One of the team members quit during working process.	Intolerable	Possible	High	Any	The whole team has to share the work again and do more tasks than expect.	Tolerable	Improbable	Low	Yes

6. Other Requirements

6.1 UI Requirements

The system is designed in a design style suitable for the environment of FPT company. The interface needs to be easy to see and use. Users can use it themselves after 30 minutes of training.

6.2 Performance Requirements

The performance of the system is important. It has an impact on everyone who uses the system. Following consultation with some FPT education system clients, the following are some system performance requirements:

- Continuity: system performance has an impact on teaching and learning continuity. To ensure continuity, the system must operate continuously and effectively 24 hours a day, seven days a week.
- The system must be light enough to be used with low-tech devices while still being quick enough to provide a good user experience.
- The system's performance should be able to handle 500 concurrent online accounts.
- With each user request, the system response time must be quick (less than 3s).

6.3 Safety and Security Requirements

Every product, every system, has a security risk. Low-security systems can be hacked, causing major problems for companies. System data, such as information regarding courses, trainers, and trainees, is critical information that must be protected in the company.

Security policy:

- Always back-up the data.
- Run a vulnerability scan on website on a regular basis.
- Maintain a current state of affairs.
- Every account's password must be encrypted.
- When the system encounters a problem, it just displays error messages to the user and does not offer error information.
- Only allow internal school accounts to access the system.

III. TASK 2 – TECHNOLOGIES EVALUATION

1. Design Tools

1.1 Tools to design UML

1.1.1 Moqups

Moqups is online tool that enables you to make flowchart, and UML diagrams with minimal effort. It allows you to drag and drop shapes to visualize any flow.

Features:

- Collaborate easily.
- Export diagram to PDF or PNG.
- Easy to share project link with stakeholders.
- Includes numerous shapes and drawing arrows.
- Offers readymade customizable templates.

1.1.2 Draw.IO

Draw.IO is a free online UML tool. It is one of the greatest UML tools available, allowing users to easily create and maintain diagrams. This technology makes a lot of the wide and early share available.

Features:

- There is no limit to the number of sizes.
- Templates are present in software design itself.
- This free UML diagram tool allows you to save the model in your preferred location

1.1.3 Visual Paradigm

Visual Paradigm is a software design tool that is specifically designed for engine software projects. The software development team can use this UML editor tool to model business information systems and development processes.

Features:

- It offers support for BPMN, UML, ERD, DFD, SysML.
- It offers a complete tool like for process analysis, system design, database design, etc.
- Offers user story feature to capture and maintain user's needs.

1.2 Tools to design UI

1.2.1 Draw.IO

In addition to using to draw UML, Draw.IO is also a handy and strong tool for creating wireframes for apps and websites. Draw.io provides basic colors and simple blocks to visualize a wireframe. Users can choose from a library of shapes and elements in the navigation bar. Users just drag and drop elements from the navigation bar to the board, then do anything they want with it.

