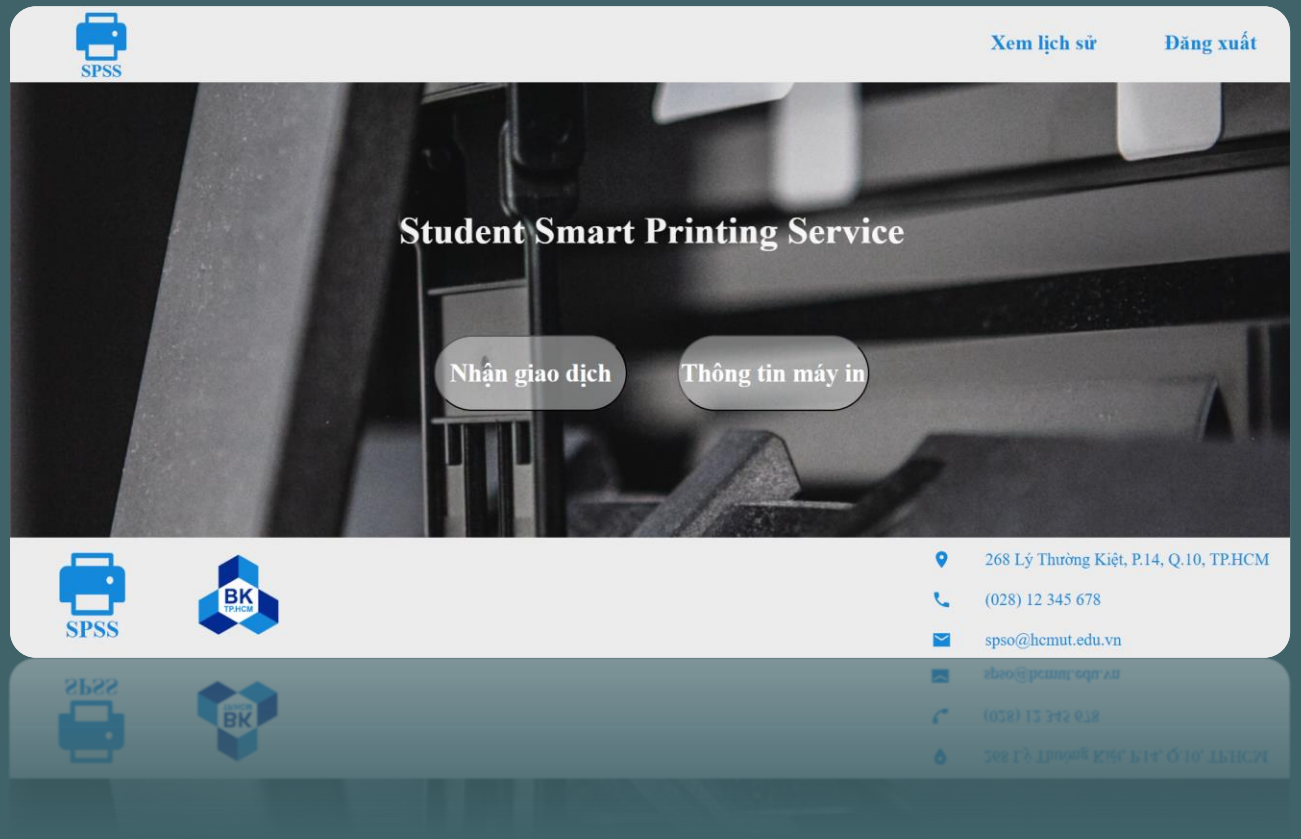
A Smart Printing Service for Students at HCMUT



