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មូលន័យសង្ខេប

ក្នុងអំឡុងកពេលធ្វើកម្មសិក្សារយះពេល៣ខែ បន្ទាប់ពីបានបញ្ចប់ការសិក្សាឆ្នាំទី៥របស់ខ្ញុំនៅវិទ្យាស្ថានបច្ចេកវិទ្យាកម្ពុជា គ្រប់សិស្សានុសិស្សទាំងអស់រួមទាំងខ្ញុំផងដែរគឺមានកាតព្វកិច្ចត្រូវចុះកម្មសិក្សាក្នុងគោលបំណងធ្វើការអនុត្តជាក់ស្តែងនូវអ្វីដែលខ្ញុំបានសិក្សានៅសាលាកន្លងមក។ របាយការណ៍នេះបានផ្តល់ឱ្យមាននូវព័ត៍មានលំអិតនៃការ​ចុះកម្មសិក្សារបស់ខ្ញុំនៅវិទ្យាស្ថានបច្ចេកវិទ្យាកម្ពុជា ៣ខែ ដែលបានធ្វើឡើងចាប់ពីថ្ងៃទី​ ១៣​ ខែកុម្ភះ ឆ្នាំ២០២២ ដល់ថ្ងៃទី ១៣​ ខែឧសភា ឆ្នាំ២០២៣។​​ ប្រធានបទកម្មសិក្សារបស់ខ្ញុំគឺ **ប្រព័ន្ធគ្រប់គ្រងបណ្ណាល័យ** ដែលជាប្រព័ន្ធមួយសំខាន់ ដែលប្រើនៅក្នុងសាលាដែលបានបង្កើតឡើងក្នុងគោលបំណងដើម្បីផ្តល់នូវគេហទំព័រមួយសម្រាប់ការគ្រប់គ្រង់ដំណើរការចុះឈ្លោះសិស្សនិសិត្សដែលចូលបណ្ណាល័យ។

**ប្រព័ន្ធគ្រប់គ្រងបណ្ណាល័យ ​**គឺជាគេហទំព័រមួយដែលត្រូវបានបង្កើតឡើងក្នុងគោលបំណងផ្តល់នូវមុខងារសំខាន់ៗ ដែលអនុញ្ញាតិឱ្យអ្នកប្រើប្រាស់អាចគ្រប់គ្រង់ទិន្នន័យបេក្ខជនទាំងអស់ដោយសំរួលការរក្សារទុក្ខជាក្រដាស់។ មួយវិញទៀតអ្នកប្រើប្រាស់អាចត្រួតពិនិត្យការចុះឈ្មោះរបស់និសិត្សជាប្រចាំថ្ងៃ និងអាចធ្វើការទាញយកទិន្នន័យសិស្សនិសិត្សជារបាយការណ៍ និងក្រាហ្វ។ មិនត្រឹមតែប៉ុណ្ណោះអ្នកប្រើប្រាស់អាចធ្វើការរក្សាទុក្ខព័ត៌មានសៀវភៅទៅតាមទីកន្លែង និងតាមដេប៉ាតឺម៉ង់បានផងដែល។ លើសពីនេះក៏អាចបញ្ចូលទិន្នន័យជាឯកសារ Excel បានផងដែរ។

គម្រោងនែកម្មវិធីគេហទំព័រមួយនេះត្រូវបាយអនុវត្តនៅក្នុងភាសាសរសេរកម្មវិធី Node JS ដោយប្រើប្រាស់ហ្វ្រេមវើក (Framework) Express JS។ សម្រាប់ការគ្រប់គ្រងទិន្នន័យនៃប្រព័ន្ធនេះត្រូវបានអនុវត្តជាមួយជាមួយ MYSQL និង សម្រាប់ខាងផ្នែកការបង្ហាញទៅកាន់អ្នកប្រើប្រាស់ត្រូវបានអនុវត្តជាមួយ Vue JS។

ជាលិទ្ធផលនៃការចុះកម្មសិក្សានេះ បច្ចុប្បន្ននេះកំពុងស្ថិតក្នុងការអភិវឌ្ឍន៍បន្ថែមដើម្បីអោយកាន់តែប្រសើរមុន។ ហើយគេហទំព័រនិងដាក់ប្រើប្រាស់ជាផ្លូវការក្នុងបណ្ណាល័យឆាប់ៗ។

RÉSUMÉ

Pendant le stage de trois mois après avoir terminé ma cinquième année universitaire à l'Institut de technologie du Cambodge. Tous les étudiants du département d'ingénierie de l'information de la technologie et de la communication et moi-même avons été obligés de faire un stage pour appliquer ce que j'ai appris à l'école dans la pratique. Dans ce rapport, on donne les détails de stage qui commencent du 13 Février jusqu’à 11 Mai 2023 à l'Institut de technologie du Cambodge. Pendant les stages, le projet que s’appelle “Library Management System” dont l’objective est fournir un réseau d’application pour contrôler les candidates information et examiner les candidates quand ils appliquent les stages et travailler dans cette entreprise.

Le système est un projet d'application web développé pour offrir des fonctionnalités utiles aux utilisateurs afin de gérer toutes les informations des étudiants et leur présence lorsqu'ils rejoignent la bibliothèque. Une autre fonctionnalité permet aux utilisateurs de contrôler les données des étudiants chaque jour et de télécharger les informations sous forme de graphiques et de fichiers CSV. De plus, les utilisateurs peuvent stocker des informations sur les livres liées à leur emplacement et à leur département. L'une des principales fonctions du système est de télécharger des informations sur les étudiants à partir d'un fichier Excel.

Ce projet de plate-forme est exécuté en le programme de Node JS avec Express JS Framework utilisation. Pour les bases de données de ce système, ils permettant avec MYSQL et pour Client side I utilisent dans Vue JS.

