ASSIGNMENT 1 FRONT SHEET

Qualification	**BTEC Level 5 HND Diploma in Business**		
Unit number and title	**Unit 30: Application Development**		
Submission date		**Date Received 1st submission**	
Re-submission Date		**Date Received 2nd submission**	
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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

Table of Figure

List of tables

Software Requirements Specification

for

FPT Co. Application

Version 1.0

Prepared by

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Course: Application Development

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1. Revisions

Version	Primary Author(s)	Description of Version	Date Completed
1.0	Nguyen Thanh Hung	Initialize the document.	30/09/2021

Table 1. Revision.

2. Introduction

2.1. Document purpose

The purpose of this document is to clearly explain as well as present all the functions and design of the system. This document describes how to use the management system, in order to make it easy for users including admin, staff, trainer and trainee. In addition, the document also provides specifications on how the system works, diagrams, and constraints to help later developers easily access and develop the system.

2.2. Product Scope

To build a management and training website for FPT Co. Users accounts, manage trainers, control course categories, manage courses, assign courses to trainers/trainees... are several of the major features and duties given by the team. In conclusion, this system is utilized solely for FPT Education, and FPT Company workers can use it as trainers, trainers, trainees, and system administrators.

2.3. Intended audience and document overview

2.3.1. Intended Audience

In the early stages of developing this project, the intended audience is an academic environment, specifically the University of Greenwich. The project was constructed and completed step by step with the mentor's guidance. As the author indicated above, this solution is particularly valuable for administrators, employees, trainers/teachers, and trainees/students in a university environment. There are three types of objects in this document: user, developer, and mentor/professor.

Object	Description
User	This document was used by admin, staff, trainers, trainer of FPT Co. in general and

	University of Greenwich in particular. To use product and understand features inside, they make sure that this document is helpful in detail for each task
Developer	This document was used by developers of project. They have to read and 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	Actually, they are who understand and got large experience in building a project. Therefore, they will give instructions, suggestions that are very import for improve product

Table 2. Describe about roles

2.3.2. Document Overview

In general, the document will cover some domains such as the personality features of the project's user, device hardware, product data, and functional specifications. The author will present and discuss in full below.

Each function and task in the project, in particular, will have its own task. As a result, the writer will offer and explore them in detail below as functional requirements and assumptions made while creating the project's HR administration website. The author also discusses and provides the product needs, as well as the requirements for external interfaces.

Directions for reading document:

- Must be officer, employee or student of FPT education system.
- Reading document step by step and note them then research more if hard to understand.
- No copy or bring out document out of organization.

2.4. Definitions, Acronyms and Abbreviations

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

Acronyms	Meaning	Definition
ERD	Entities Relationship Diagram	The relationships of entity set stored in a

		database
MongoDB	MongoDB	A distributed database built for modern application developers and for the cloud era
NodeJS	NodeJS	As an asynchronous event-driven JavaScript runtime, NodeJS is designed to build scalable network applications
Bootstrap	Bootstrap	Bootstrap is the most popular CSS Framework for developing responsive and mobile-first websites
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
Use case diagram	Use case diagram	A technique used to describe the functional requirements
Class diagram	Class diagram	A class diagram is a type of static structure diagram that describes the structure of a system by showing the system's classes, their attributes, operations (or methods), and the relationships among objects
MVC	Model-View-Controller	A software design pattern commonly used for developing user interfaces that divide the related program logic into three interconnected elements

Table 3. Definitions, Acronyms

2.5. Document conventions

In this document, the author's team 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.

2.6. References and Acknowledgments

The author's team had built some application website the same as this project, and the team got enough experience to implement. Therefore, the team don't use any documents or web address.

3. Overall Description

3.1. Product Overview

This system is the application which helps staff and administrators to manage accounts, trainees, and courses easily. Moreover, the application applied the top-notch technology to match with the requirements documentation and user's needs. It will decentralize based on their roles to allow them do their tasks.

3.2. Product Functionality

The system is used by HR department, which has 4 roles in this system, an administrator, training staff, a trainer and a trainee:

- **Admins**: Admin can manage the training staff/ trainer accounts (add, edit, search, delete, update, view).
- **Training staff**: Training staff can manage the course category, courses, and the profile of trainees/staff. The tasks include (add, update, view, delete, search, edit, etc.)
- **Trainer**: Trainer can update his (or her) profile; view courses which he (or she) is assigned to; view all Trainees who enroll his/ her course.
- **Trainee**: trainer can view his/her profile; can view courses which s/he is assigned to; view all students who enroll the same course that Trainee enrolls to.

In terms of the author, he covers the **admin** functionality.

3.3. Design and Implementation Constraints

3.3.1. Hardware design constraints

The hardware system of the project meets the system requirements, as a minimum:

- Microsoft Window 8 or higher.
- X86 Dual Core Professor or higher.
- Minimum 2GB RAM.
- Minimum 5GB free space.

3.3.2. Software constraints

The software system for the team's 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.

3.4. Assumption and Dependencies

Some of the current version of MongoDB, HTML, NodeJS, or Express.js might not be supported on several outdated web browsers. This leads to the website cannot run properly, or cannot display the expected user interface. As a result, the initial assumption is that the machine hosting the website will be able to operate and utilize the most recent version of the most popular internet browser. Another assumption is that the machine hosting the website has a display capable of displaying the website's user-friendly interface. A computer with an old-fashioned 3x4 screen, for example, may present unfavorable results for the user, resulting in the website's original shape being lost.

The site is reliant on the following for dependencies:

Database MongoDB: MongoDB is a source-available cross-platform document-oriented database program. Classified as a NoSQL database program, MongoDB uses JSON-like documents with optional schemas. MongoDB is developed by MongoDB Inc. and licensed under the Server-Side Public License (SSPL).

Backend NodeJS: It is a software platform for building expandable internet applications, especially web servers. It is presently free to use when combined with Visual Studio Code. Make it an excellent project option as well. It is uncertain whether the framework will stay free in the future, despite the fact that it is building several Fundamentals Courses to earn more income.

HTML for User Interfaces: HTML is a markup language that is used to build UI for websites. It is a safe bet for a website's user interface because it is well-known and utilized on a lot of well-known websites. Furthermore, if consumers wish to provide a pleasant user experience, HTML, also known as Front-end, will be generated from this point based on consumer experiences, and UX/UI is a different problem. The topic need polishing, and the greatest time to do it is when the product is still in the hands of the customer.

GitHub: The application was developed by a five-person team, but due to current world conditions, which include a Covid 19 epidemic, the team will be unable to meet face-to-face. As a result, engineers will be able to use GitHub as a software collaboration platform for project development to exchange and integrate code. Furthermore, GitHub makes it much easier for everyone on the team to exchange, modify, and publish code, significantly improving the team's experience over that of other similar applications. As a consequence, GitHub is an indispensable part of the project's success.

4. Specific Requirements

4.1. External Interface Requirements

4.1.1. User Interface

In this part, the author will cover the interfaces of admin.

Figure 1. Login page

Login page is shared for all users. The layout is simple and effective.

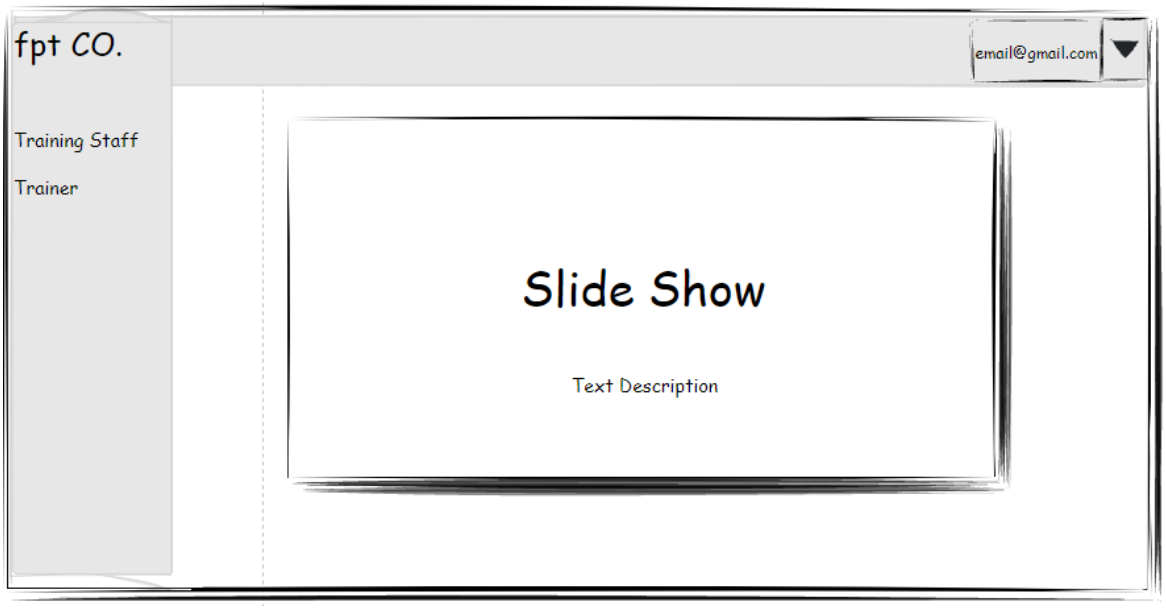

Figure 2. Admin index

This is the admin index. The author has to make the user feel most comfortable. For admin interface convenience and ease of use (UX) must put on top. So, he decided to have more navigation bars to be able to arrange more convenient functions for users. Here, he used a slideshow to show the information about the university.

Admin view staff, view trainer, and search have the same design because only user stats are statistical so the only difference of these pages is its parameters. The main content component of these pages is the statistics table of the number of users and its information