Class CC01 – Group 12

Team Members

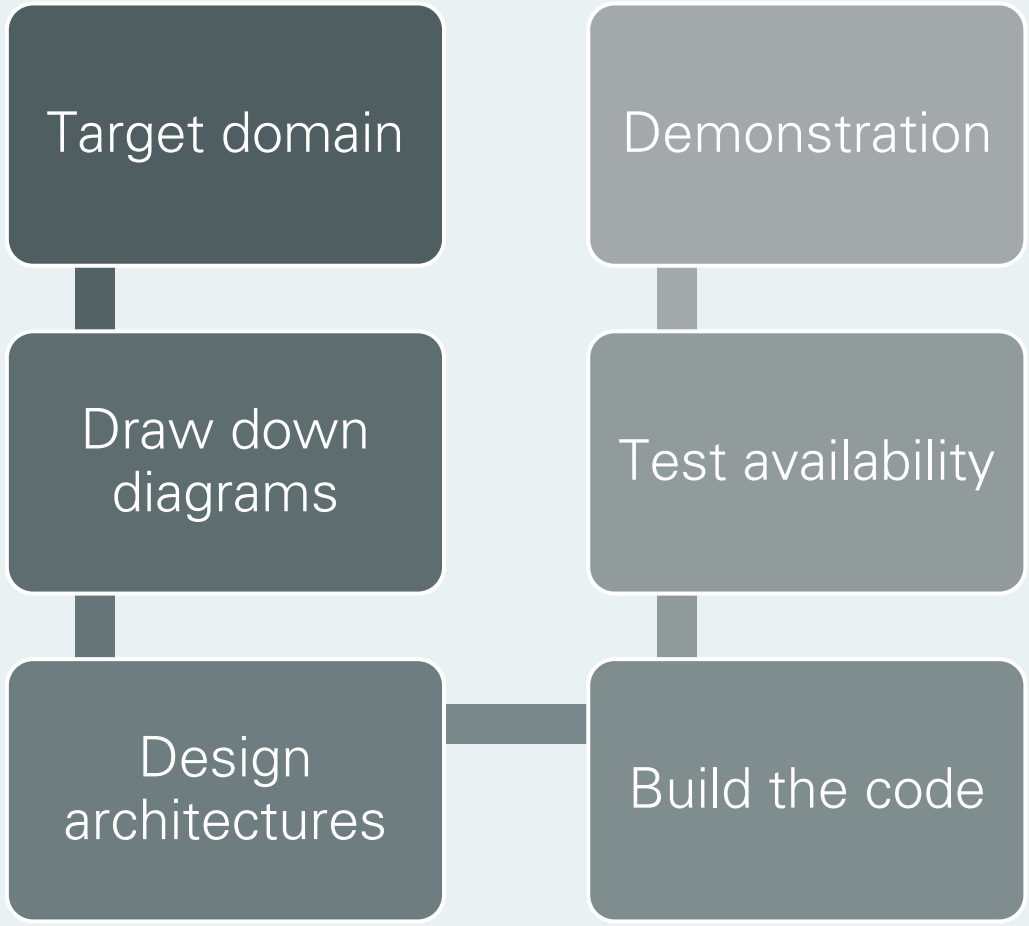
- Thai Quang Phat – 2252606
- Phan Quang Minh – 2212074
- Phan Quang Nhan – 2053286
- Phung Gia Minh Khoi – 2252381
- Thai Quang Du – 2252136

Table of Contents

- Requirements Elicitation
- Diagrams
- Architectures
- Usability Testing
- Demonstration

Work Planning

Planning


Target domain
Draw down diagrams
Design architectures
Build the code
Test availability
Demonstration

Team working progress

- **Task 1:** Requirement elicitation
- After receiving assignment and group information, we make contact with each others, then we assign jobs as following:

Process	Member	Deadline
1.1 Domain description	Quang Minh, Quang Nhân	18/9/2024
1.2. Functional, non-functional requirements	Quang Phát, Minh Khôi	18/9/2024
1.3. Use-case diagram	Quang Dự, Quang Minh	22/9/2024

Team working progress

- **Task 2:** System modelling
- To demonstrate the program, we draw an activity diagram to capture the business process between systems and the stakeholders, draw a sequence diagram, class diagram, and develop user interfaces.

Process	Member	Deadline
2.1. Activity diagram	Minh Khôi, Quang Phát	30/9/2024
2.2. Sequence diagram	Quang Nhân, Quang Dự	30/9/2024
2.3. Class diagram	Quang Phát, Quang Minh	30/9/2024
2.4. MVP 1 UI	Quang Phát	10/10/2024

Team working progress

- **Task 3:** Architecture design
- We design the HCMUT-SSPS system by using a layered architecture. Describe how to present the User Interface. Describe how to store data, access to external services/ APIs, and draw a component diagram.

Process	Member	Deadline
3.1. Layered architecture	Quang Dự, Minh Khôi	30/9/2024
3.2. Component diagram	Quang Minh, Quang Nhân	30/9/2024

Team working progress

- **Task 4 and 5:** Implementation
- Having enough information conducted from task 1 through 3, we started constructing the code base for our website system. We divide our task into backend and frontend.