Le projet suite de ce stage, il est actuellement en cours de développement pour s'améliorer. Et le système sera bientôt officiellement lancé dans la bibliothèque Stem.

ABSTRACT

During the three-month internship after ending my fifth academic year at the Institute of Technology of Cambodia. All students of the Department of Information of Technology and Communication Engineering and I were obliged to undergo an internship to apply what I have learned in school into practice. This report drives into detail of internship which took place between 13 February and 11 May 2023 at the Institute of Technology of Cambodia. The project during the internship concerns the “**Library Management System**” whose object is to provide a web application platform for controlling the candidate information and candidate attendance when they join the stem library.

The system is a web application project developed to provide useful features for users to manage all student information and attendance when joining the library. Another feature allows users to monitor student data each day and download the information as graphs and CSV files. Additionally, users can store book information related to their location and department. One of the main functions of the system is to upload student information from an Excel file.

This web platform project is implemented using the Express JS framework in Node JS language. The system's database is implemented with MYSQL and Vue JS is implemented on the client side.

As a result of this internship, it is current it is currently being further developed for the better. And for the system will be officially launched in the Stem library soon.

INTRODUCTION

As engineering students of the Department of Information and Communication Engineering at ITC, the students are required to take an internship for thesis defending before graduation, so they can apply the knowledge that has learned from school as well as acquire new knowledge both soft and hard skill from a company, organization or somewhere else.

Technology offers us many innovations from day to day, especially smartphones, laptops, and desktops which contain modern browsers. Nowadays, there are several platforms of browser applications in the market like Google Chrome, Microsoft Edge, and Apple Safari that offered the use and develop many types of websites. Through this evolution, during my internship, I decided to develop a website application. Otherwise, I applied knowledge, I got from my adviser, about design patterns to prove the lesson theory.

The year fifth internship required students to hold an acceptable project considered by their adviser. Meanwhile, project management at STEM Library needs a system to help the administrator manage their attendance easier than usual. The system creates for managing users’ information and attendance when they do join the library. Moreover, this application is built using to manage book information related to location and department that is easy to find and put back.

As a result, a project manager has proposed a project on the Web application “Library Management System” to meet these constraints to facilitate users to manage their system in STEM Library.

This is the final internship report such a thesis divided into 7 chapters. The first is the general presentation of the internship project and information about the place where I took it to build this application. The second focuses on the internship project presentation that I work on during three months internship. Third is the analysis of project ideas, conception, and design that talk about main functional requirements and optional functional requirements. Fourth talk about technology and tool that I use. The Fifth is focused on project implementation. The last one is the conclusion.

# GENERAL PRESENTATION OF INTERNSHIP

## Introduction

The Institute of Technology of Cambodia (ITC) is a Cambodian Higher Education Institution which was founded in 1964 and supported by cooperation between Cambodia and the former Soviet Union. More than 10000 executive members have graduated from ITC. They are currently working intensely on the economic and social infrastructure development of Cambodia. In 1993, the Cambodian and French governments agreed to renovate ITC to improve the performance of the administration and financial services along with the educational system of the institution and the human resources.

The goal of ITC is to provide students with a high-quality education in the fields of engineering sciences and technologies. Students are provided with technical know-how and skills of analysis which allow integration and evolution in the labor market. To achieve this, academic and international scientific research requires development.

Besides academic activities, ITC contributes to maintaining sustainable development and decreasing the inequalities within society through its internal functioning and opening up to foreign countries and the way their students get admitted.

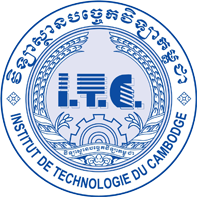


Figure 1: ITC Logo

## Department of Information and Communication Engineering

The Institute of Technology of Cambodia consists of eight engineering departments, including Information and Communication. Department of Information and Communication Engineering provides training in both fundamental and advanced methods and tools of modern computing. Train engineers and masters in IT who can evolve and adapt to new technologies and methods of computing such as software engineering, mobile, and web application development, databases, networks, Management of Information Systems, multimedia, etc. DICE currently cooperates with foreign universities and also some companies to ensure students will have the opportunities to get scholarships to continue further studies and also work with professionals to gain their experiences.

## Address and contact

* Address: PO Box 86, Russian Conf. Blvd Phnom Penh Cambodia.
* Tel: (+855) 23 880 370
* Email: [**info@itc.edu.kh**](mailto:info@itc.edu.kh)
* Website: <https://itc.edu.kh/>
* Location: Show in *Figure 2*