Figure 3. Admin view staff account

Figure 4. Admin View Trainer

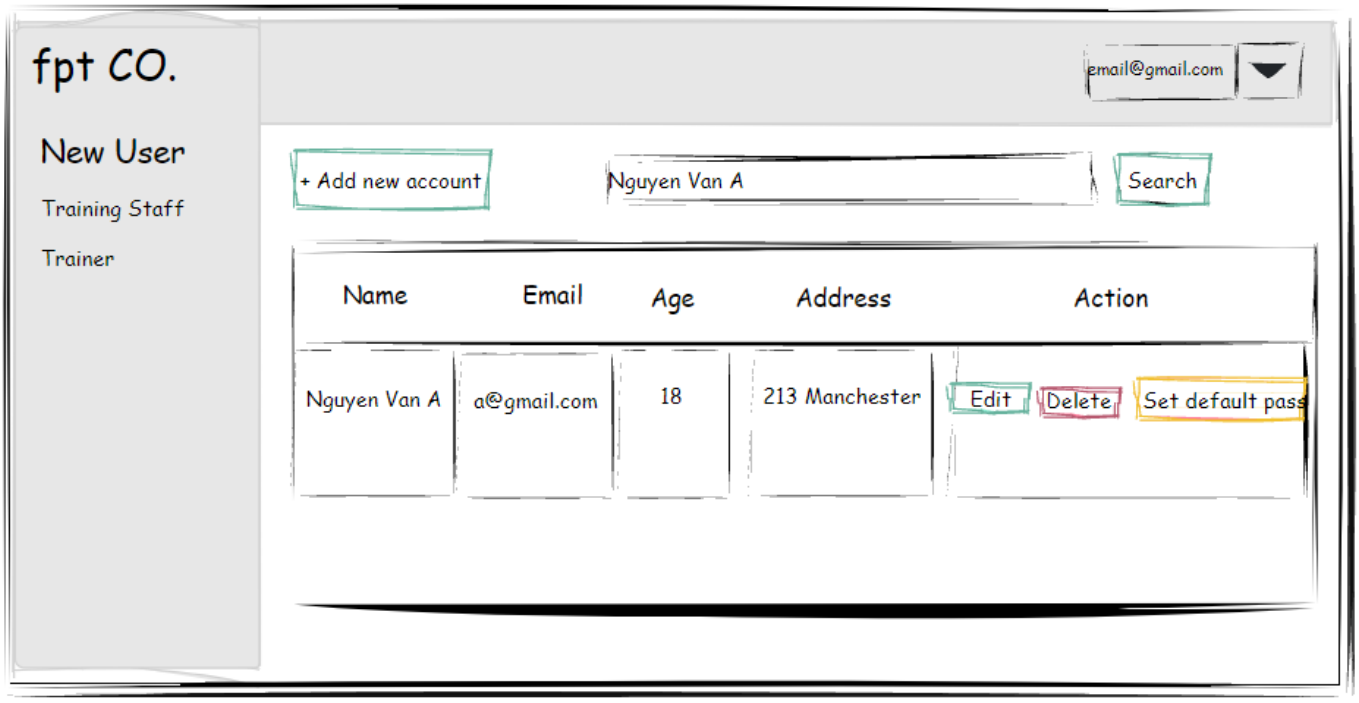

Figure 5. Search Training staff

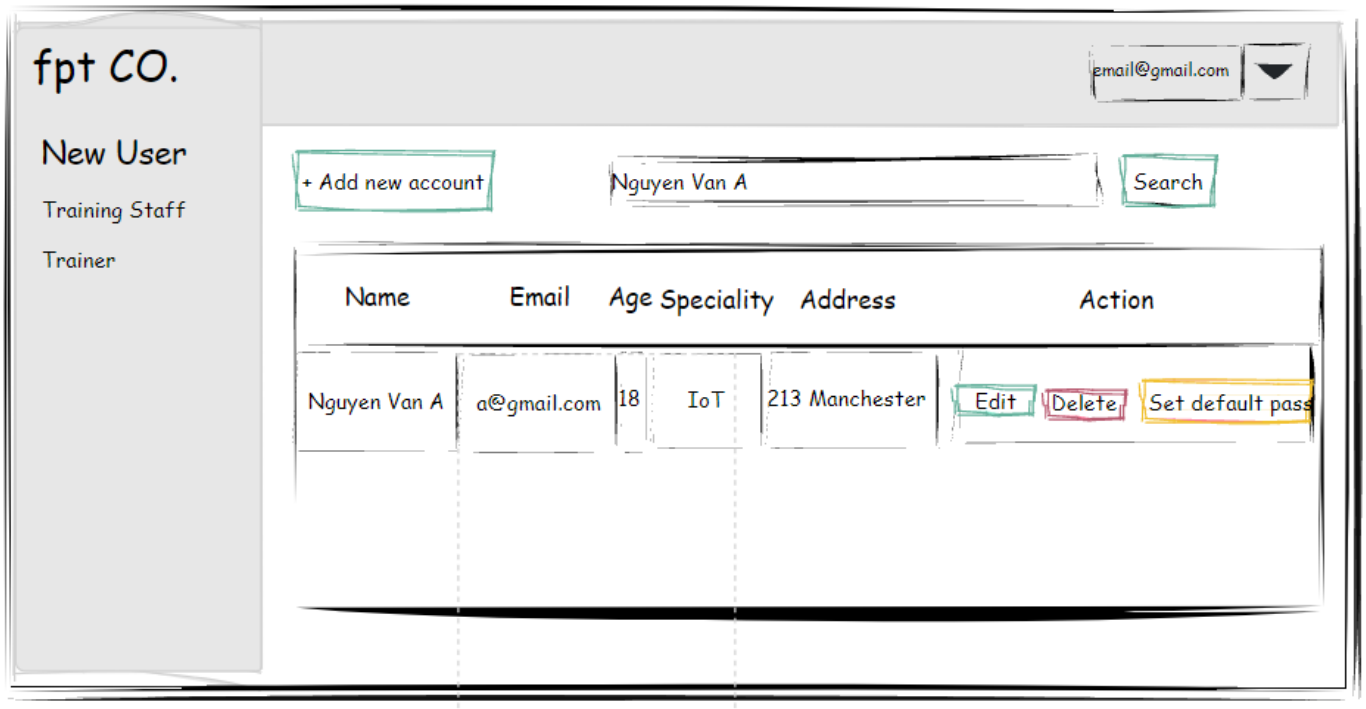

Figure 6. Search trainer

The UI of create trainer, training staff, edit trainer, edit staff are the same. There are several differences such as the data fields, …

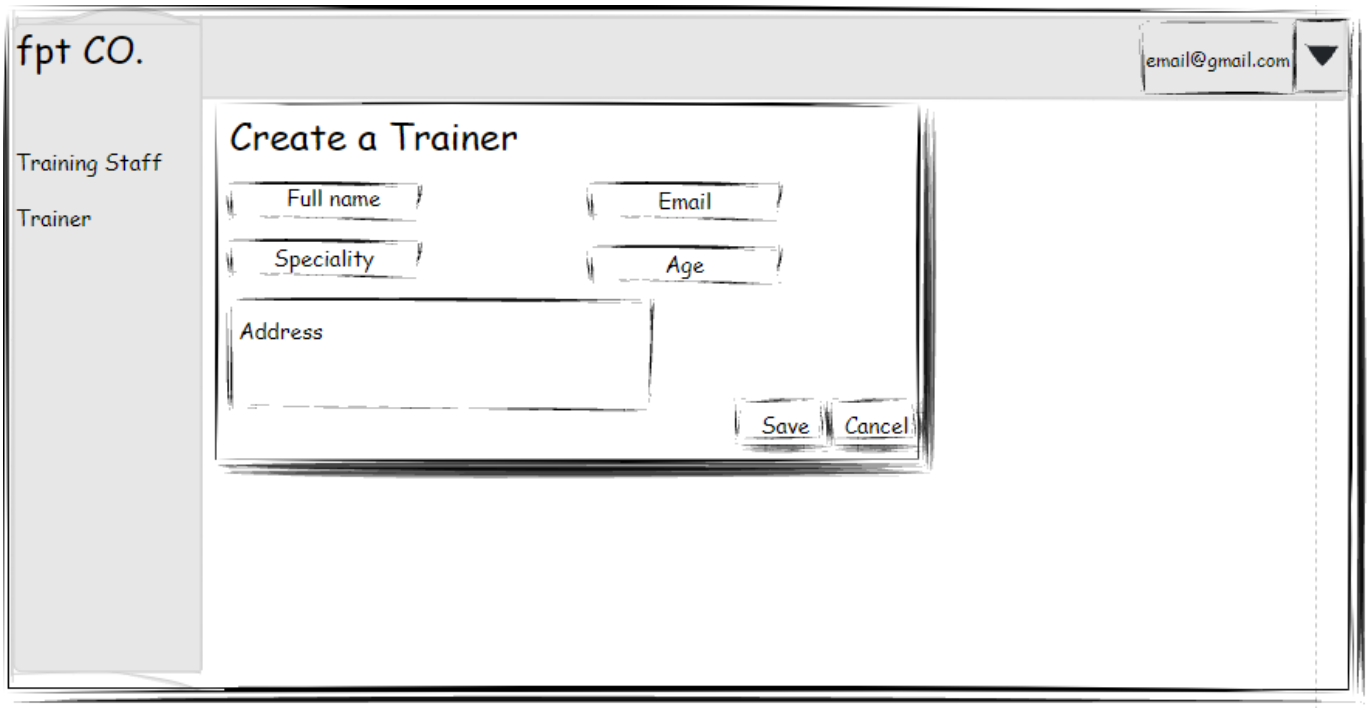

Figure 7. Add new Trainer

Figure 8. Edit Trainer

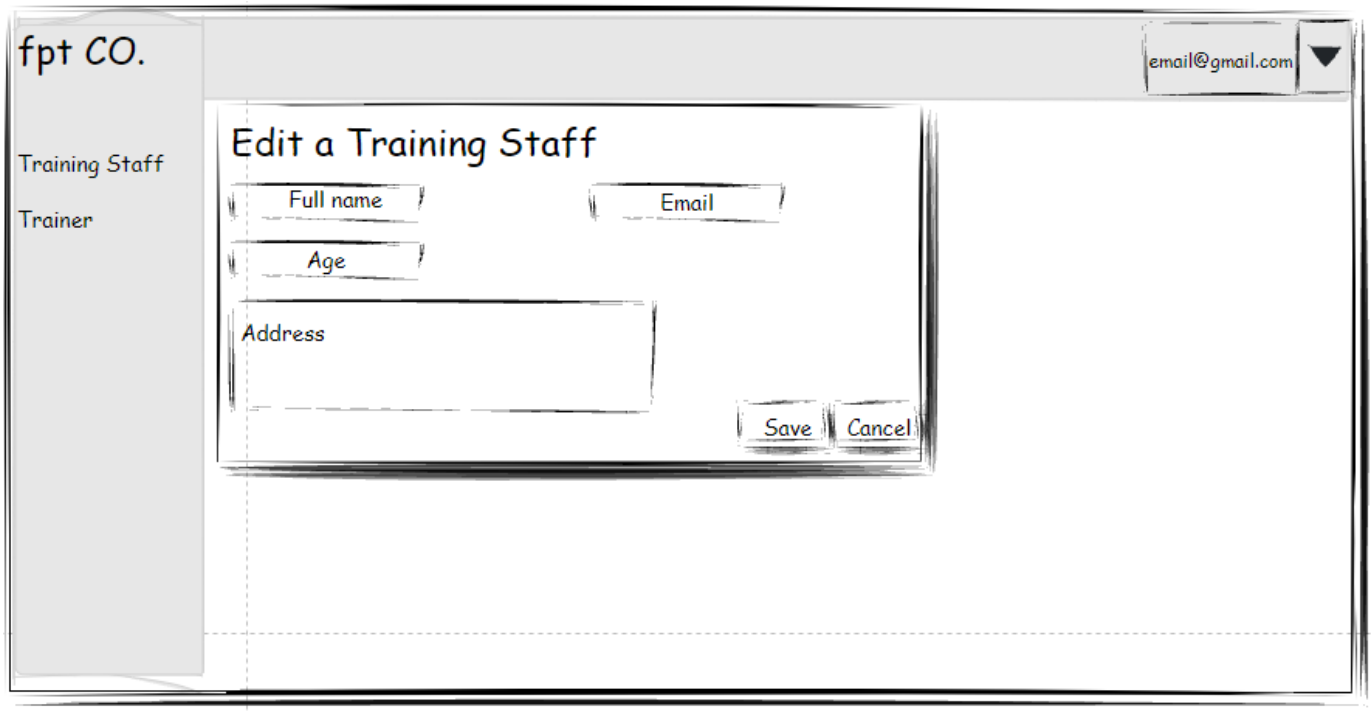

Figure 9. Edit Staff

Figure 10. Create a staff

4.1.2. Hardware Interfaces

The software is written as a web application, which is a computer program that uses web browsers and web technology to accomplish operations via the Internet. As a result, it works with PCs and laptops. Based on the requirements documentation, the software will be used by managers, training staff, trainers and trainee. These kinds of user mainly use Windows and MacOS operation system. As long as they are connected to the Internet, machines running Windows 8 or later, MacOS, and web browsers like Chrome, Firefox, and Opera can view the website.

The hardware requirement for those devices is Microsoft Window 8 or higher (for Windows), X86 Dual Core Professor or higher, Minimum 2GB RAM, Minimum 5GB free space.

The application cannot be used on mobile wearable devices such as smart watches, phones.

4.1.3. Software Interfaces

PCs and laptops must have Windows or MacOS operating system. Moreover, to use the application, web browsers such as Google Chrome, Microsoft Edge, and Firefox must be installed.

The development team built the application in the Windows OS.

The chosen database is MongoDB.

Programming Language: HTML, CSS, JavaScript were used because these are many convenient and can be used for developing websites, especially web-app.

Development Software: Visual Studio Code. This is an IDE of Microsoft. It works with Windows OS.

4.2. Functional requirements

Login page

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

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.

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.

Searching/ reporting requirements:

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

Database

Storage data of account, courses, course categories and profile.