Process	Member	Deadline
4.1 Coding frontend	Quang Minh, Quang Nhân, Minh Khôi	31/10/2024
4.2 Coding backend	Quang Phát, Quang Dự	31/10/2024

Team working progress

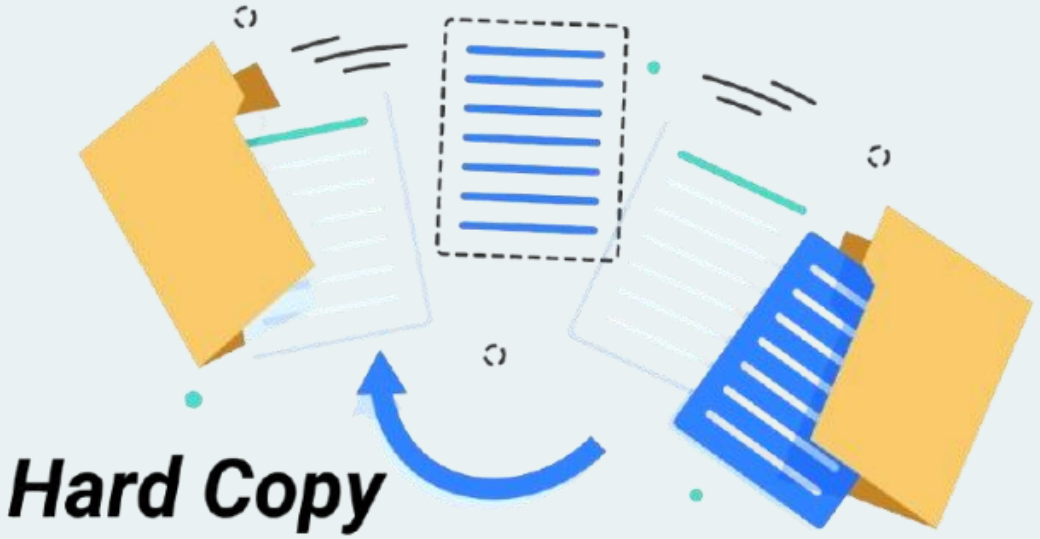
- Other tasks

Process	Member	Deadline
5.1 Final report	Quang Phát, Minh Khôi	17/11/2024
5.2 Slide	Quang Minh, Quang Nhân	17/11/2024
5.3 Create form to survey	Quang Dự	10/11/2024

Requirements Elicitation

Domain Context

Currently, the printing needs of university students in Vietnam in general and students of Ho Chi Minh City University of Technology in particular are increasing. Hard copies of learning materials are becoming increasingly useful in the learning process of students.