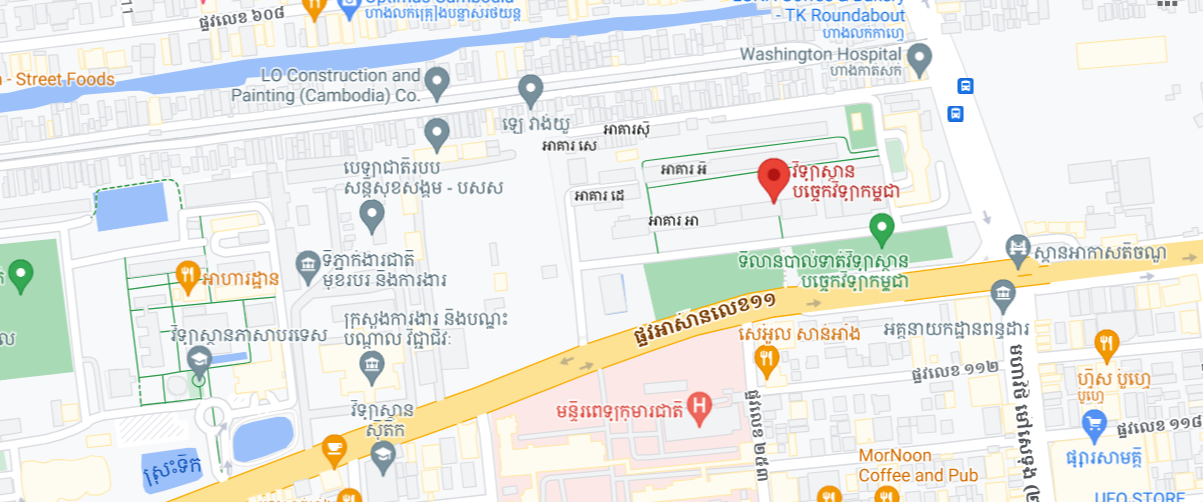


Figure 2: ITC Location

# THE INTERNSHIP PROJECT PRESENTATION

During the internship of three months at ITC, I work on a project called “Library System”, which is a web application developed to manage student information, attendance, and book information. The project is a new project at ITC.

## Structure

The internship and project development was guided and assisted by:

* Academic Supervisor: Mr. SOK Kimheng

Lecturer in the Department of Information and Communication Engineering

* Project Advisor: Mr. SOK Kimheng

Manager Library

## Problem overview

The reason that we propose to build this system is that we found many difficulties whenever there is a new candidate who wants to join the library.

* The attendance register is using Excel difficult to input and increase rows.
* Difficult to keep historical records of candidates after they join the library
* Cannot export data daily, weekly, monthly, and yearly
* Cannot manage student information and their payments every year
* Wasted time finding books for students borrow and to put them back in position

## Objective

To develop a web application called “Library Management System” to solve many problems such as:

* Accurate attendance tracking: an automated system can accurately record the attendance of students visiting the library.
* Can export student library cards that have a barcode easy to scan when they join the library.
* It can calculate the total of students visiting the library daily, weekly, monthly, and yearly
* Analysis attendance data: can provide a good usage to export data by select date. Can make decisions regarding exporting Excel and bar charts.

## Software development life cycle

### Waterfall

As shown in Figure 3, to realize a project, it is necessary to carefully choose a great and suitable development methodology. As a result, the Waterfall methodology was chosen for developing this project, because the project is respectful to an approach, define-before-design, and design-before-code. Moreover, the methodology works well on this project with limited development time.

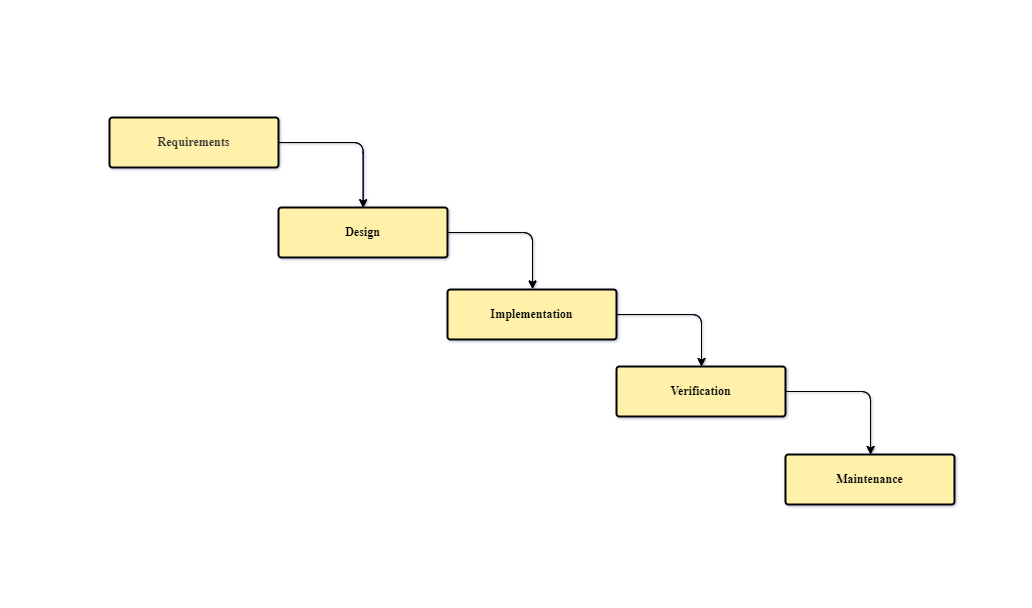
* Requirement: I had to understand the objective, functionalities, and what needs to be designed.
* Design: for this stage, I studied the requirement specification and prepare for the system design.
* Implementation: the whole web application was divided into tasks where each of which needed to be finished by coding and testing
* Verification: all of the tasks were integrated to get a complete application. And the web application is needed to do testing to find out about the errors or flaws.
* Maintenance: as a web developer, I have to check the report from the user and fix the error that has occurred.

Figure 3: Waterfall methodology

## Planning

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Tasks** | **Weeks** | | | | | | | | | | | | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| Get the requirement |  |  |  |  |  |  |  |  |  |  |  |  |
| Define the project scope |  |  |  |  |  |  |  |  |  |  |  |  |
| Wireframing and prototype |  |  |  |  |  |  |  |  |  |  |  |  |
| Implement |  |  |  |  |  |  |  |  |  |  |  |  |
| Testing and Bug Fix |  |  |  |  |  |  |  |  |  |  |  |  |
| Prepare for deployment |  |  |  |  |  |  |  |  |  |  |  |  |

*Table 1: Planning table*

As shown in Table 1, during my twelfth-week internship at ITC, I spent the first week meeting with clients to gather requirements and define the project scope. After obtaining the project scope, I dedicated two weeks to designing the wireframes and prototypes. Starting from the fourth week, I began implementing the front-end and back-end, which continued until the ninth week. Once I completed the implementation, the client and I conducted testing together to verify the tasks I had accomplished. I spent two weeks resolving bugs and also preparing documents and setting up the environment for deployment and release.