4.3. Use Case Model

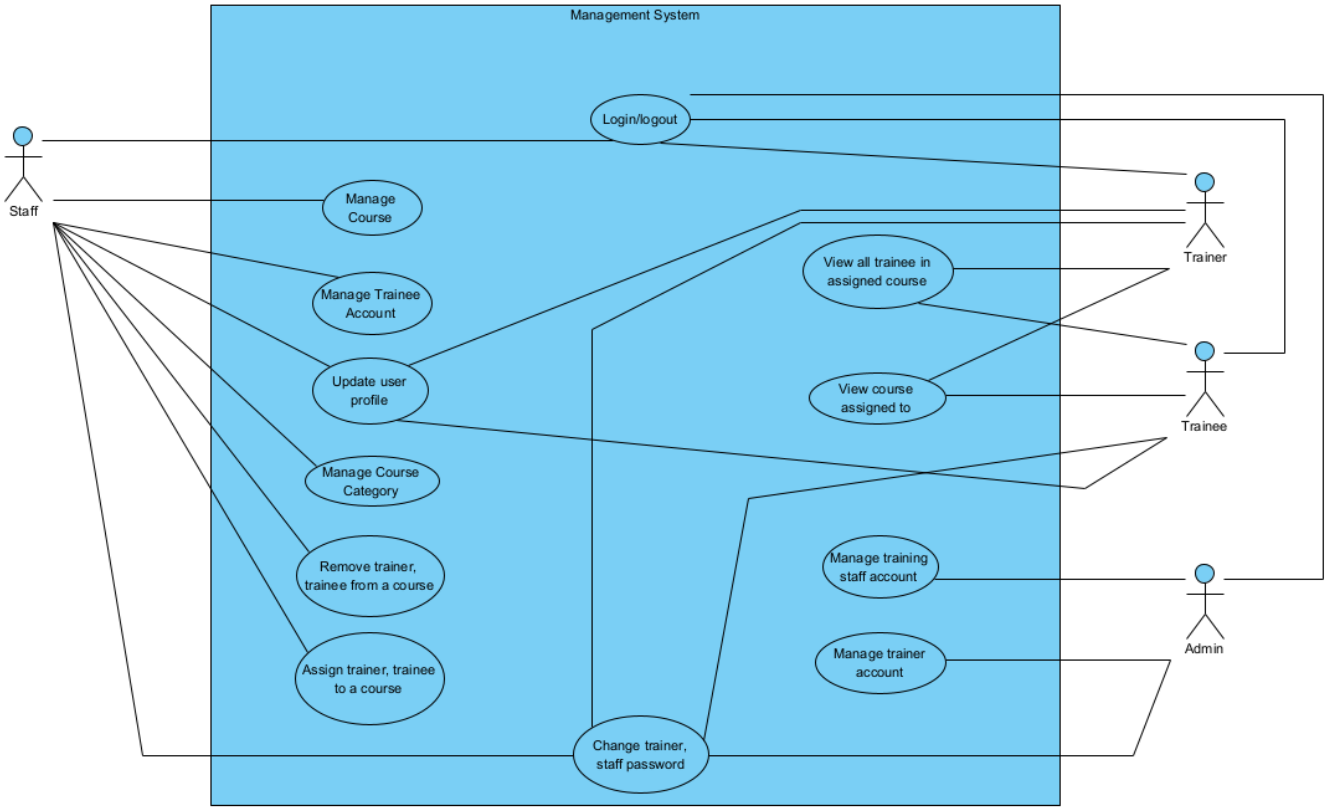

Figure 11. Use case diagram

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.

Any users will be able to use login/logout function.

Users need to login to the system to access the software. Then, the information will be sent to the database to determine which role the user is and direct them to one of the following:

- **Admin**: admin has the rights for viewing, searching, adding, editing and deleting trainers and staff, and change password.

- **Staff**: staff has the rights for viewing, searching, adding, editing and deleting trainee, course category, course. In addition, staff also can assign, or remove a trainer or trainee to(from) a course. They also can update their profile and password.
- **Trainer:** trainer has the rights for viewing course they are assigned to and viewing all Trainees who enroll his/ her course. They also can update their profile and password.
- **Trainee**: trainee has the rights for viewing course they are assigned to and viewing all students who enroll the same course that Trainee enrolls to. They also can update their profile and password.

In this section, the author will provide the specification for each use case diagram in **admin** role.

4.3.1. Use case #1

Use Case ID	*UC-1.1*
Use Case Name	*Admin add training staff*
Description	*An admin must have the ability to add new training staff.*
Actor(s)	*Admin*
Priority	*Must Have*
Trigger	*An admin can the add new training staff.*
Pre-Condition(s):	• *The admin account has been created* • *The admin account is logged.* • *The admin account must have permission to modify that specific function.*

Post-Condition(s):	• *The admin has updated the information of the system.* • *Wrong format or empty data fields, system should alert.* • *Create new training staff successfully.* • *The server record changes log.*
Basic Flow	*1. The admin logged in the system.* *2. Admin add new information of the user.* *3. The System creates backup file.* *4. System update the modified information.* *5. System record the change on the change log.*
Alternative Flow	*2b. Admin exit without making any modifications. Case break.*
Exception Flow	*1a. User is not an admin, error report, case break.* *5a. System is down after the update. The system reverted to its previous phase with the backup file.*
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	*NFR1.1-3: If the server is down after the modify, revert the system to the previous process with a backup file.* *NFR1.1-2: User passwords must be encrypted during transportation.*

Table 4. Use-case add staff

4.3.2. Use case #2

Use Case ID	*UC-1.2*
Use Case Name	*Admin edit training staff*

Description	*An admin must have the ability to edit an exist training staff.*
Actor(s)	*Admin*
Priority	*Must Have*
Trigger	*An admin can edit an exist training staff.*
Pre-Condition(s):	• *The admin account has been created* • *The admin account is logged.* • *The admin account must have permission to modify that specific function.*
Post-Condition(s):	• *The admin has updated the information of the system.* • *Wrong format or empty data fields, system should alert.* • *Update training staff successfully.* • *The server record changes log.*
Basic Flow	*1. The admin logged in the system.* *2. Admin edit an exist training staff.* *3. The System creates backup file.* *4. System update the modified information.* *5. System record the change on the change log.*
Alternative Flow	*2a. Admin exit without making any modifications. Case break.*
Exception Flow	*1a. User is not an admin, error report, case break.* *2b. User does not exist, report error.* *5a. System is down after the update. The system reverted to its previous phase with the backup file.*

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	*NFR1.1-3: If the server is down after the modify, revert the system to the previous process with a backup file.* *NFR1.1-2: User passwords must be encrypted during transportation.*

Table 5. Use-case edit staff

4.3.3. Use case #3

Use Case ID	*UC-1.3*
Use Case Name	*Admin delete training staff*
Description	*An admin must have the ability to delete an exist training staff.*
Actor(s)	*Admin*
Priority	*Must Have*
Trigger	*An admin can delete an exist training staff.*
Pre-Condition(s):	• *The admin account has been created* • *The admin account is logged.* • *The admin account must have permission to modify that specific function.*
Post-Condition(s):	• *The admin has updated the information of the system.* • *Delete training staff successfully.* • *The server record changes log.*

Basic Flow	*1. The admin logged in the system.* *2. Admin delete an exist training staff.* *3. Next, admin will make decisions remove* *4. Click delete button and make sure* *5. The System creates backup file.* *6. System update the modified information.* *7. System record the change on the change log.*
Alternative Flow	*2a. Admin exit without making any modifications. Case break.*
Exception Flow	*1a. User is not an admin, error report, case break.* *2b. User does not exist, report error.* *5a. System is down after the update. The system reverted to its previous phase with the backup file.*
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	*NFR1.1-3: If the server is down after the modify, revert the system to the previous process with a backup file.* *NFR1.1-2: User passwords must be encrypted during transportation.*

Table 6. Use-case delete staff

4.3.4. Use case #4

Use Case ID	*UC-1.4*
Use Case Name	*Admin search training staff*
Description	*An admin must have the ability to search an exist training staff.*
Actor(s)	*Admin*

Priority	*Must Have*
Trigger	*An admin can search an exist training staff.*
Pre-Condition(s):	• *The admin account has been created* • *The admin account is logged.* • *Enter keyword in characters in alphabet.* • *The admin account must have permission to modify that specific function.*
Post-Condition(s):	• *The admin has updated the information of the system.* • *Wrong format or empty data fields, system should alert.* • *Search successfully.* • *The server record changes log.*
Basic Flow	*1. The admin logged in the system.* *2. Admin enter keyword.* *3. Next, admin will enter keyword for search.* *3. The System creates backup file.* *4. System update the modified information.* *5. System record the change on the change log.*
Alternative Flow	*2a. Admin exit without making any modifications. Case break.*
Exception Flow	*1a. User is not an admin, error report, case break.* *3a. If keyword doesn't match any course name Use Case stops* *3b. User does not exist, report error.* *5a. System is down after the update. The system reverted to its previous phase with the backup file.*
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	*NFR1.1-3: If the server is down after the modify, revert the system to the previous process with a backup file.* *NFR1.1-2: User passwords must be encrypted during transportation.*

Table 7. Use-case search staff

4.3.5. Use case #5

Use Case ID	*UC-1.5*
Use Case Name	*Admin add trainer*
Description	*An admin must have the ability to add new trainer.*
Actor(s)	*Admin*
Priority	*Must Have*
Trigger	*An admin can the add new trainer.*
Pre-Condition(s):	• *The admin account has been created* • *The admin account is logged.* • *The admin account must have permission to modify that specific function.*
Post-Condition(s):	• *The admin has updated the information of the system.* • *Wrong format or empty data fields, system should alert.* • *Create new trainer successfully.* • *The server record changes log.*
Basic Flow	*1. The admin logged in the system.*

	2. Admin add new information of the user. *3. The System creates backup file.* *4. System update the modified information.* *5. System record the change on the change log.*
Alternative Flow	*2b. Admin exit without making any modifications. Case break.*
Exception Flow	*1a. User is not an admin, error report, case break.* *5a. System is down after the update. The system reverted to its previous phase with the backup file.*
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	*NFR1.1-3: If the server is down after the modify, revert the system to the previous process with a backup file.* *NFR1.1-2: User passwords must be encrypted during transportation.*

Table 8. Use-case add trainer

4.3.6. Use case #6

Use Case ID	*UC-1.6*
Use Case Name	*Admin edit trainer*
Description	*An admin must have the ability to edit an exist trainer.*
Actor(s)	*Admin*

Priority	*Must Have*
Trigger	*An admin can edit an exist trainer.*
Pre-Condition(s):	• *The admin account has been created* • *The admin account is logged.* • *The admin account must have permission to modify that specific function.*
Post-Condition(s):	• *The admin has updated the information of the system.* • *Wrong format or empty data fields, system should alert.* • *Update trainer successfully.* • *The server record changes log.*
Basic Flow	*1. The admin logged in the system.* *2. Admin edit an exist trainer.* *3. The System creates backup file.* *4. System update the modified information.* *5. System record the change on the change log.*
Alternative Flow	*2a. Admin exit without making any modifications. Case break.*
Exception Flow	*1a. User is not an admin, error report, case break.* *2b. User does not exist, report error.* *5a. System is down after the update. The system reverted to its previous phase with the backup file.*
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	*NFR1.1-3: If the server is down after the modify, revert the system to the previous process with a backup file.*

	NFR1.1-2: User passwords must be encrypted during transportation.