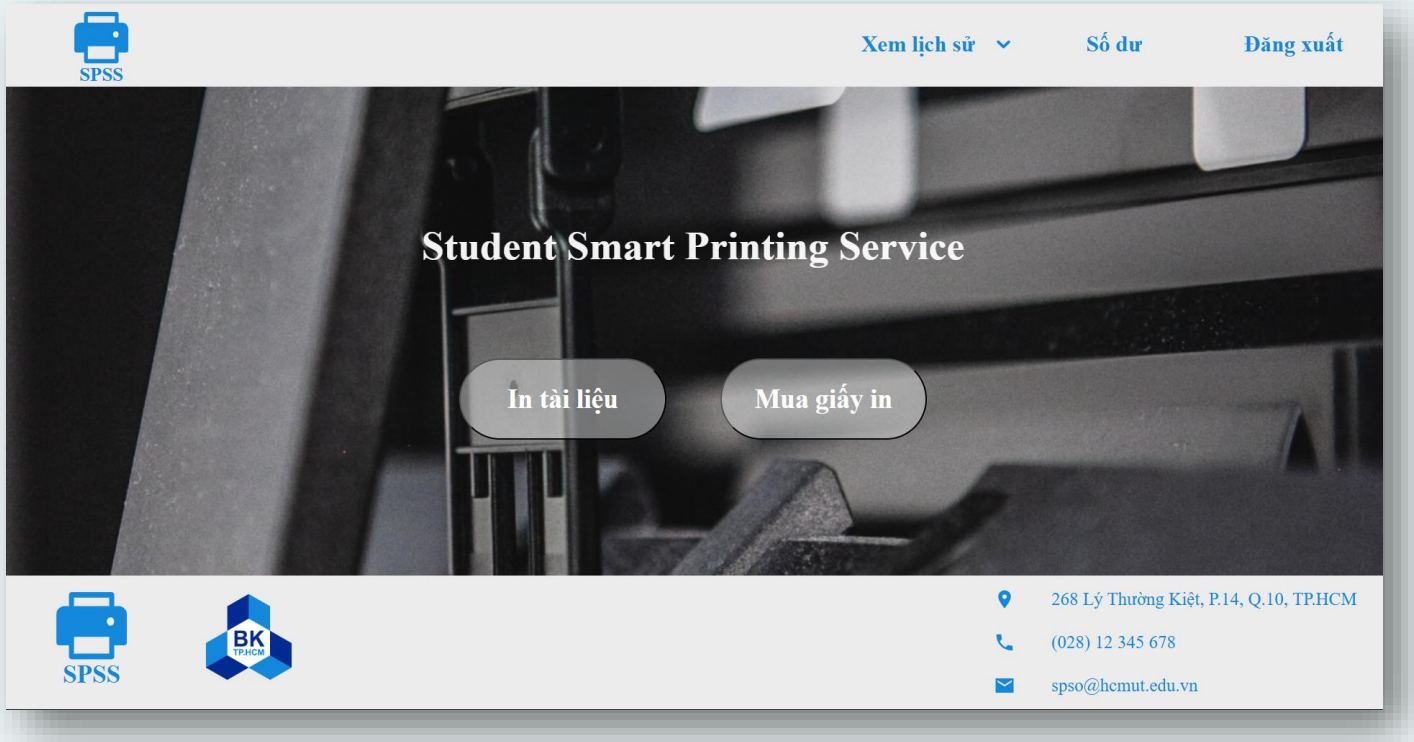
Domain Context

However, with the traditional method of providing printing services through printing shops, there are still some problems such as:

- Students may have to travel a long distance to get to the printing shops.
- Sending files to the printing shop through many different platforms can cause errors, making it difficult to manage.
- Printing services often do not have a price list and do not have invoices, so students cannot manage their spending on printing services.

Domain Context

The Student Smart Printing Service at HCMUT (HCM-SSPS) is designed to allow students at HCMUT to print documents through a network of printers distributed across the university's campus.



Stakeholders. Students

Students are primary users of the system. They need a reliable, easy to use system to upload, manage, and print their documents on campus, as well as the ability to track their print usage and manage their print quota.