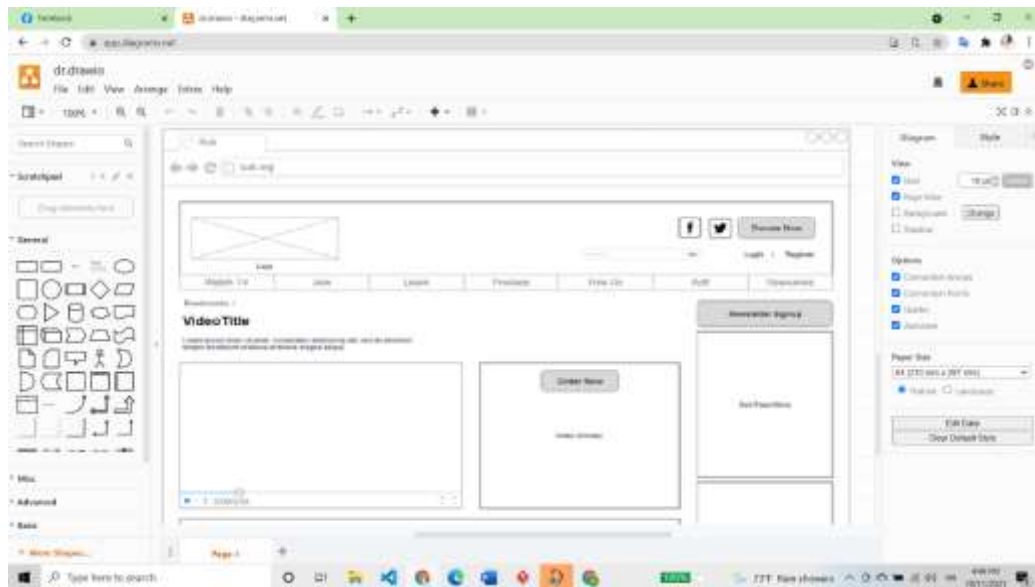


Figure 25: Draw.IO

1.2.2 Visual Paradigm

Wireframe templates abound in Visual Paradigm, allowing users to quickly explain their applications. Users can save time by using the Visual Paradigm's wireframes template.

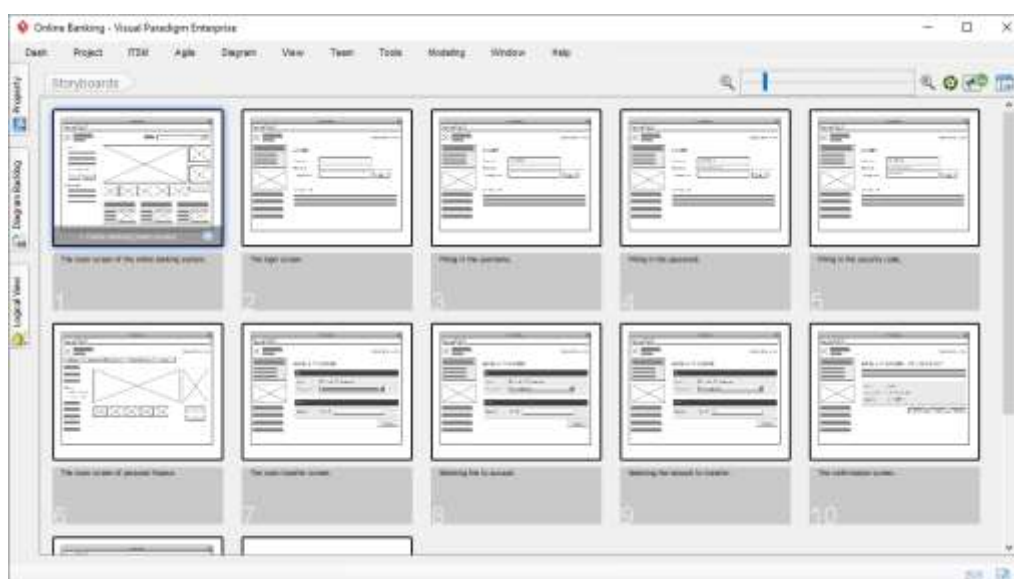


Figure 26: Visual Paradigm

1.3 Team's choice

After discussion, the author and her team decided to choose Visual Paradigm as a tool for design applications for the following reasons:

- The first, Visual Paradigm's user interface is quite friendly and intuitive, and the left navigation bar includes a lot of possibilities. There are numerous templates for each option. The team saves a lot of time with these templates because they can simply update the available templates. The author can quickly design using these templates.
- The second, the author's team wants to use Visual Paradigm because they want to use an application that can both design UML and build wireframes. As a result, the team can easily and logically manage the files.
- The third, Visual Paradigm can be utilized locally as well as on the internet. All of the website's features are still available in the local app. Without an internet connection, the team can still change the diagram and wireframes.
- Additionally, The team members installed Visual Paradigm because they had already learned how to utilize it in the Advanced Programming course and use it in previous projects.
- Next, Visual Paradigm provides the free-trial version.
- Lastly, Visual Paradigm is a powerful tool for creating wireframes for applications because it includes a large number of templates that save time. Draw.io is also a useful tool, but on the other hand, it just offers very basic shapes and components, and no templates, so it wastes a lot of time designing, and the team can't develop elaborate wireframes with it.

2. Front End technology stack

2.1 Programming language

2.1.1 JavaScript

JavaScript is a dynamic computer programming language and very popular in this time. It is also one of the 3 main languages of web programming for client-side. It's a very lightweight script that's commonly used as part of web pages, allowing the client-side script to interact with the user and generate dynamic pages. It's an object-oriented programming language that can be interpreted.

Advantage of JavaScript:

- Easy to learn.
- Works across many browsers and platforms.

- Faster and lighter than other programming languages.
- It has a lot packages and libraries, frameworks.
- It helps websites interact better with visitors.