Table 9. Use-case edit trainer

4.3.7. Use case #7

Use Case ID	*UC-1.7*
Use Case Name	*Admin delete trainer*
Description	*An admin must have the ability to delete an exist trainer.*
Actor(s)	*Admin*
Priority	*Must Have*
Trigger	*An admin can delete an exist trainer.*
Pre-Condition(s):	• *The admin account has been created* • *The admin account is logged.* • *The admin account must have permission to modify that specific function.*
Post-Condition(s):	• *The admin has updated the information of the system.* • *Delete training staff successfully.* • *The server record changes log.*
Basic Flow	*1. The admin logged in the system.* *2. Admin delete an exist trainer.* *3. Next, admin will make decisions remove* *4. Click delete button and make sure*

	5. The System creates backup file. *6. System update the modified information.* *7. System record the change on the change log.*
Alternative Flow	*2a. Admin exit without making any modifications. Case break.*
Exception Flow	*1a. User is not an admin, error report, case break.* *2b. User does not exist, report error.* *5a. System is down after the update. The system reverted to its previous phase with the backup file.*
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	*NFR1.1-3: If the server is down after the modify, revert the system to the previous process with a backup file.* *NFR1.1-2: User passwords must be encrypted during transportation.*

Table 10. Use-case delete trainer

4.3.8. Use case #8

Use Case ID	*UC-1.4*
Use Case Name	*Admin search trainer*
Description	*An admin must have the ability to search an exist trainer.*
Actor(s)	*Admin*
Priority	*Must Have*

Trigger	*An admin can search an exist trainer.*
Pre-Condition(s):	• *The admin account has been created* • *The admin account is logged.* • *Enter keyword in characters in alphabet.* • *The admin account must have permission to modify that specific function.*
Post-Condition(s):	• *The admin has updated the information of the system.* • *Wrong format or empty data fields, system should alert.* • *Search successfully.* • *The server record changes log.*
Basic Flow	*1. The admin logged in the system.* *2. Admin enter keyword.* *3. Next, admin will enter keyword for search.* *3. The System creates backup file.* *4. System update the modified information.* *5. System record the change on the change log.*
Alternative Flow	*2a. Admin exit without making any modifications. Case break.*
Exception Flow	*1a. User is not an admin, error report, case break.* *3a. If keyword doesn't match any course name Use Case stops* *3b. User does not exist, report error.* *5a. System is down after the update. The system reverted to its previous phase with the backup file.*
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	*NFR1.1-3: If the server is down after the modify, revert the system to the previous process with a backup file.*

	NFR1.1-2: User passwords must be encrypted during transportation.

Table 11. Use-case search trainer

4.3.2. Use case #9

Use Case ID	*UC-1.9*
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):	• *The account has been created* • *The account is authorized* • *The device is connected to the Internet*
Post-Condition(s):	• *The user logged in successfully* • *The system records the activity.*
Basic Flow	*1. The user goes to the login page via URL.* *2. The user enters the email and password in the login field.* *3. The user presses the login button to send information to the server* *4. The server checks for the login information and give user permission for their account-related action.* *5. The server record the action on the activity log.*

Alternative Flow	*Empty*
Exception Flow	*4a. The system report unsuccessfully logs in.* *4b. The user cancels the login or turned off the browser, the user case break.*
Business Rules	*BR1.1-1The login function will be postponed for 15 mins after 5 times user enters the wrong name and password.*
Non-Functional Requirement	*NFR1.1-1: After 120 seconds, the login will be timed out.* *NFR1.1-2: User passwords must be encrypted during transportation.*

Table 12. Use-case login

5. Technical Design

5.1. Site map

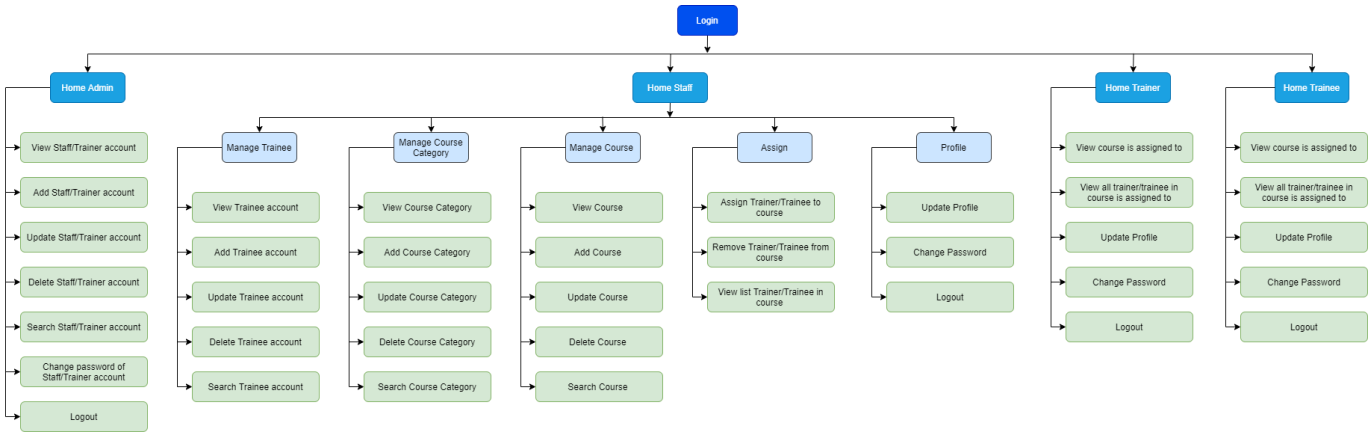

Figure 12. Site map.

Here is the site map of the whole system. Based on the requirements, the author and his team noticed that there are 4 roles in the management system: Admin, Staff, Trainer, and Trainee. Each role has its own functions. Thus, the author created those 4 roles in this site map, and each role has its own specific function. For instance, admin has the rights to manage the training staff and trainer staff account, so he is able to view list of account, add, delete, update, search, and change the password of trainer or training

staff account. However, staff is unable to handle the tasks of staff such as manage course or manage categories. Based on the requirements, the author's group claimed that the management function is create, update, delete and view. Each role will have its own User Interface with 4 this function. This can be achieved in the figure given above. For the detail of the function, please see the list below:

- Admin: Add, view, update, search, delete, change password of training staff/trainer account.
- Staff:
    - Add, view, update, delete, search trainee account.
    - Add, view, update, delete, search course.
    - Add, view, update, delete, search course category.
    - Assign, remove trainer/trainee to/from course; view list of trainer/trainee in course.
    - Update, change password.
- Trainer: View course assigned to; view all trainees in his/her course.
- Trainee: View course assigned to; view all trainees in the same course that trainees enroll to.

The system requirements have 4 roles in the management system: an administrator, training staff, a trainer and a trainee. Each has its own functions. As a result, the author has created those four roles in the use-case diagrams, ERDs, activity diagrams, and assigned the task for each role for members on Trello. The author team used the requirement to divide the view into four key view groups while constructing and designing the user interface. Each position is assigned to a view group. Each view corresponds to a role function. For instance, admin has the rights to manage the training staff and trainer staff account. So, admin is unable to

In addition, each user will be given an account as part of the analysis process of the team in order to meet the system requirements. The system will use this account to determine the role of the user. From there, users can be directed to their views, and functionality can be decentralized to that user. As a result, the author has introduced a table called **account** to the ERD and class diagram. Users can connect in to the system and utilize the website after creating an account.

5.2. Entity Relationship Diagram (ERD)

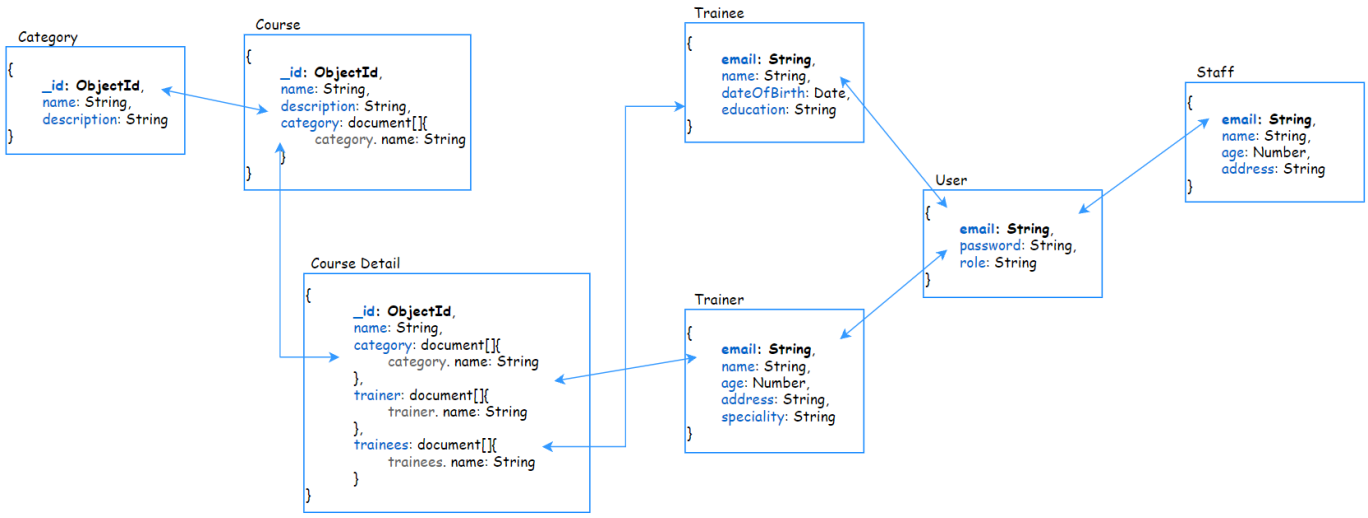

Figure 13. ERD diagram

The management system includes 7 documents which are Category, Course, Course Detail, Trainer, Staff, User, and Trainee. In the requirements documentation, there is no description about admin's information such as name, age, etc. so the team did not build any document about admin role, they just insert the admin's account manually with the role is admin.

First, the user has 3 attributes: email, password, and role. Each user will have a unique email to be easily distinguishable from the other. Furthermore, the email will be unique, in every table of users (staff, trainer, trainee) because it is considered to be the username for users.

As the requirements documentation said, the staff will include 4 basic information: email, name, age and address; trainee contains email, name, date of birth, and education; trainer has 5 data fields: email, name, age, address, specialty.

Category will have 3 attributes: _id, name and description, whereas **_id** is the primary key of the category so that it can be identified, name is the name of the category (E.g., Marketing) and the description is what the category is all about.

Course is the same with category, but it has category in document, which the category name is the same with the name of category table. It could be an array. This is familiar with course detail.