# PROJECT ANALYSIS, CONCEPTION, AND DESIGN

In this section, I begin to identify all the main functional requirements and optional functional requirements of the system.

## Case study of requirement

### Project requirement

The Library Management System is designed with two different user roles, each having specific functions assigned to them. The table below illustrates the roles and their corresponding functions:

|  |  |  |
| --- | --- | --- |
| **User** | **Functional** | **Description** |
| Admin | CRUD user | The admin can create, read, update, and delete users from the system. |
| CRUD candidate | The admin can create, read, update, and delete candidates from the system. |
| CRUD candidate type | The admin can create, read, update, and delete candidate types from the system. |
| Upload data as an Excel file | The admin can upload student information as an Excel file |
| CRUD department | The admin can create, read, update, and delete departments from the system. |
| CRUD department option | The admin can create, read, update, and delete department options from the system. |
| Generate student card | The admin can generate and export student card as image |
| CRUD book | The admin can create, read, update, and delete book information from the system. |
| Admin | CRUD book location | The admin can create, read, update, and delete book locations from the system. |
| Find book | The admin can find a book by item code and update book information |
| Add the book to department | The admin can add the book to each department easy to manage and find when students borrow. |
| Generate report | The admin can generate reports in Excel and Bar chart |
| Login authentication | The system requires admin for login before using the feature |
| Candidate | Register attendance | Candidates can register attendance when they join the STEM library |

Table 2: Project requirement table

### Non-functional requirement

Non-functional requirements refer to aspects of a system that focus on its qualities and characteristics rather than specific functions. Here are the corrected descriptions of the important non-functional requirements you mentioned:

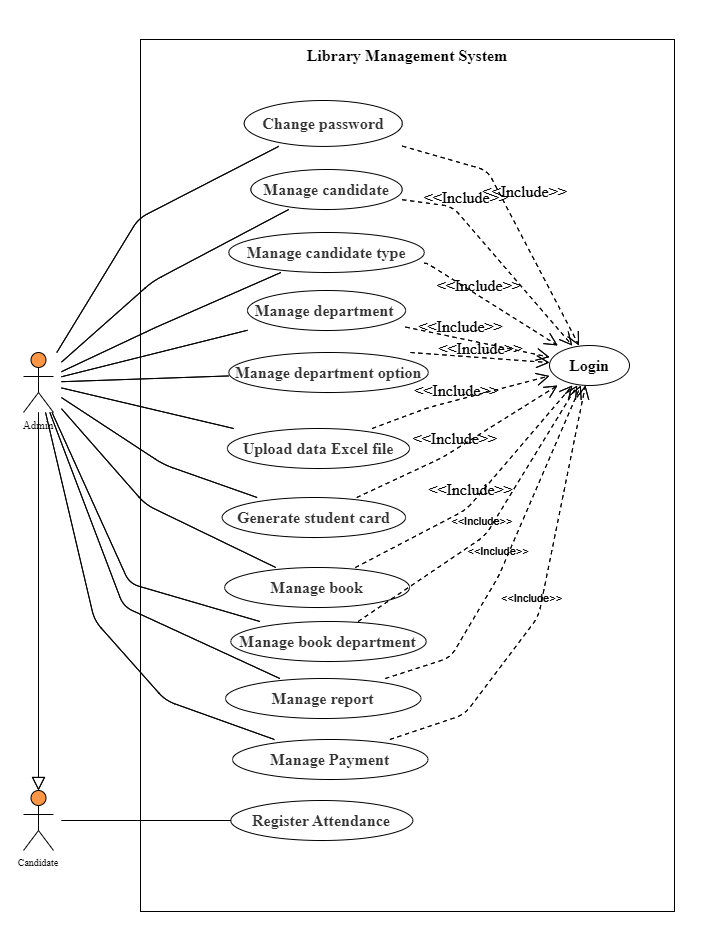
* Clean code: It is important to ensure that our code is clean and well-organized, facilitating future development by other individuals.
* Performance: Ensuring that the website operates smoothly and efficiently, without any errors, is of utmost importance.
* Stability: The website should run reliably and consistently, without encountering errors, slowdowns, or data loss.
* Security: Strengthening website security is crucial to prevent unauthorized access and data breaches.
* Maintenance: Detecting and addressing errors or mistakes promptly enhances the overall quality and reliability of the application.

## Project analysis

In this section, I will begin utilizing a UML diagram, which is a standardized language used to visually model processes or designs within a software-based system.