2.1.2 TypeScript

TypeScript is a variant of JavaScript, which has been the most popular programming language for many years. TypeScript is designed for the building of large, complex applications. TypeScript is a static language (Static typed), which means it is strict and orderly as opposed to free type. It inherits many concepts from Java and C#. It also includes an object-oriented class not found in JavaScript. TypeScript inherits most of the advantages of JavaScript, but it also provides benefits such as static typing and other TS-specific concepts. They're particularly useful when working with large codebases and distributed teams on the same project (Finnegan, 2019).

Advantage of TypeScript:

- Larger projects are easier to develop due to the help of major JavaScript frameworks.
- Typescript implements most object-oriented syntaxes, such as inheritance, encapsulation, constructor, abstract, interface, implement, override, and so on.
- Organizations can achieve organization, support for modular code system architecture, and namespace support, making it easier to develop complex systems in which several developers may cooperate.
- Compatibility with the most recent JavaScript features. TypeScript always makes advantage of the most up-to-date JavaScript techniques.
- Another benefit of Typescript is that it is open-source, which means it is free and has a large community of users.

2.2 HTML/CSS

HTML, or Hypertext Markup Language, is the most popularly used language for creating Web pages. HTML uses tags to markup text documents, as the name implies. HTML was created to define a document's structure, such as lists, titles, and other sections, so that user can easily find and read information shared among themselves. HTML has become an important language for formatting web pages with the various tags available as the Internet has grown. HTML can be called to as the "skeleton" of a website (Point, 2015).

CSS stands for Cascading Style Sheets with an emphasis placed on “Style”. It is the language for describing the presentation of Web pages, including colors, layout, and fonts. It allows one to adapt the presentation to different types of devices, such as large screens, small screens, or printers. CSS is independent of HTML and can be used with any XML-based markup language. If HTML is the skeleton, CSS is the aesthetic choice and beautifies it.

Advantage of HTML and CSS:

- Easy to learn and use.
- Supported by all browsers
- Very lightweight.
- Simple to Edit.
- They can integrate easily with other languages.
- They are the friendliest search engine.

2.3 JavaScript Library

One of the most popular JavaScript libraries is jQuery. It makes things simpler for JavaScript to modify the DOM. Because of its simple syntax and easy learning process, a new generation of client-side developers has evolved. It may be said that jQuery is especially useful in website development because it is cross-browser compatible. The web developer's work with jQuery has been substantially reduced as a result of the appearance of jQuery plugins such as Image Slider and Pop-up Boxes. jQuery is often regarded as the best choice for creating strong, cross-browser compatible websites. The popularity of jQuery is due to its key features, which include CSS-based DOM manipulation, event handling, and AJAX requests (Deering, 2010).

Advantage of jQuery:

- Easy to use and understand
- jQuery does not require highly skilled developers, so it is suitable for beginners
- jQuery is quite fast, simple
- jQuery optimized for SEO, small in size, search bots can read jQuery content on search pages.
- There are many support plugins

2.4 CSS Framework

Bootstrap is a powerful toolkit that contains HTML, CSS, and JavaScript tools for creating and developing web pages and apps. It is a free and open-source project that was built by (and for) Twitter and is hosted on GitHub. Bootstrap quickly grown in popularity after its debut in 2011, because to its flexibility and ease of use. With Bootstrap, web developers can focus on development instead of design, allowing them to easily get a good-looking website up and running. On the other side, it provides a solid basis for web designers to create interesting Bootstrap themes.

Advantage of Bootstrap:

- It is responsive by design.
- It maintains wide browser compatibility.
- It offers consistent design by using re-usable components.
- Easy to use and quick to learn.
- Can be used with any IDE or editor, and any server-side technology and language.

2.5 Team's choice

After discussion, JavaScript was chosen as the main programming language by the team. Because, they has experience for develop software with JavaScript. Initially, the team wanted to try to use TypeScript because it is a more advanced version of JavaScript that is designed to offer more convenient functions while improving on JavaScript's faults. However, after several failed attempts to learn TypeScript's syntax and code, as well as the group's previous experience with JavaScript, the team decided to stay with JavaScript. The team utilized JavaScript to create functions in the project, as well as event handlers like onClick,... The team, on the other hand, will continue to study TypeScript in the future and will apply it in future projects.