5.3. Class Diagram

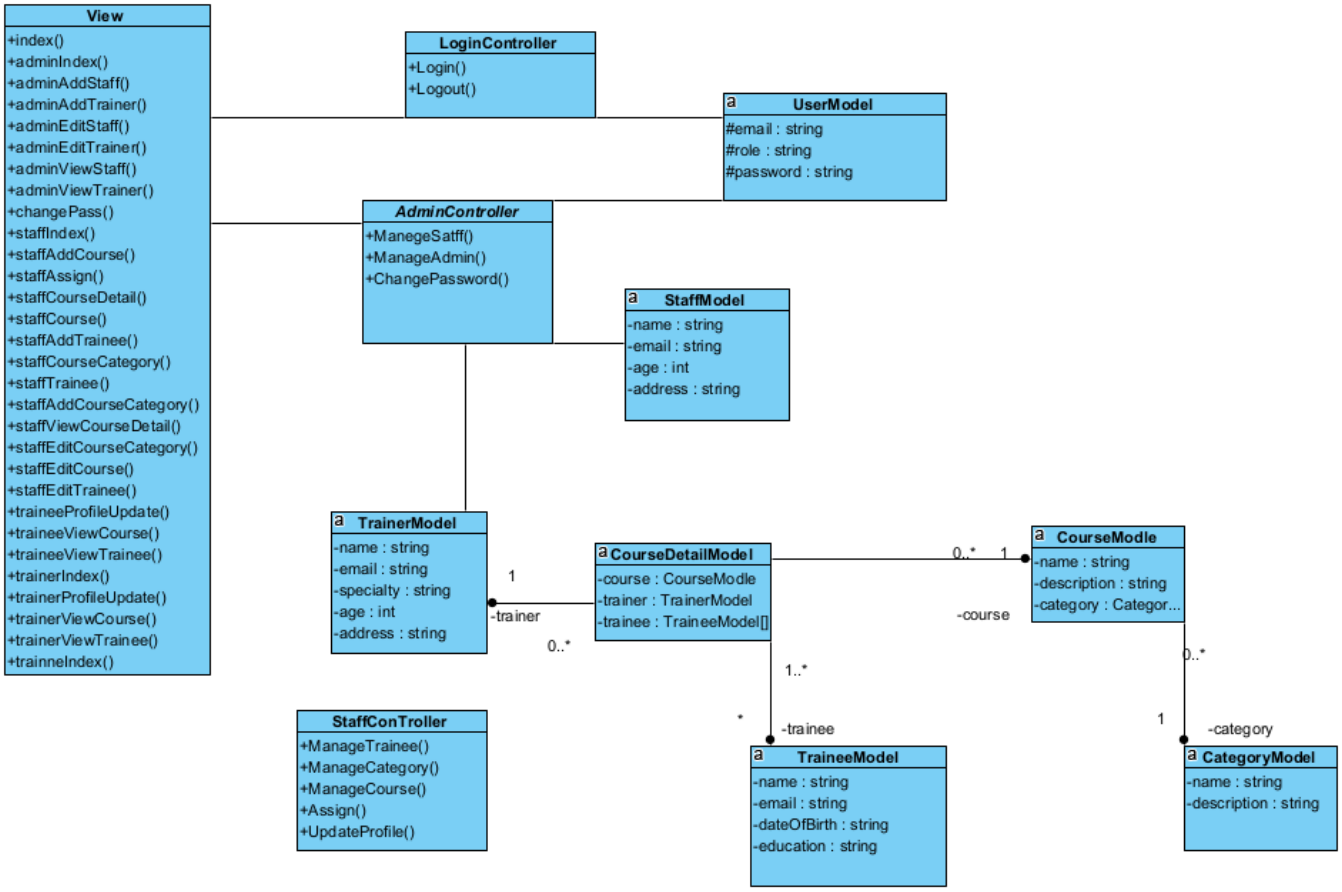

Figure 14. Class diagram according MVC model

Above is the class diagram in MVC model (model, view, controller).

5.4. Active Diagram

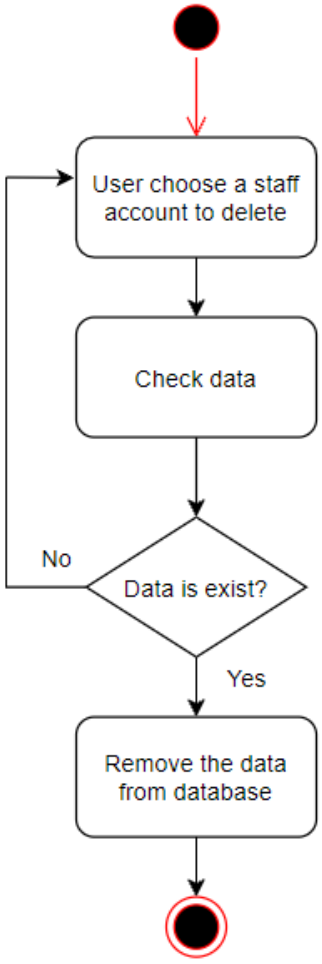

Figure 15. Activity diagram for delete staff account

This is the admin's delete function. This tool allows you to remove a trainer's account as well as a staff member's account. The system checks to determine if the data exists before deleting it. If this is the case, the information is removed. Otherwise, the administrator will be taken back to the process of choosing which data to delete. The picture given above is also the activity diagram for delete trainer account.

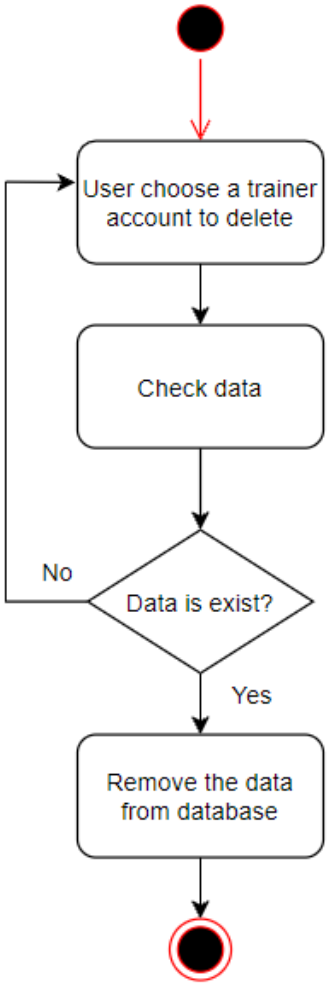

Figure 16. Activity diagram for delete trainer account

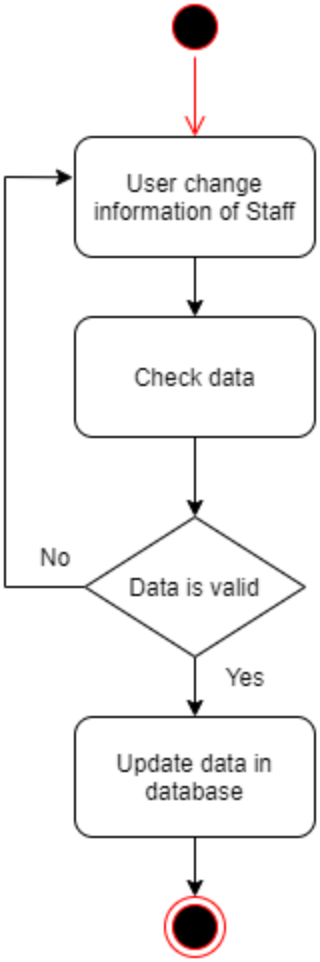

Figure 17. Activity diagram for update staff

The delete and update functions are quite similar. The system will receive the data from the user and check whether the data is valid or not. If it is valid, the data will be saved. Otherwise, the administrator will have to re-enter the data. The picture given above is also the activity diagram for update trainer account

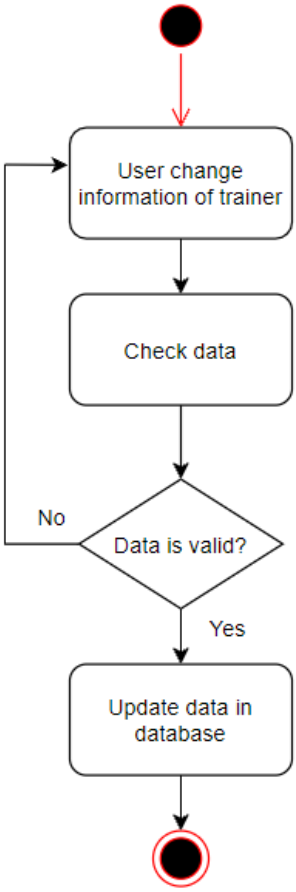

Figure 18. Activity diagram for update trainer

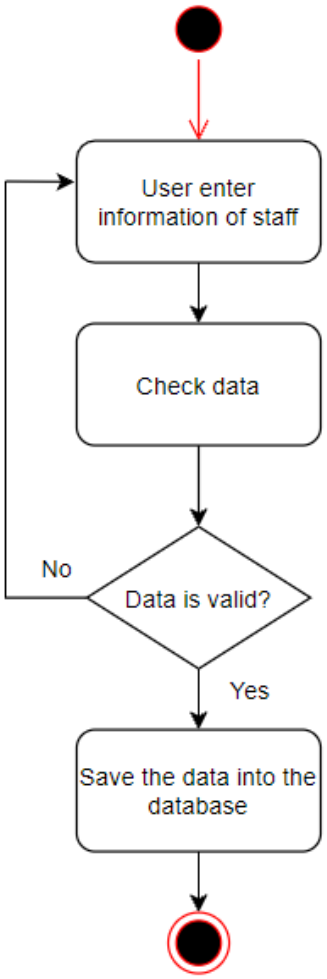

Figure 19. Activity diagram for add staff

The add function is also similar with update function. User enter the information of staff (or trainer like the figure below), then the system will check whether the data is valid or not. If it is correct, the new information will be added into database.

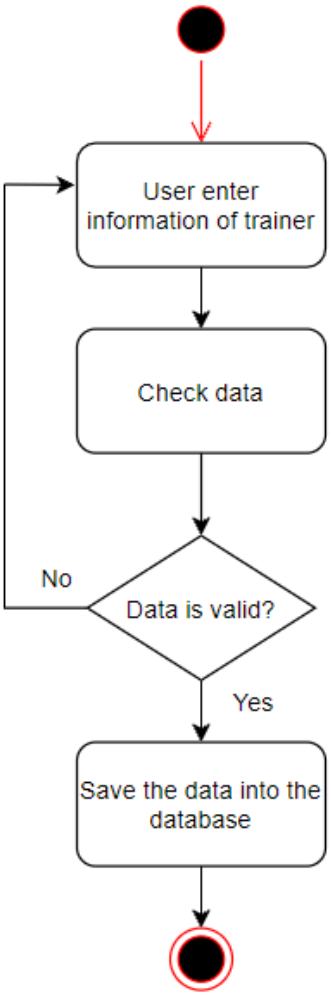

Figure 20. Activity diagram for add new trainer

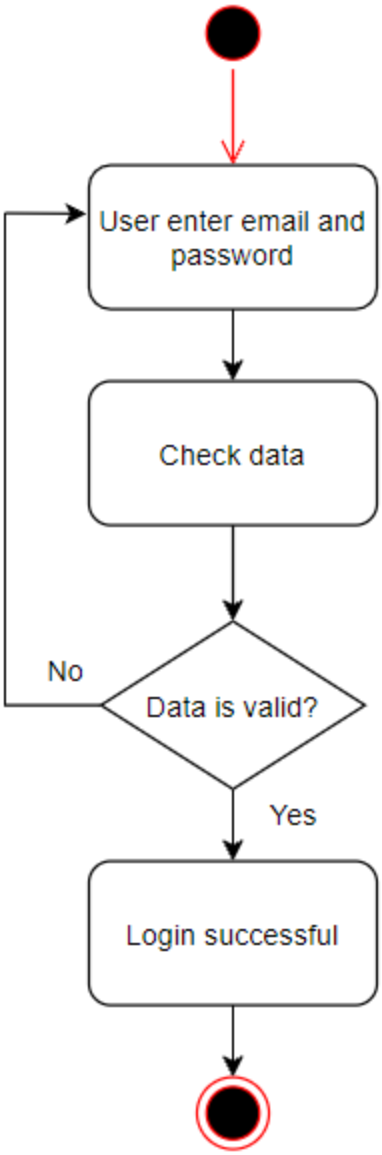

Figure 21. Activity diagram for login

Here is the login function. This login applies to all four roles on the system when using the login function. To log in, the user must provide an email address and a password. If the password and email are accurate, the system will identify which role account is next, allowing the user to be sent to the appropriate page. The user will have to re-enter the password and username if they are incorrect.

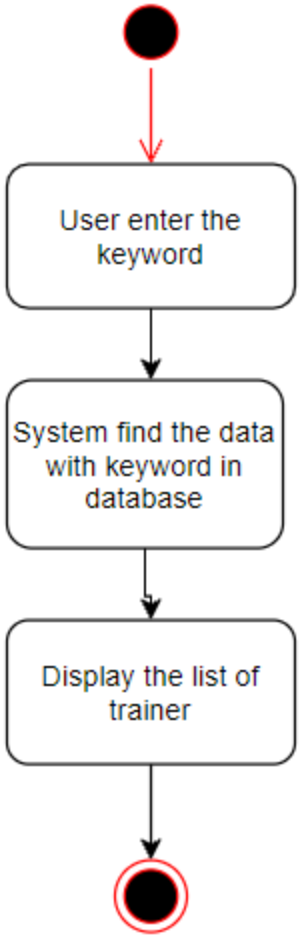

Figure 22. Activity diagram for search trainer

Here is the search function. If user wants to find a certain trainer (or staff), they must enter a key word (name or date of birth). Then, the system will look for the key word in the database and return the result.