Stakeholders. HCMUT

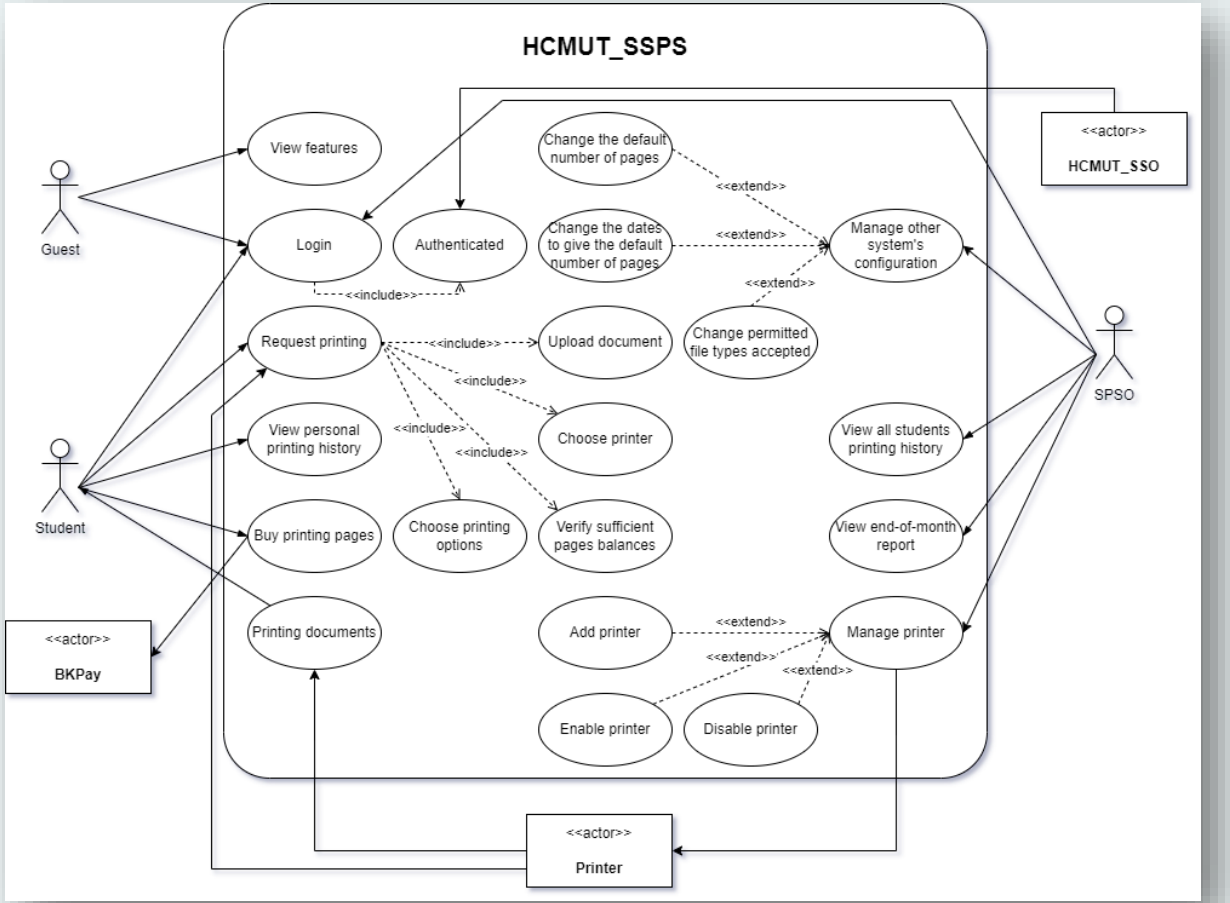
Student Printing Service Officer (SPSO), HCMUT Administration , BKPay. They are responsible for overseeing the system’s overall functionality and alignment with institutional policies.

Stakeholders. Supporters

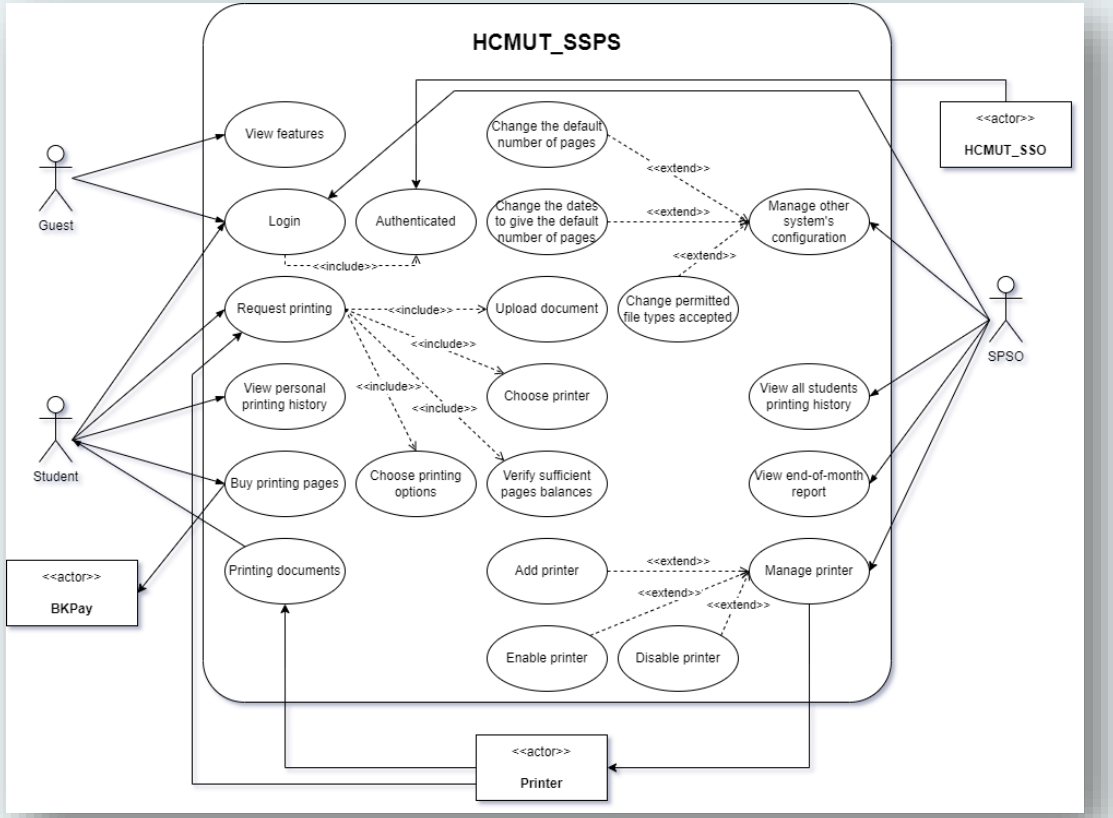
Printer provider, Guests. They provide printers to support the SPSO service, and help increase the system's income.