### Use case diagram

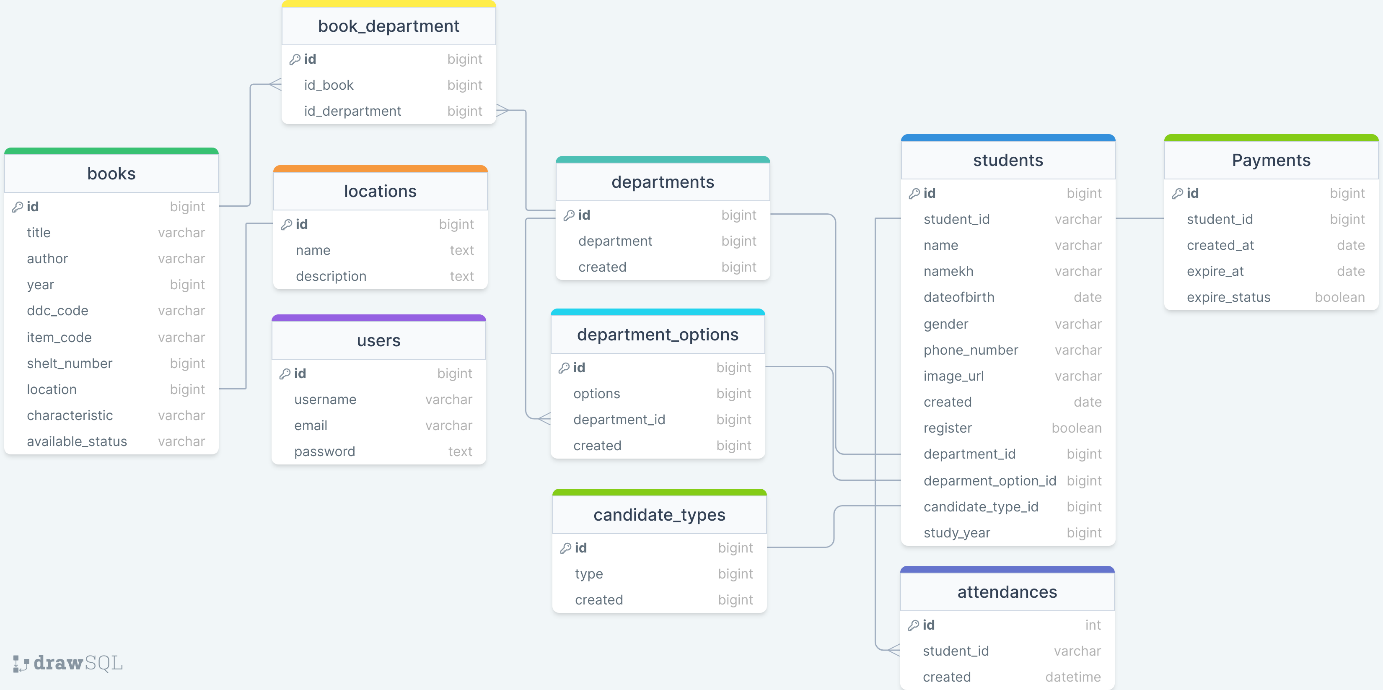
The use case diagram is important for defining and validating the required features in our application. Each use case box represents an important module that is implemented and contains other features within it. There are two types of users: candidates and admins. Candidates are not required to log in, whereas admins must log in before accessing all functionalities. The following figure is the use case diagram of a “Library Management System”.



*Figure 4:Use case diagram Library Management System*

### Database schema

After analyzing the main functions of the project, I have identified the required entities and their corresponding categories in the different database tables. By conceptualizing the association entity and the relational model, I can determine the relationships and cardinalities between each table. Furthermore, I can define the conceptual data model by specifying the attributes within each entity. The following figure is a design database schema that can represent the system:



*Figure 5: The database schema*

### Activity diagram

#### Add new user diagram

Figure 6 depicts an activity diagram for the process of creating new candidates by users. To create a new user authentication, administrators are required to first log in to the system. Upon successful login, administrators gain access to the "User Management" feature within their profile. They can then proceed to input the necessary data of the new user and click the "Submit" button to finalize the process.

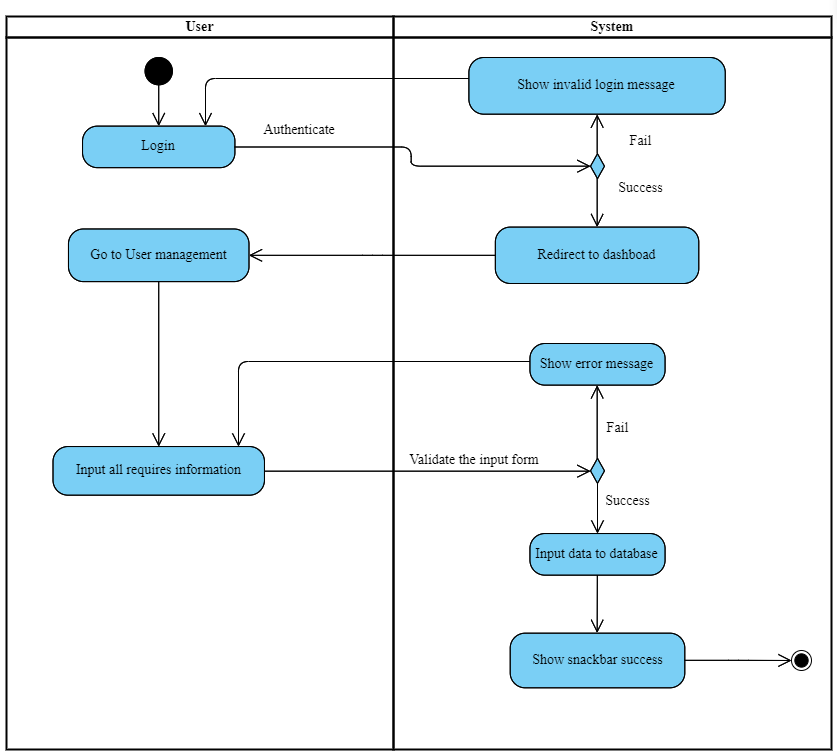


Figure 6: Activity diagram of adding new user

#### Add new candidate diagram

Candidates' information holds significant importance for the system, as it is necessary for users to input their ID and verify their details before joining the library. To create a new candidate, the initial step is for the administrator to log in. Once logged in, the system redirects the administrator to the dashboard. From there, the admin can navigate to the candidate page and click on the "Create candidate" button. Then the user is required to input essential information such as student ID, first name, last name, candidate type, department, department option, and year. Finally, upon clicking "Save," the system will display a success alert if the data is valid; otherwise, it will show an error alert.