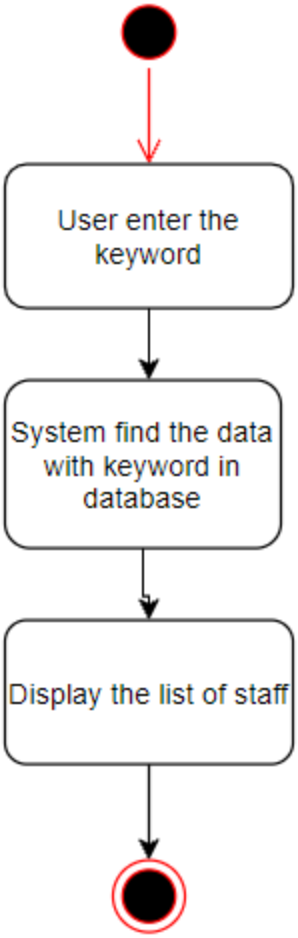

Figure 23. Activity diagram for staff

5.5. Trello

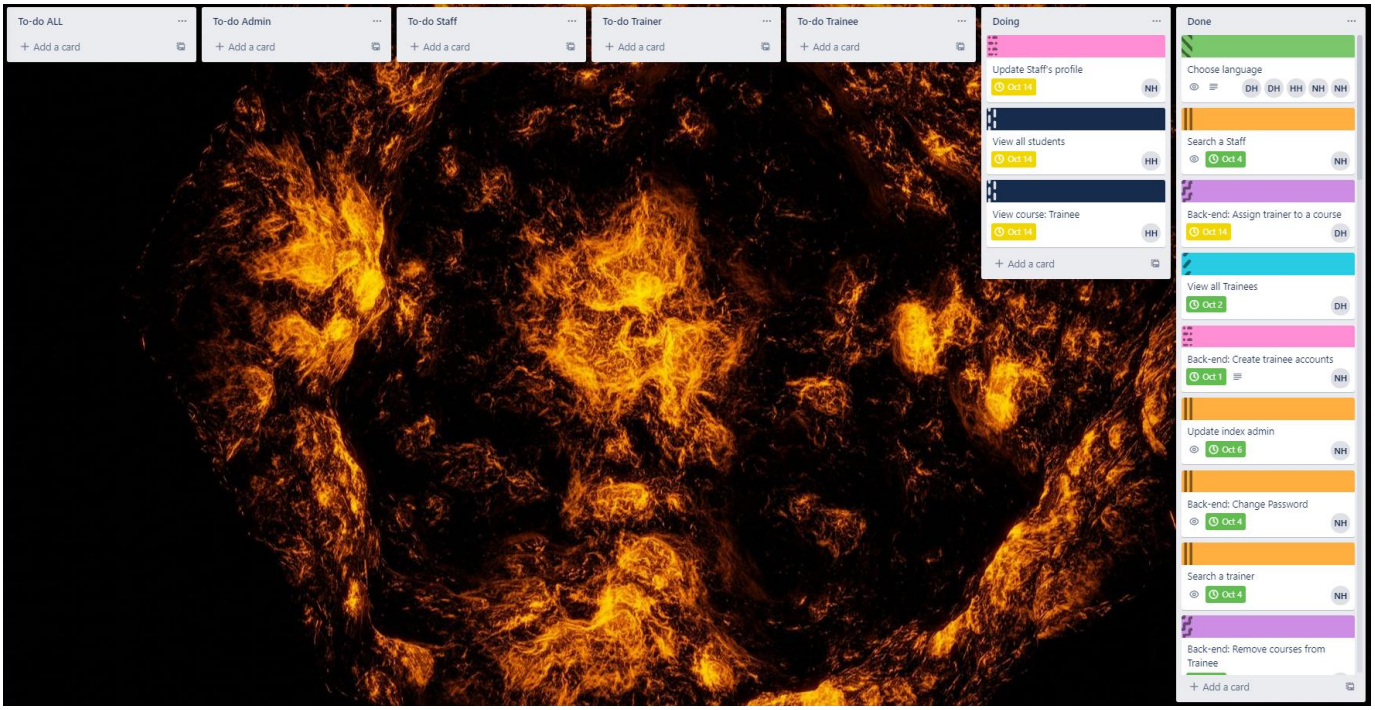

Figure 24. Trello

As stated above, the system requirements have 4 roles in the management system: an administrator, training staff, a trainer and a trainee. Each has its own functions. So, the author assigned the task for each role for members on Trello. In the figure above, the task is divided into 5 groups: **To-do all** (every member must do); **To-do admin**, **to-do staff**, **to-do trainer** and **to-do trainee** is divided for each member.

The **doing** column illustrates the tasks that team members are doing. In addition, the **done** column means that the tasks of given members were finished.

Besides, the team also colored members task to let each member know what their tasks are. This will ensure the members do not confuse about each other's duties.

6. 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				Frontend,	Experienced members can support and guide				

	MVC model to develop the project. Some members never use this model before.	Tolerable	Possible	**Medium**	Backend, Database	the other to complete their tasks.	Tolerable	Improbable	**Low**	**Yes**
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**

Table 13. Risk table

7. Other Requirements

7.1. UI Requirements

The system must follow the style of FPT Education. The interface must be intuitive, friendly and easy to use. Users can be trained to use the system in 30 minutes.

7.2. Performance Requirements

Performance plays an important role because it has huge influence on the users. Here are some system performance requirements:

- **Continuity**: The effectiveness of a system has an impact on the continuity of teaching and learning. The system must run constantly and effectively 24/7 to maintain continuity.
- 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).

7.3. 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.

Task 2 – Technologies evaluation

Chapter 1 – Design Tools

1. Draw.io

Draw.io is a useful, free diagramming service that very popular nowadays. People can use the software's automatic layout option or create their own unique layout. Draw.io provides a big number of shapes and hundreds of visual elements to let users create a one-of-a-kind diagram or chart. The drag-and-drop feature makes creating a professional-looking diagram or charts a breeze. Especially, users can start drawing or diagramming in Draw.io without downloading because it has built-in features. However, users can also save files they create with the service to their computer. Even though it's a Web app, Chrome users can access it offline by installing the Draw.io Desktop Chrome app.

Figure 25. Draw.io

Moreover, when used with Google Drive, Draw.io has good support for real-time collaboration so that more than one person can work on a diagram simultaneously. Thus, it saves a lot of time when team members can contribute, draw the activity diagrams and use-case diagram.

It is also a powerful, convenient tool for building wireframes for apps or websites. Draw.io provides simple blocks to visualize a wireframe with some basic colors. The navigation bar has many options for users to choose a library of shapes and elements. Users just need to drag-and-drop the element from the navigation bar to the board and do anything they want with these elements.

2. Visual Paradigm

According to Oit (2021), Visual Paradigm is a software application designed for software development teams to model business information systems and manage development processes. Visual Paradigm features Unified Modeling Language (UML) diagrams, Entity Relationship Diagram (ERD), and Object Relational Mapping Diagrams (ORMD) utilities essential in system and database design.

There are multiple editions of Visual Paradigm: Community, Modeler, Standard, Professional, and Enterprise. Based on the needs of users, they can choose a specific version with its own advantages and disadvantages. It can be said that this is a powerful, cross-platform tool that can be used easily across systems. It helps developers, programmers design, sketch ideas more perfectly.

Figure 26. Visual paradigm

Visual Paradigm has a lot of templates of wireframes, so the users can use it to illustrate their application easily. Users can save time by using the available wireframes template of visual paradigm. The templates of wireframe that Visual Paradigm provides include: Phone, Android, iPhone, tablet, …

3. Conclude which tools will be used for the design of the application

	Draw.io	Visual Paradigm
Advantages	- It is free to use. - Excellent real-time collaboration support included when connected to a Google account. - Extremely user-friendly and easy to pick up. - It is web based - no installation necessary! - Allows for collaborative development of diagrams. - Provide mostly basic shapes, components, colors. - Several templates are available.	- User-friendly. - Lots of diagrams to choose. - Cross-platform. - Theme changeable. - Used by large software developer's communities. - Available both online and offline. - Visual Paradigm's wireframing tool is so intuitive. - It has different devices style with different components. - Many templates are available.
Disadvantages	- As working in a browser, the app seems to lag if working on it for a while. - There's no dark mode to work in the dark and be softer on the eyes. - Cannot draw complex wireframes.	- The price is quite high. - Not very easy for beginners.

Figure 27. Compare draw.io vs visual paradigm

Based on the comparison table above, the author and his team decided to choose **Visual Paradigm** as the tool for design application. 2 tools given above have its own perks, however, the most appropriate tool with the team is **Visual Paradigm** due to the following reasons:

At the first meeting, the team decided drawing the UML together, so the team don't need any collaboration tool. **Visual Paradigm** was installed by the team members since the course **Advanced Programming**, the team has already known how to use the application.

The UI of **Visual Paradigm** is very friendly and intuitive, it has a lot of options in the left navigation bar. Each option has many. With these templates, it saves a lot of time for the team because they can just edit the available templates. With these templates, the author can easily design Activity Diagram or User Diagram.

The author as well as the team is still student, so they do not have enough money for purchasing the license. However, **Visual Paradigm** provides the free-trial version, so the team can leverage this chance to finish the project.

Visual Paradigm can be used not only on the Internet but also in local. In the local application, it still has all the function on the website. The team can still edit the diagram and wireframes without the internet connection. Moreover, the author can change the theme of the application, this helps protect eyes during the design, where **Draw.io**.

Besides, **Visual Paradigm** also is a powerful tool to create wireframe for the application because it has a lot of templates that saves much time. Nevertheless, **Draw.io** just has a very simple, basic shapes and components, it has no available templates, so it wastes so much time for designing, and the team cannot create complex wireframe with **Draw.io**.

The author wants to use **Visual Paradigm** because he wants to use an application that can both design UML and create wireframes for the FPT Co. Application. Thus, the team can manage the files logically and easily.

Chapter 2 – Front-end technology stack

1. Programming language

1.1. JavaScript

JavaScript is a dynamic computer programming language. It is an extremely lightweight script that's widely utilized as part of web pages, allowing the client-side script to interact with the user and generate dynamic pages. It is an object-oriented programming language that can be interpreted (Tutorialspoint, 2021).

1.2. TypeScript

Technically speaking, Typescript is a strict, typed superset of JavaScript developed by Microsoft. It starts from the same JavaScript code, and it compiles to JavaScript, but it has a few added features that make life easier for programmers (Finnegan, 2019).

By understanding JavaScript, TypeScript saves user's time catching errors and providing fixes before run code. Any browser, any OS, anywhere JavaScript runs. Entirely Open Source (Finnegan, 2019).

2. HTML/CSS

Hypertext Markup Language (HTML) is a computer language that makes up most web pages and online applications. A hypertext is a text that is used to reference other pieces of text, while a markup language is a series of markings that tells web servers the style and structure of a document. With the development of the Internet, HTML has become an indispensable language for formatting web pages with the various tags available in them. It can be said that HTML is the skeleton of a website. (Curtis, 2021).

CSS stands for Cascading Style Sheets with an emphasis placed on "Style." While HTML is used to structure a web document (defining things like headlines and paragraphs, and allowing users to embed images, video, and other media), CSS comes through and specifies their document's style—page layouts, colors, and fonts are all determined with CSS. Think of HTML as the foundation (every house has one), and CSS as the aesthetic choices (Morris, 2017).