Diagrams

Use-Case diagram

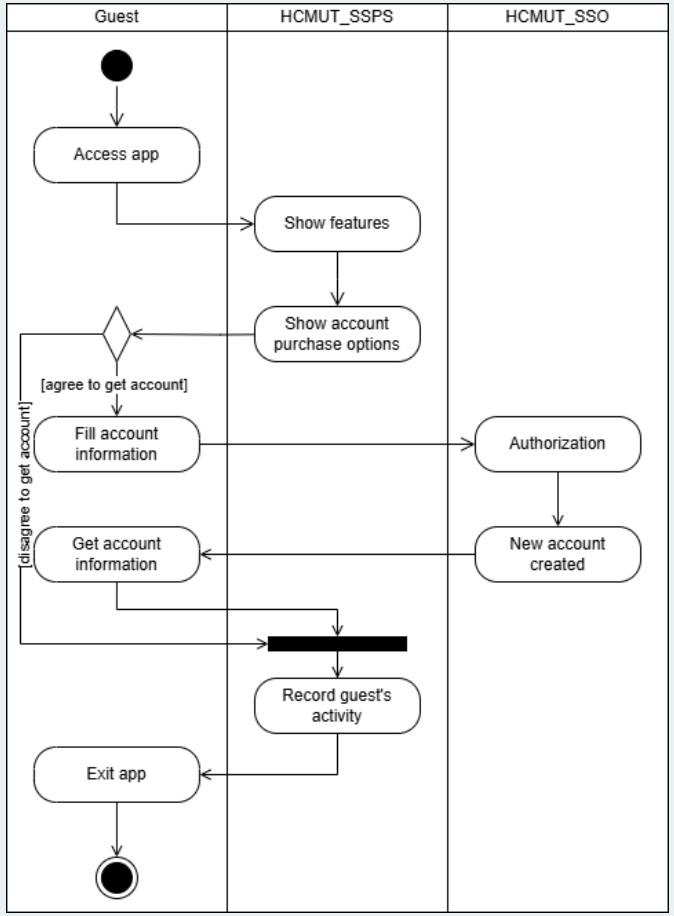


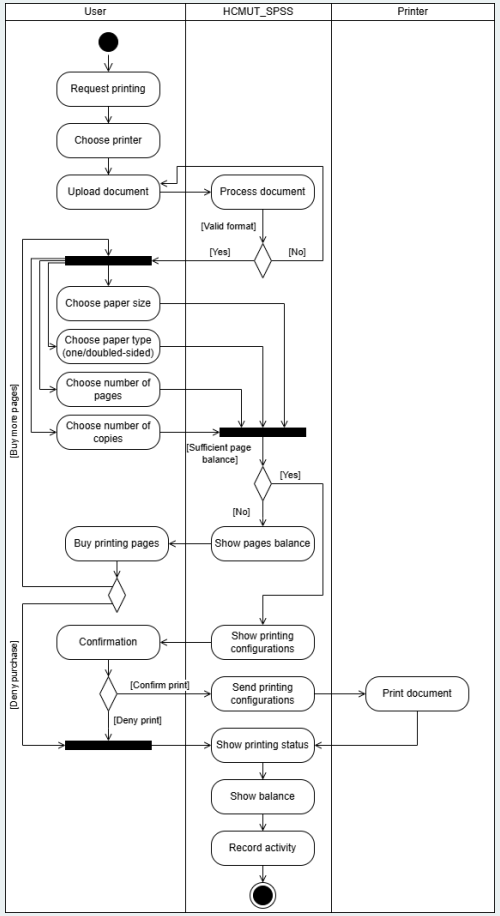
Use-Case diagram



- **Guest** can view features and login to the system.
- **Student** can request printing, upload documents, choose printing options, buy pages, view printing history, and manage their account details.
- **BKPay** facilitates the purchase of pages.
- **Printer** enables the printing of documents, including adding, enabling, and disabling printers.
- **SPSO** can view students' printing histories and generate end-of-month reports. Additionally, system configurations such as default page numbers and permitted file types are managed.