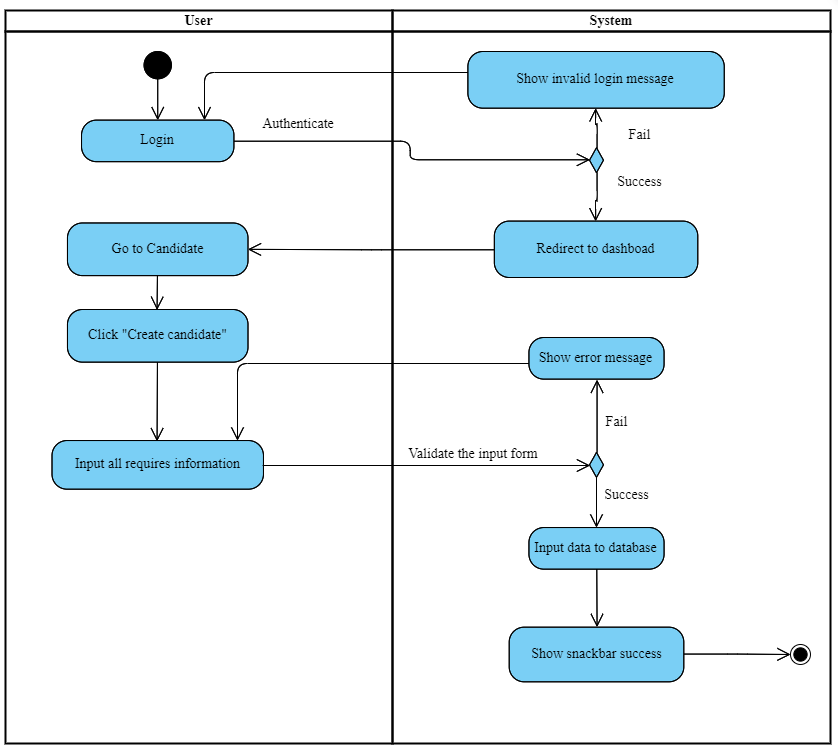


Figure 7: Activity diagram of adding new candidate

#### Register attendance

As shown in Figure 8, the activity diagram illustrates the sequence of steps to register attendance. The first user accesses the system. Before they can proceed with the registration, they need to ensure that their data has already been created as a candidate. To register attendance, users do not need to log in; instead, they simply navigate to the home page and enter their ID. The ID can be entered as a number, for example, "20180328," or input in full format as "e20180328." Once they have inputted their ID, they can either press "Enter" or click the submit button. After verifying the existence of information associated with the ID, the system will display a success alert. Alternatively, if the ID is not found, the system will display an alert indicating the absence of the ID.

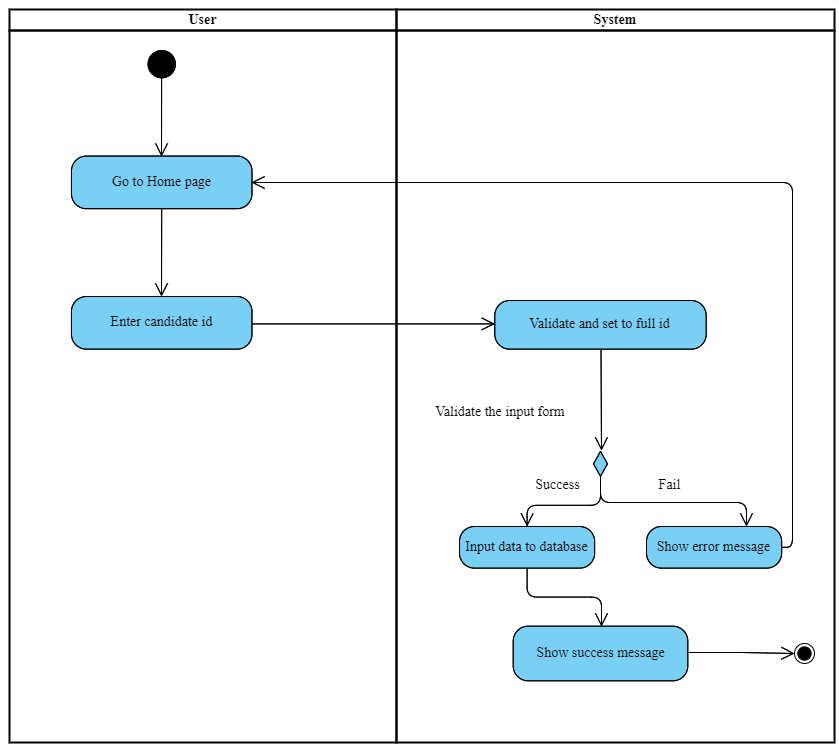


Figure 8: Activity diagram for register attendance

#### Add the book to department

To add the book to a department, the admin needs to log in to the system first. Once logged in, the user will be redirected to the book page. From there, they can click on the "Settings" option and select the book department. The user should choose the department to which they want to add the book. After selecting the department, the system will redirect them to the book department page, which displays a list of books in that department. To add a book, the user can click on the "Add Book" button, select the book they want to add to the department and click "Submit." Upon submission, the system will insert the data into the database. If the operation is successful, it will display a success message as shown in the figure 9.