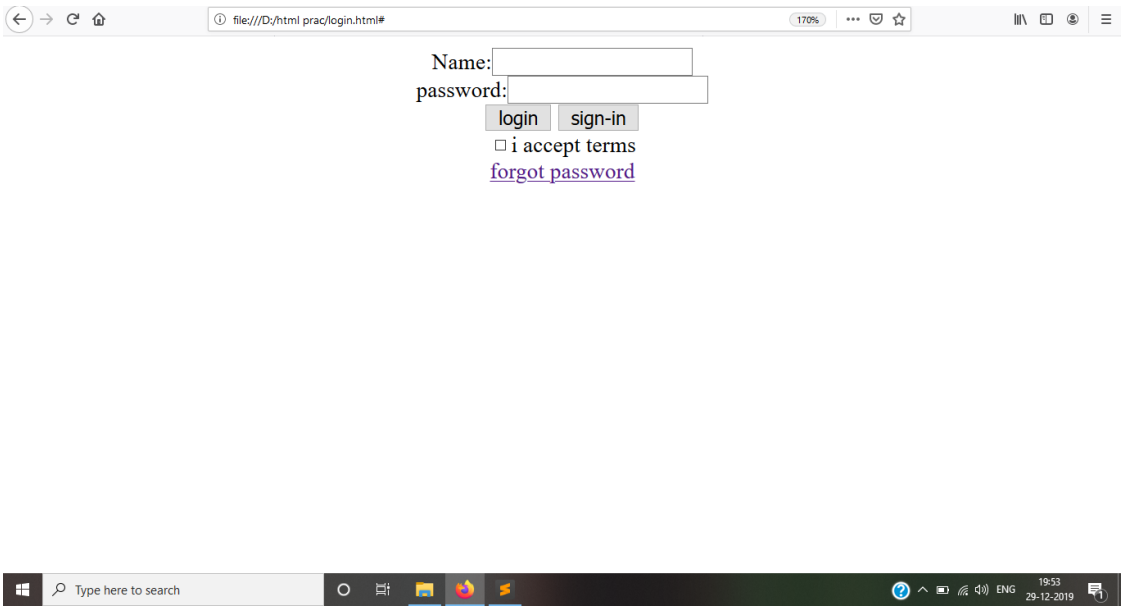

Figure 28. HTML only

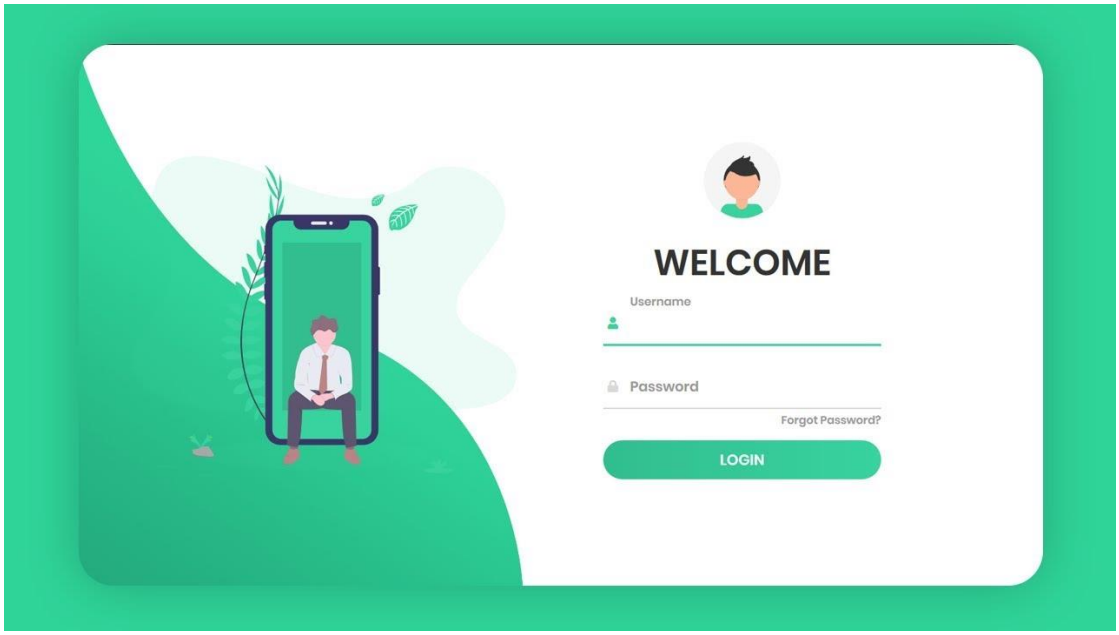

Figure 29. HTML with CSS

3. JavaScript Library.

jQuery is one of the most widely used JavaScript libraries. It allows JavaScript to modify the DOM more easily. A new generation of client-side developers has evolved as a result of its simple syntax and simple learning process. It may be claimed that jQuery is particularly important in the development of websites

because it is cross-browser compatible. Because of the appearance of jQuery plugins such as Image Slider and Pop-up Boxes, the web developer's work with jQuery is substantially reduced.

jQuery is often regarded as the greatest choice for creating strong websites that are cross-browser compatible. The popularity of jQuery is due to its key features, which include CSS-based DOM manipulation, event handling, and AJAX requests (Deering, 2010).

4. CSS Framework

Bootstrap is a powerful toolkit - a collection of HTML, CSS, and JavaScript tools for creating and building web pages and web applications. It is a free and open-source project, hosted on GitHub, and originally created by (and for) Twitter. After released in 2011, Bootstrap became popular very quickly, due to it is flexible and easy to work with. With Bootstrap, web developers can concentrate on the development work, without worrying about design, and get a good-looking website up and running quickly. Conversely, it gives web designers a solid foundation for creating interesting Bootstrap themes.

5. Conclude which Front End technologies will be used for the development

Based on the theory as well as the example the author gave above, the team decided to choose JavaScript as the main programming language. Initially, the team wanted to use TypeScript, because TypeScript is a more advanced version of JavaScript, it is designed to add more convenient functions, improving from the weaknesses of JavaScript. However, after several failed attempts to get along with TypeScript in terms of syntax and code, as well as the team that was used to using JavaScript before, the team decided to use JavaScript. In the project, the team used JavaScript for building functions, and some event handler such as onClick, … For team members, using JavaScript will help them to program better, easier to debug. For the author himself, the author will continue to learn about TypeScript in the future and will use TypeScript for upcoming applications.

Next, the team decided to use HTML/CSS and Bootstrap to build the front end of the website. Bootstrap allows the team build the application faster, especially in build front end since the teacher – Mr. Binh always track the working progress of the team, and the leader wants the group basically finish the application first and then build other additional requirements from Mr. Binh. The team has basic understanding of HTML, CSS and JavaScript, thus using Bootstrap is very easy with a plenty of templates,

themes, and tools that will help the team get started building the application. Moreover, to customize the templates in the team's way, the team use a little CSS to fit with the application requirements.

For the time being, the team intends to use rendering in the back end to connect the back end and front end. As a result, the website hasn't progressed in terms of API requests. Because all data is processed at the server, the first load is quick and straightforward to optimize with the Server-side Rendering approach. The client will just show. Server-side rendering works nicely with HTML and CSS. Not only that, but the author team is well-versed in HTML and CSS. Learning and mastering a new language in a short period of time is extremely challenging. As a result, the team chose HTML and CSS to develop the website in order to stay up with the project's timetable despite the significant quantity of labor. However, for the further development, the author's group plans to use API for the application, and apply some framework to improve the application such as Angular.js.

Chapter 3 - Back End technology stack

1. Backend Programming Language

1.1. Node.js

Node.js is a cross-platform runtime environment based on V8, an open-source JavaScript engine with outstanding performance. Node.js uses an event-driven, non-blocking I/O paradigm to provide high performance. It has garnered a lot of traction in the Node.js developer community in recent years. Node.js excels in creating fast, scalable network applications, with performance, development speed, and other advantages. Today's demands for processing and consuming real-time data are critical, and Node.js is lightning fast in multi-user real-time data scenarios (Dziuba, 2021).

1.2. PHP

PHP: Hypertext Preprocessor: An extremely popular scripting language that is used to create dynamic Web pages. Combining syntax from the C, Java and Perl languages, PHP code is embedded within HTML pages for server-side execution. It is commonly used to extract data out of a database on the Web server and present it on the Web page. Originally known as "Personal Home Page," PHP is supported by all Web servers and widely used with the MySQL database (PCMag, 2021).

2. Operating System

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

3. Web Server

(chua xong)

4. Database

4.1. MySQL

MySQL is a relational database management system based on SQL – Structured Query Language. The application is used for a wide range of purposes, including data warehousing, e-commerce, and logging applications. The most common use for MySQL however, is for the purpose of a web database. It can be used to store anything from a single record of information to an entire inventory of available products for an online store. In association with a scripting language such as PHP or Perl (both offered on our hosting accounts) it is possible to create websites which will interact in real-time with a MySQL database to rapidly display categorized and searchable information to a website user (Boyett, 2021).

4.2. MongoDB

MongoDB is an open-source document-oriented database that is designed to store a large scale of data and also allows users to work with that data very efficiently. It is categorized under the NoSQL (Not only SQL) database because the storage and retrieval of data in the MongoDB are not in the form of tables. It also provides official driver support for all the popular languages like C, C++, C#, and .Net, Go, Java, Node.js, Perl, PHP, Python, Motor, Ruby, Scala, Swift. Nowadays there are so many companies that used MongoDB like Facebook, Nokia, eBay, Adobe, Google, etc. to store their large amount of data (Saini, 2021).

5. Hosting

Nowadays, there are many hosting around the world such as Firebase, Azure, Heroku, and so on. 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 very flexible and easy to use, providing developers the simplest way to get their applications to market.

For instance, to deploy applications on Heroku, users only need to know a few commands on Heroku CLI and Dashboard. These commands are available in Heroku documentation.

6. Frameworks

Express.Js is one of the best backend development JavaScript Framework. The primary usage of it is creating Restful API's what accept request from frontend and send the appropriate response. Actually Express.js is a JavaScript library and with the help of it, users can build a backend. First, start an NPM project, install Express package, create models, routes, etc. A simple backend server is ready (Chris, 2020).

Express.js can reduce the coding time by half and still help us build efficient web applications. It not only reduces the time but it also reduces the effort required to build web apps with the help of its different features. Another reason to use Express.js is JavaScript. Express.js allows even beginners to enter the field of web application development because it supports JavaScript. JavaScript is very easy to learn for anyone even if they do not have any prior knowledge of any other languages. Therefore, Express.js allows young talent to enter the field of web app development and achieve success. 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).

7. Conclude which Back End technologies will be used for the development

Choosing programming language:

In the previous section, the author mentioned that Node.js is gradually becoming a hot trend among platforms used for developing backend applications. The Node.js developer community is growing rapidly. According to StackOverflow's 2020 developer survey (2020), over half of the respondents in the survey reported having used it in their projects.

Figure 30. StackOverflow's 2020 developer survey

Moreover, Uber, Trello, Netflix and many large enterprises use Node.js for their website/product. This shows that Node.js is a really powerful technology that meets the different user's requirements. With its famous, it is understandable when there are many company/organizations switch to use the Node.js for their website. There are millions of users and transactions every day, but Node.js is still favorite technology with enormous enterprises so that the information of user will always be secured and the scalability is robust. From these examples, the author came up with:

Firstly, Node.js provides a good scalability for the application. Thus, the team can use it for extending the system. Currently, the application is just the CMS website. However, with the power of Node.js, expanding the new features such as payment, attendance system, etc. or handle millions of requests per seconds is not a big deal in the future.

Secondly, one of the thorny problems of education management systems is congestion due to too much traffic at the same time (E.g., credit registration). To handle this, they usually upgrade the system. However, this will gradually go to waste when daily usage is not high, while usage spikes at some point. With Nodejs, the team was able to reduce the above problem because the Nodejs Web server is integrated directly at startup and the asynchronous mechanism. Nodejs can handle a huge number of user requests thanks to its asynchronous method. Non-blocking I/O also makes other tasks possible even when input-output tasks are active. Some critics argue that because Nodejs is a single thread, it will not perform as well as alternative backend solutions. Nodejs, on the other hand, has a problem-solving

package called Nodejs Worker. Nodejs may operate as a multithreaded language with non-blocking I/O by using virtual threads.

Thirdly, it is necessary to secure the information when storing them in the website. With the rapid development of hackers, it is extremely important that the team must secure the information of users, as well as tests score, exam topic, … because hackers can leverage them to do bad things.

Last but not least, the fact that Node.js employs JavaScript aids the team in maintaining a level of synchronization between the Backend and Frontend. When it comes to frontend frameworks, the majority of them employ JavaScript as their foundation.

With the above explanation, the author with the team decided to use Node.js for this project.