The team then chose to build the website's front end using HTML/CSS and Bootstrap. The team can create the app faster thanks to Bootstrap. Because the team has a basic understanding of HTML, CSS, and JavaScript, Bootstrap is a simple to use, with a variety of templates, themes, and tools to get them started developing the app. Furthermore, the team used a little CSS to adapt the templates to fit the application's requirements.

The team decided to use jQuery, a JavaScript framework, to enable HTML page browsing, event handling, and animation simpler. The team used jQuery to create the slideshow and Event Handlers to handle various events without having to spend time with HTML code.

3. Back End technology stack

3.1 Programming language

3.1.1 Node.js

Node.js is a framework based on Chrome's JavaScript engine that makes it easy to develop fast and scalable network applications. With an event-driven, non-blocking I/O architecture, Node.js makes it lightweight and flexible, making it ideal for real-time systems that use a lot of data and run on distributed computers.

Advantage of Node.js:

- Because of the asynchronous processing mechanism, it has a fast processing speed (non-blocking).
- Makes it simple to extend when you need to develop a website.
- With a single thread, receive and handle multiple connections. As a consequence, the processing system will use the least amount of RAM feasible, enabling Node.js processing more faster.
- Able to handle several requests at once in the shortest amount of time.

3.1.2 .NET

The .NET Architecture, according to NGWS, is a Microsoft software development tool introduced in the late 1990s. On February 13, 2002, Microsoft published the first version of the .NET Framework, known as .NET Framework 1.0.0 (tutorialspoint, 2020).

It's a virtual machine that provides a general platform for executing the application developed in a number of languages, including C#, VB.NET, Visual Basic, and others. It's also used to build a form-based, console-based, electronic, or web-based application or utility that runs in the Microsoft environment. The .NET framework, which is similar to the Java language, is a pure object-oriented framework. However, unlike Java, it is not an identity platform (tutorialspoint, 2020).

Advantage of Node.js:

- .NET is based on an Object-Oriented Module for Programming.

- Design of cross-platforms(Windows, Linux, OSx, Mac ...)
- Flexible deployment and easy maintenance
- .NET Core serves a wide range of applications.
- .NET Core Makes for Top App Output
- Cost-Effective, Large Society

3.2 Operating System

The website is designed to run well on the platforms of Windows and macOS operating systems.

3.3 Database

3.3.1 MySQL

MySQL is a cheap, easy-to-use RDBMS that many big and small corporation's use. MySQL is produced, sold, and sponsored by a Swedish corporation named MySQL AB. MySQL is a very efficient program. It manages the most efficient and expensive database packages with a wide usable subset. It runs on various operating systems and in many languages, including PHP, PERL, C , C++ , JAVA, etc. And with huge data sets, MySQL is very fast and performs well. MySQL, the highest ranked language for web creation, is very PHP friendly (tutorialspoint, 2021).

Advantage of MySQL:

- Simple to use: MySQL is a fast and stable database that runs on a variety of operating systems. It has a large number of useful features.
- High security: MySQL is well suited for applications that access databases through the internet because it provides a variety of security features, including high-level security.
- Multi-featured: MySQL may be used to support a wide range of SQL functions in both direct and indirect relational database management systems.
- Scalable and powerful: The MySQL engine can scale up and down to handle large amounts of data.
- Cross-OS compatibility: MySQL works with a range of operating systems, including Windows, Linux, and Mac OS X. Clients of MySQL can run on the same or other computers as the server (communicating over a local area network or the Internet).
- Allow transaction rollback: Transactions in MySQL may be rolled back, committed, and crash-recovered.

3.3.2 MongoDB

MongoDB is a text-oriented database system. This means that it stores its data in JSON-like document sets rather than tables and rows. Because such papers enable embedded fields, similar data may be stored within them. It's also a schema-less database, which means we don't have to define the number or format of columns before entering our data. MongoDB is a NoSQL database that stores data as key-value pairs. It is an open-source document database that provides high performance and scalability in enterprise applications, as well as data modeling and data management of huge datasets. An Auto-Scaling function is also supported by MongoDB. Since MongoDB is a cross-platform database that can be set up on multiple platforms, such as Windows, Linux, etc (M, 2020).