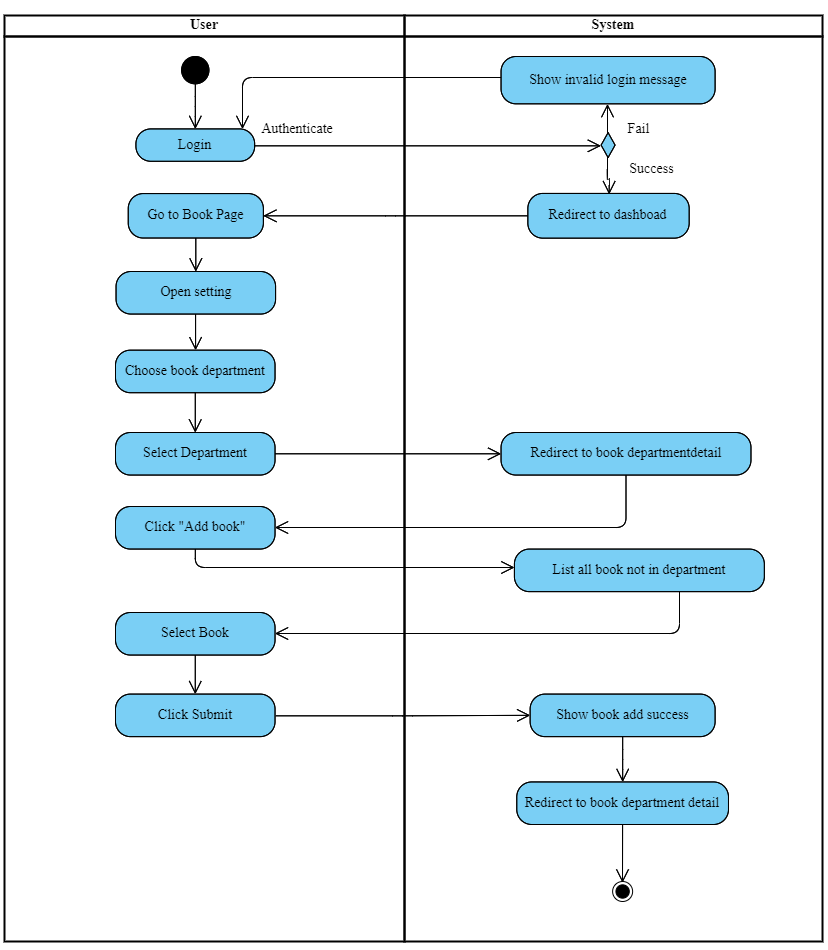


Figure 9: Activity diagram add book to department

# TECHNOLOGY AND DESIGN

## System and Design

### Physical architecture

The physical architecture of the system is described below in Figure 10 and the explanation of each of the following components.

* Client side: Users access the system through a web browser. They interact with the system by sending HTTP requests to the web server.
* Web Server: The web server receives the HTTP requests from clients and processes them. It uses Node.js, which is a JavaScript runtime environment, along with an instructs framework and makes communication with the database server.
* Database Server (MYSQL): This component is responsible for storing and managing the data for the system. MYSQL is a popular open-source relational database management system. When the web server receives a request that requires data retrieval or modification, it generates the corresponding SQL query to interact with the MYSQL database server. The query is then executed on the database server, and the results are sent back to the web server.

In summary, the client accesses the system via a web browser and sends HTTP requests to the web server. The web server processes these requests using Node.js and an instructs framework, generating JSP files for the web view. The database server (MYSQL) stores and manages the system's data, and the web server communicates with the database server by generating and executing SQL queries.

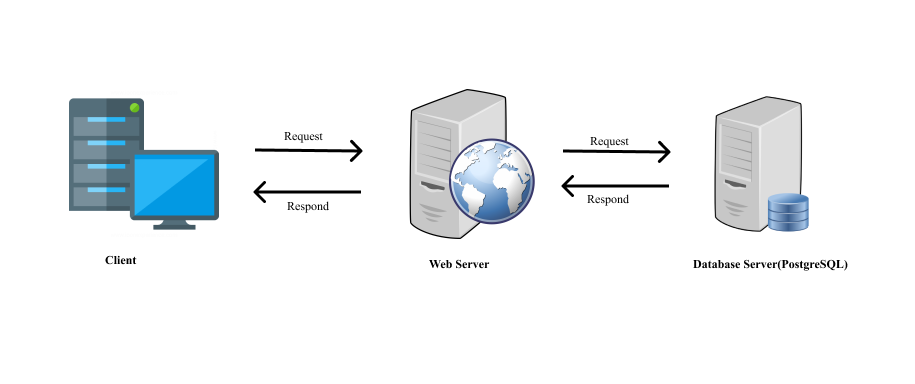


Figure 10: Physical architecture of application

### Logical architecture

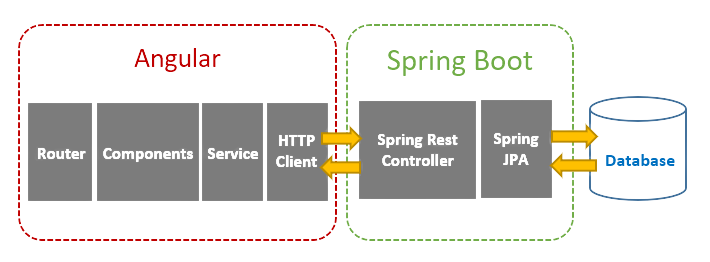
The logical architecture as shown in Figure 11 describes the idea of how the structs framework uses MVC structure to build the web application with Node JS as API and Vue JS as Front-end.

Figure 11: Logical architecture of application

* Node.js is a runtime environment built on the V8 JavaScript engine, which allows you to run JavaScript on the server side. It follows a single-threaded, event-driven, and non-blocking I/O model, making it highly scalable and efficient for building server-side applications. The logical architecture of a Node.js application typically consists of the following components:
  + Routes: define the API endpoint and handle incoming HTTP requests
  + Middleware function: Process incoming requests before they reach the route handles
  + Controller: contain the business logic for processing requests are generating response
  + Models: Represent the data structure and interact with the database
* Vue.js is a JavaScript framework for building user interfaces. It focuses on the view layer of the application and provides tools for building reactive and component-based UIs. The logical architecture of a Vue.js application typically includes the following components:
  + Route: define the end point of the page
  + View: for displaying the user interface when an incoming request from the router
  + Service: can communicate with external APIs or backend services through HTTP requests or WebSocket connections.

## Framework and Technology

Node JS [1] is an open-source, server-side runtime environment that allows developers to run JavaScript code outside of a web browser. It is built on the Chrome V8 JavaScript engine and provides an event-driven, non-blocking I/O model, making it efficient and lightweight for building scalable network applications.