Choosing database:

There are 2 main choices for database: relational database systems (SQL) and non-relational database systems (NoSQL). In this project, the author's team decided to use NoSQL, and he will explain the team's choice.

First of all, it is the flexible data models. NoSQL databases typically have very flexible schemas. A flexible schema allows the team to easily make changes to the database as requirements change. The author's team can iterate quickly and continuously integrate new application features to provide value to their users faster. Especially with this project, which requires constant change to innovate and grow. With system expansion, database changes are inevitable. With MySQL, rebuilding a new database seems to take a lot of time, especially as it requires experienced people to keep the system running smoothly; MySQL has a rigid structure that needs complex engineering work for scaling purposes. On the other hand, NoSQL provides ease of database changes through flexibility in schemas. Moreover, It works well with **mongoose**, which allows the team easily manage the schema system.

Secondly, Most SQL databases require the team to scale-up vertically (migrate to a larger, more expensive server) when us exceed the capacity requirements of our current server. Conversely, most NoSQL databases allow author's team to scale-out horizontally, meaning they can add cheaper,

commodity servers whenever they need to. This is a really good thing to the company, because they can save a lot of money in developing application.

Thirdly, queries in NoSQL databases can be faster than SQL databases. Because data in SQL databases is typically normalized, so queries for a single object or entity require users to join data from multiple tables. As their tables grow in size, the joins can become expensive. However, data in NoSQL databases is typically stored in a way that is optimized for queries. The rule of thumb when the team use MongoDB is Data is that is accessed together should be stored together. Queries typically do not require joins, so the queries are very fast.

Finally, MongoDB is also an important part of MEAN stack, which the author mentioned in the previous part.

Choosing framework:

Express.js was introduced by the team's assessor – Mr. Binh since the last semester. After digging into Express.js, the team decided to choose Express.js is the framework for development. It is totally a suitable framework for the development of the application, which help development and maintenance and upgrades take place efficiently.

According to the survey of Stateofjs (2019), Express is ranked in the first place in many recent years when it comes to the satisfaction. This showed, and proved, how popular Express is with its capabilities and utility. Moreover, the author decided to choose the Express because it fits with the project as well as what the team has gained before learning this course. During the last semester, the author's group learnt about Node.js and know how to install and use Express. It helps the team does not waste much time for developing the application. Furthermore, Express also compatible with JavaScript.

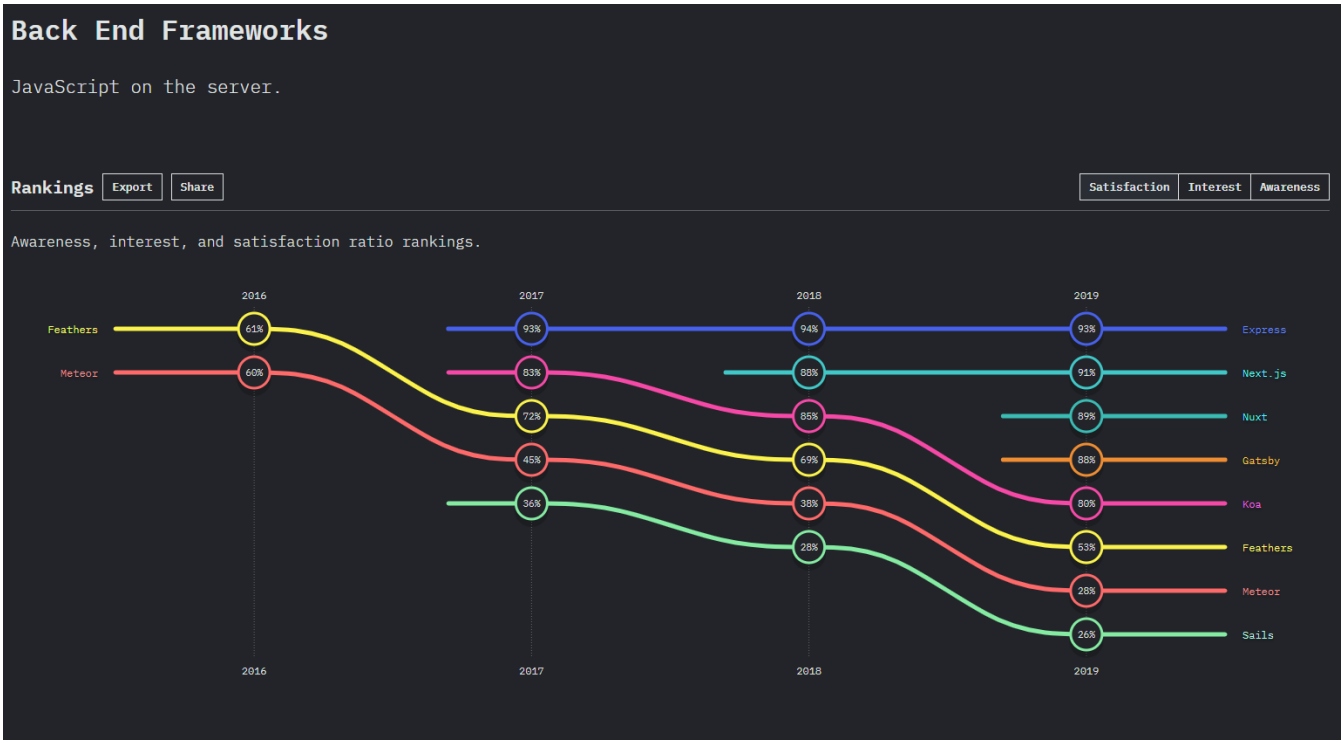

Figure 31. Express.js is the most satisfaction backend frameworks

The next reason is Express works by making use of middleware. Every route the author create with Express JS will have the option to supply a middleware. For example, in this project, the author creates a middleware called *isAdmin* to check if the user is admin or not. He can pass this middleware into the route and when it reaches that part, it will run the function for validating the role. With middle-wares, the author can make modular code that he can reuse all over the team's application that makes it easy for development.

```
router.get('/admin', isAdmin, adminController.getAdmin);

router.get('/admin/adminAddStaff', isAdmin, adminController.getAddStaff);
```

Figure 32. Middleware with express.js

Thirdly, the framework Express.js is very flexible that makes reliability as the pivot for the application to scale. Express JS comes with powerful features that can be achieved via the inheritance from Node JS. This framework will allow the developer to scale the applications in a better way. Express JS helps the developer's team with the addition of robust modules and resources. It allows the developers to produce

dependable web apps that will scale higher when new nodes are added. That's the reason why from Yummly to IBM and from Storify to MySpace, there are many enterprises that believe in the Express JS Framework.

Furthermore, because of the urgency of the application that the team decided to use Express.js framework. To quickly solve the problem of FPT, the company asked the team to build a new application as quickly as possible, because the lack of a management system would lead to difficult management for teachers as well as students, and staff in the management of students. Express JS happens to be minimalistic and offers quick development. Therefore, using Express.js helps in time response to the requirements of FPT.

On top of that, Express.js functions properly with others, particularly with the front-end Angular JS framework. It is already known to us that it happens to be a back-end framework that aids in the development of application architecture and server-side programming. Angular JS helps to develop front-end representations for the information stored in the database that one can access via Express JS. Thus, in the future, the application can be improved the front-end by working with another Angular.js developer without any conflict.

Finally, for the further development, Express.js is a good choice. It is an integral part of the MEAN stack, which is the combination of MongoDB, Express.js, Angular.JS and Node.js. It helps to building web-apps is very simple and easy to improve. The technology stack created around the frameworks which happen to be JavaScript-based has made the LAMP obsolete. It has likewise invigorated the entire development process with a more powerful database management system than traditional MySQL. The combination of Node JS and Express JS happens to be the backbone of the entire technology stack. Express JS is responsible for handling the user request parsed from the client-side utilizing Angular JS towards the server-side Node JS. It aids in partial processing and parsing of the requests along with access to the information from MongoDB.

Chapter 4 - Tools for source control management

1. Tools for source control management

GitHub is an open-source hosting repository service, kind of like a code cloud. In a number of different programming languages, it hosts the source code projects and keeps track of the different modifications made to each iteration. Other users of GitHub can check your code and suggest modifications.

2. Conclude which tools will be used for the development

The author's team uses GitHub because of its open-source advantages, tracking improvements across versions, community-reviewed code, creating and implementing a management strategy.

Chapter 5 - Software Development Models

1. Scrum

Scrum is a process framework used to manage product development and other knowledge work. Scrum is empirical in that it provides a means for teams to establish a hypothesis of how they think something works, try it out, reflect on the experience, and make the appropriate adjustments. That is, when the framework is used properly. Scrum is structured in a way that allows teams to incorporate practices from other frameworks where they make sense for the team's context.

The Scrum model's whole framework is driven at the team level. It does not focus exclusively on individuals, but rather on individuals working together as part of a team to achieve a good end result.

Advantages of Scrum:

There are two big pros of implementing Scrum method in any organization. The first one is that Scrum teams complete their projects of a much higher quality. The second biggest advantage of using Scrum is that it ensures that Scrum teams operate in the most efficient manner possible. Scrum methods make keeping track of these elements much easier because they break down big tasks into smaller, more workable parts and teams have a much more relatable approach to completing them.

Another aspect of Scrum is their daily Scrum meetings that the Scrum team engages in. This helps the entire team keep track of each iteration's progress and find any hiccups they may face early on into the

project. This also showcases the tasks each team member has completed daily, so there is more validation for their hard work.

2. Waterfall

The Waterfall Approach was the first SDLC Model to be widely utilized in Software Engineering to ensure project success. The entire software development process is separated into several phases in "**The Waterfall**" technique. Typically, the output of one phase serves as the input for the following phase in this Waterfall approach (Tutorialspoint, 2021).

However, once an application has errors in the previous stage, it is very difficult to go back and change something that was not well-thought out in the concept stage.

3. Conclude which SDLC model will be used for the development

In terms of SDLC model, the author's group decided to use Scrum over Waterfall. This project is an extensible system, the functions are not clear in the early stage. Besides, in the process of working, new functions are added continuously. Thus, there are many risks that can harm the system. However, with the scrum, the risk can be reduced in each time of meeting. Before adding any functions, or expand the application, the team will always participate meeting to make a plan about the implementing. If there is any potential risk, the team member just adds a new task in "To-do" on Trello. It helps the leader easily keep track the working progress and avoid the risk easily. In contrast, Waterfall is potentially high risk. If some risks occur in the previous stage, it is very difficult to go back and change. That's the reason Waterfall is not suitable for complex projects that have a lot of change in requirements over the development lifecycle.

Secondly, it optimizes the team's efficiency and efficacy. The task elements are assigned by the team to the team members. The team 15 minutes meeting each day called daily meeting or daily scrum, where each member of the team answer three simple questions:

- What have I done yesterday?
- What am I going to do today?
- Which problems do I have or what is blocking my work?

This information lets the team know what's doing each member, the level of progress and the problems that have arisen. The actions to correct the possible altered course are taken in this meeting through inspection and adaptation of the daily work. The team is cross-functional and self-organized, so any member must help in any task needed, either he/she is an expert or not. The team as a whole must have all the skills needed to develop the product, but how it's internally organized is only up to the team. This increases the team feeling of each member, the team's cohesion, and each member can grow professionally in areas where he/she is not an expert. Moreover, the efficiency and efficacy of the Scrum team as a whole are optimized.

Thirdly, by updating the product day by day, Scrum also lets the customer to use the product earlier. This can be achieved when the team needs to demo the application to the assessor to show him the working progress of the team. Mr. Binh also gives advices for the team to get the application better. During the working progress, the team had misunderstanding about the requirements. Using scrum enable changes based on feedback a lot more easily.

Finally, dividing the large task into smaller task help the team carry out tasks easily without misunderstanding. What's more, it makes it easy for team leaders and instructors to check progress.

IV. Conclusion

The author outlined the essential stages for creating a website, as well as tools, languages, and software to aid project management. The author has also strengthened cooperation skills by monitoring and observing the members' actions and work. The author, in particular, knew how to make SRS records, which are one of the most critical and vital documents in the workplace.

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