Advantage of MongoDB:

- Database Flexibility: MongoDB is a schema-less database. As a result, users may save any type of information in a separate document. This feature provides users with the flexibility and freedom to store data of various types.
- Sharding: Sharding allows users to store large amounts of data by distributing it over several servers connected to the application. There will be no failure condition if a server is unable to manage such large amounts of data. "Auto-sharding" is a word that can be used here.
- High-speed: MongoDB is a document-oriented database, therefore it's fast. Indexing makes it easy to find documents. As a result, it answers all queries quickly. MongoDB is 100 times quicker than traditional relational databases.
- High Availability: MongoDB has replication and gridFS features. These features contribute to MongoDB's increased data availability. As a result, the performance is excellent.
- Scalability: MongoDB has the benefit of being a horizontally scalable database. When working with large amounts of data, users might divide it across many machines.
- Full Technical Assistance: MongoDB Inc. provides complete technical support to its clients. Users can contact a MongoDB client support system directly if they have any problems.

3.4 Hosting

There are several hosting options available now, including Firebase, Azure, Heroku, and others. According to Middleton and Schneemann (2014), Heroku is a platform-as-a-service (PaaS) based on a managed container system for building, running, and managing modern apps in the cloud. Its platform is highly flexible and user-friendly, making it the simplest way for developers to get their apps to

market. To deploy apps on Heroku, for example, you just need to know a few Heroku CLI and Dashboard commands. The documentation for these commands is accessible on Heroku. With experience working with Heroku on previous projects, the team decided to use Heroku in this project.

3.5 Frameworks

3.5.1 MVC

MVC is the design pattern used in software engineering. It is an acronym for 3 words Model – View – Controller. Simply put, MVC will divide the source code into 3 parts, corresponding to each word. Each word corresponds to a separate activity in a pattern.

- **Model:** The part that stores all the data of the application. This part is a bridge between the two components below, View and Controller.
- **View:** This is the user interface (theme). Where users can get information about data of MVC through query operations such as searching or using through websites.
- **Controller:** The department is responsible for handling user requests made through the view. From there, Controller gives the right data to the user. Besides, the Controller also has the function of connecting to the model.

3.5.2 Express

Express.js is a popular JavaScript framework for backend development. Its major application is in the creation of Restful APIs that take requests from the frontend and respond appropriately. Actually, Express.js is a JavaScript library that allows users to create a backend. To begin, create an NPM project, install the Express package, and construct models, routes, and other components. A simple backend server is now accessible (Chris, 2020).

Express.js can reduce coding time in half while also still enabling us to create effective online apps. With the help of its many features, it not only reduces the time but also the work required to develop web apps. JavaScript is another incentive to utilize Express.js. Because it supports JavaScript, Express.js allows even novices to enter the area of web application development. JavaScript is a very simple language to learn, especially if you have no previous experience with other languages. As a result, Express.js enables novices to enter the area of web app development and succeed. Since Express.js is an open-source and free web application that provides many great features, there is no reason left to not use it (Chris, 2020).

3.6 Team's choice

After discussion, the author's team decided to choose the programming Node.js due to the following reasons:

- The team learned the basics of Node.js in the Cloud Computing class last semester. This will save the team a significant amount of time in learning and finish the task.
- Because it can maintain a continuous connection to the server while employing the high-speed V8 engine, Node.js is thought to be much faster than PHP. Because Node.js is an asynchronous language, it may utilize event handler to handle many requests at the same time.
- Because the system used the same JavaScript language, the team chose Node.js.

Then, the team decided to use MongoDB because:

- When compared to MySQL, MongoDB's ability to grow effectively is one of its greatest strengths. MongoDB provides flexible data models, allowing the database schema to adapt to changing business requirements. MySQL, on the other hand, has a rigid structure that requires extensive technical effort in order to scale.
- Because they utilize MongoDB Atlas for Database as a Service (DBaaS) for cloud adoption, the team does not have to worry about database management.
- It integrates nicely with Mongoose, allowing teams to do database-related activities more quickly.

For framework, the team chose Express and MVC because:

- According to the Stateofjs (2019) survey, Express has consistently scored top in client satisfaction in recent years. This showed and proved the popularity of Express's capabilities and utility. Furthermore, the author chose the Express because it is suitable for the project and what the team has learned before to studying this class. The author's group learned about Node.js and how to install and utilize Express during the previous semester. It helps team spend time developing the application. Moreover, Express is JavaScript compatible, flexible and can connect to any sort of database such as MySQL, MongoDB, or PostgreSQL, and choose from a variety of views such as pug, ejs, handlebars, mustache, and more. This allows the team to choose from a variety of options that are appropriate for the project.
- Applying the MVC model will help the team easily check and check software errors before reaching consumers, ensuring higher quality and credibility. Especially when working in groups, code files are exchanged between members. What's more, MVC doesn't use viewstate, so it

saves bandwidth. When used, users can use web applications that need to interact to send and receive data continuously. Therefore, reducing bandwidth makes the website work better and more stable.