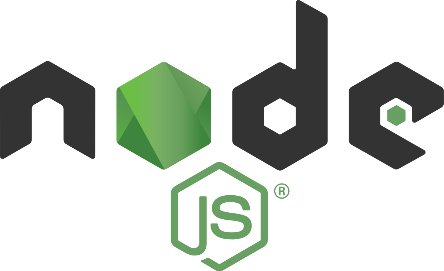


Figure 12: Node JS logo

HTML [2] is used to put the structure of a website together for documents designed to be displayed in a web browser. CSS [3] acts as makeup for HTML where it improves the user interface such as the color and layout of a website structure build with HTML. JavaScript [4] is a full-on programming language that adds interactivity and functionality to a website.



Figure 13: HTML, CSS and Javascript

Vue JS [5] is an open-source JavaScript framework for building user interfaces (UIs). It is often referred to as a progressive framework because it can be incrementally adopted into existing projects or used to build full-fledged single-page applications (SPAs). Vue JS focuses on the view layer of an application and aims to simplify the development of interactive web interfaces. It provides a set of tools and features that enable developers to create reusable components and efficiently manage the state and behavior of their applications.



Figure 14: Vue JS logo

Vuetify [6] is a popular open-source UI component framework for Vue.js. It provides a set of pre-styled, reusable UI components that developers can easily integrate into their Vue.js applications. Vuetify follows the Material Design guidelines, offering a modern and visually appealing UI design.

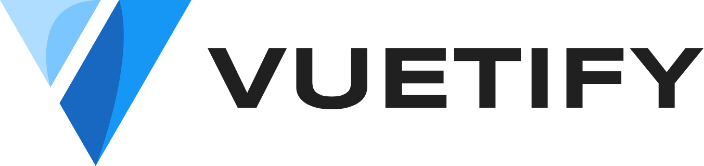


Figure 15: Vuetify logo

MYSQL [7] is one of the most popular and widely used open-source relational database management systems (RDBMS). There are several reasons why MySQL is commonly used and its importance is known for its ease of installation, configuration, and management. It has a straightforward setup process and provides user-friendly command-line and graphical interfaces, making it accessible to developers of all skill levels.



Figure 16: MYSQL logo

## Version control system

In the programming field such as web development, vision control is a type of practice that tracks and provides control over changes to source code. I chose GitHub [8] for project version controls. For my project, version control is very important because it helps me to manage my project. I can store my source code every time I complete any functionality. Easy to get it back when writing something wrong in my project. Additionally, I can create an additional branch to store our code. Because it my project there are 3 main folder projects is API, admin panel, and candidate panel.



Figure 17: GitHub logo

## Tools

IntelliJ IDEA [9] is a type of the best IDE. Integrated Development Environment is Intelligent Coding Assistance for web development because it provides on-the-fly error prevention, best auto completion and code refactoring, zero configuration debugging, and an extended HTML, CSS, and JavaScript editor. Intellij has many features but the best three features are interesting and we decide to use them.

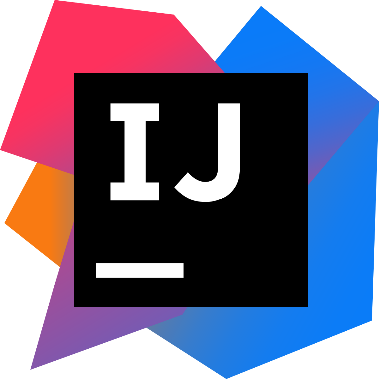


Figure 18: InterlliJ logo

Visual Studio Code [10] is a standalone source code editor that runs on Windows, macOS, and Linus. The top pick for Website development, with more extension support. I used it because it works fast for my computer and can create and compile the project like other tools.

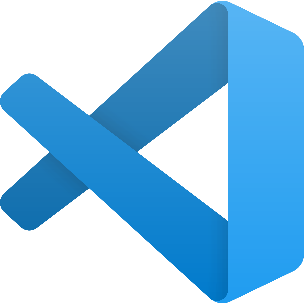


Figure 19: VS code logo

Postman [11] is an API platform for developers to design, build, test, and iterate their APIs. It is an HTTP client that tests HTTP requests, utilizing a graphical user interface, through which we obtain different types of responses that need to be subsequently validated. I used Postman for testing project API after I build it completely in each functionality before, I integrate it with the front end. When we have the swagger configuration in our project, we just import the link of our API description, it generates all the requests for us to test easily.



Figure 20: Postman logo

XAMPP Control panel [12] is a popular software package that simplifies the setup and management of a local development environment for web applications. It includes Apache HTTP Server, MySQL database, PHP, and Perl, allowing developers to easily run and test their web projects on their own computers before deploying them to a live server.

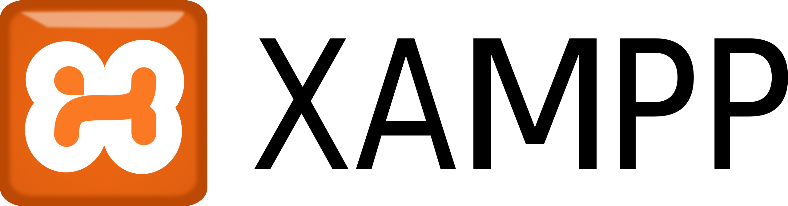


Figure 21: XAMPP control panel logo

Heidi SQL [13] is an administration MYSQL tool. We use it to design, back up, restored, and manage databases. It works well and easy to manage the data in my database. It can generate queries for me to select, create, update, and delete. An important control on data is that we can back up the data as a file from the tool and we can restore it, so our data is secure.



Figure 22: Heidi SQL logo

# PROJECT IMPLEMENTATION

This section, detail the implementation of the project during the internship. I explain how to set up tools and technology, project implementation, and installment.