4. Tools for source control management

The team used GitHub to make it easier to control the work and manage the project. Because it provides a repository of Git source code for projects, the team chose GitHub. Moreover, GitHub has all of Git's features as well as social features that allow team members to communicate and interact. GitHub, in particular, can synchronize the team's source code to a server and also has the ability to verify the source code while working. GitHub was chosen by the team because of these capabilities.

5. Software Development Models

5.1 Waterfall

Royce initially launched the waterfall model in 1970. It works in a sequential, step-by-step manner, with each stage needing to be completed before moving on to the next. After completing all the stages, there will be no turning back (Dennis, 2014).

Advantages of Waterfall:

- Easy for usage and manage the process
- All of requirements are set first so it makes it easier to do the project
- Suitable for big projects when everything needs to be point out first

5.2 Scrum

Scrum is a method for managing product development and other types of knowledge work. Scrum is empirical in that it allows a team to develop a hypothesis about how they think something works, test it, reflect on the findings, and make necessary adjustments. The Scrum model's whole framework is controlled by the team. It focuses on individuals working together as part of a team to achieve a good end result, rather than on individuals working individually.

Usually, a scrum team comprises of three main roles:

- Product Owner – ensures the end user is engaged in the product.
- Scrum Master – manages the proper implementation of Scrum process in the team and coordinates the entire process.

- Development Team – self-organizing and cross-functional units responsible for the execution of tasks and aiming at a solid final result.

Advantages of Waterfall:

- The deadline is flexible.
- Fast development saves time. Produces high-quality outcomes.
- Increased productivity and accuracy.
- Bugs and issues are identified early on. As a result, you'll be able to solve it fast.
- Good product quality and cheap cost, as well as reduced manufacturing risk.

5.3 Team's choice

The teacher always wants to check the work progress and wants the team to offer other tasks during development, so after evaluating all of the SDLC models above, the author decided that the scrum is the best fit.

First, the author's team split the work into tiny tasks (as per the requirements), grouped them on Trello, and set specific deadlines to each task. This allows both the author and the teacher to keep track of the group's development and offer any necessary warnings. Moreover, breaking down tasks helps team members in understanding and effectively completing their tasks.

Second, the team comes time aside on a regular basis to meet and discuss the project. The group was unable to meet face-to-face due to the complicated evolution of the COVID-19 epidemic. The team, on the other hand, has moved to Google Meetings. The team meets regularly in the evenings on weekdays for members to report on work progress as well as difficulties encountered, so that all team members know of and can work together to correct mistakes. As a result, the project's quality will be clear to the team leader.

Finally, because this is a small team of only five people, managing and assigning work is easier than with a bigger number. Regular meetings will not be boring because the group regularly addresses issues faced while working on projects and exchanges information about projects.

Reference

Chris, S., 2020. *Techomoro*. [Online]

Available at: <https://www.techomoro.com/what-are-the-benefits-of-using-express-js-for-backend-development/> [Accessed 2021].

Deering, S., 2010. *Benefits of jQuery*. [Online]

Available at: <https://www.sitepoint.com/benefits-jquery/> [Accessed 2021].

Dennis, A., 2014. *Systems Analysis and Design*. In: 6th, ed. Systems Analysis and Design.. s.l.:s.n.

Finnegan, C., 2019. [Online]

Available at: <https://medium.com/swlh/the-major-benefits-of-using-typescript-aa8553f5e2ed> [Accessed 2021].

M, M., 2020. <https://www.sitepoint.com>. [Online]

Available at: <https://www.sitepoint.com/an-introduction-to-mongodb/> [Accessed 2021].

Middleton, N., Schneeman, R., 2014. *Heroku: Up and Running*. In: Heroku: Up and Running. s.l.:O'Reilly Media.

Point, T., 2015. HTML. [Online]

Available at: https://www.tutorialspoint.com/html/html_tutorial.pdf [Accessed 2021].

Stateofjs, 2019. *Stateofjs*. [Online]

Available at: <https://2019.stateofjs.com/back-end/> [Accessed 2021].

tutorialspoint, 2021. <https://www.tutorialspoint.com>. [Online]

Available at: <https://www.tutorialspoint.com/mysql/mysql-introduction.htm> [Accessed 2021]