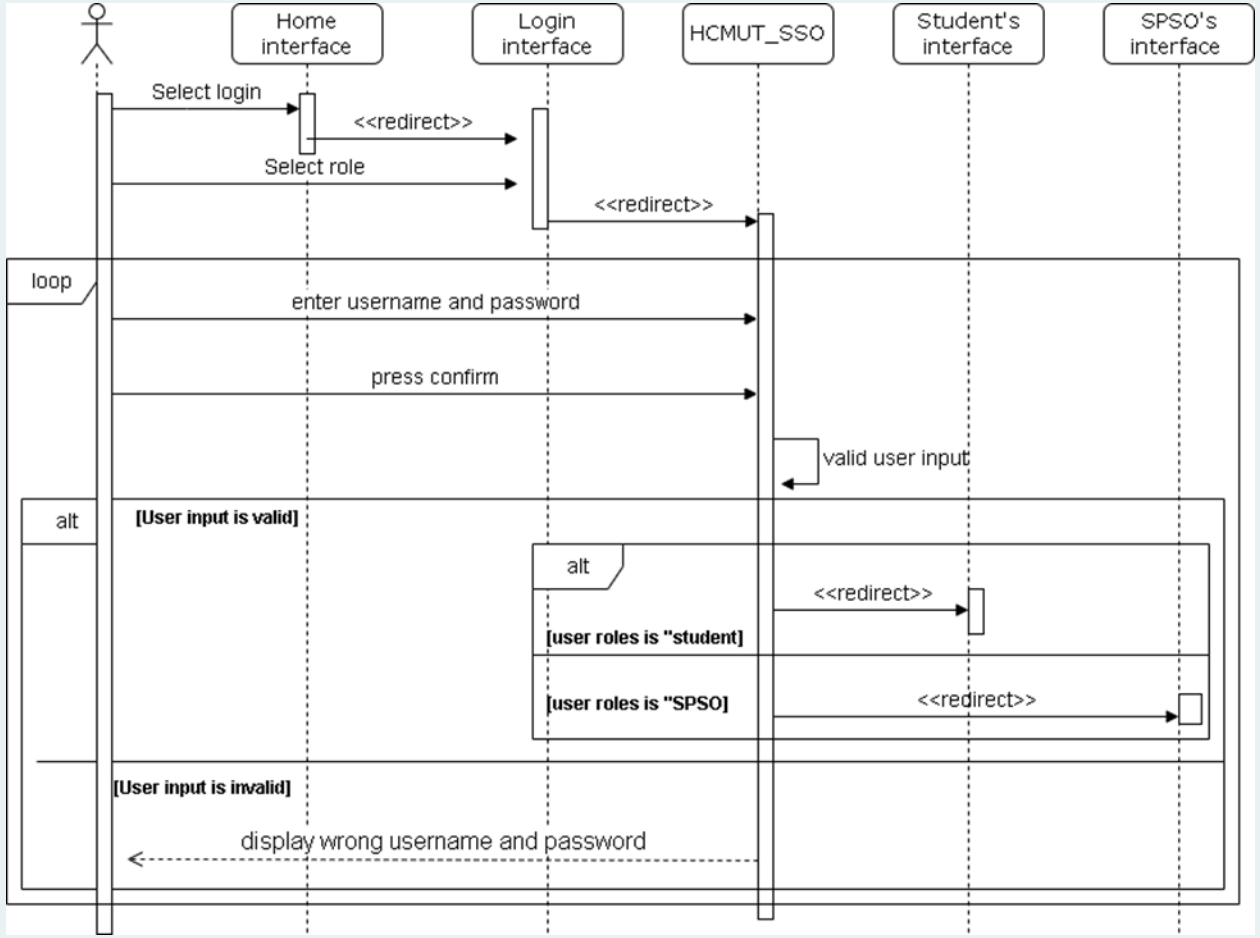
Activity Diagram





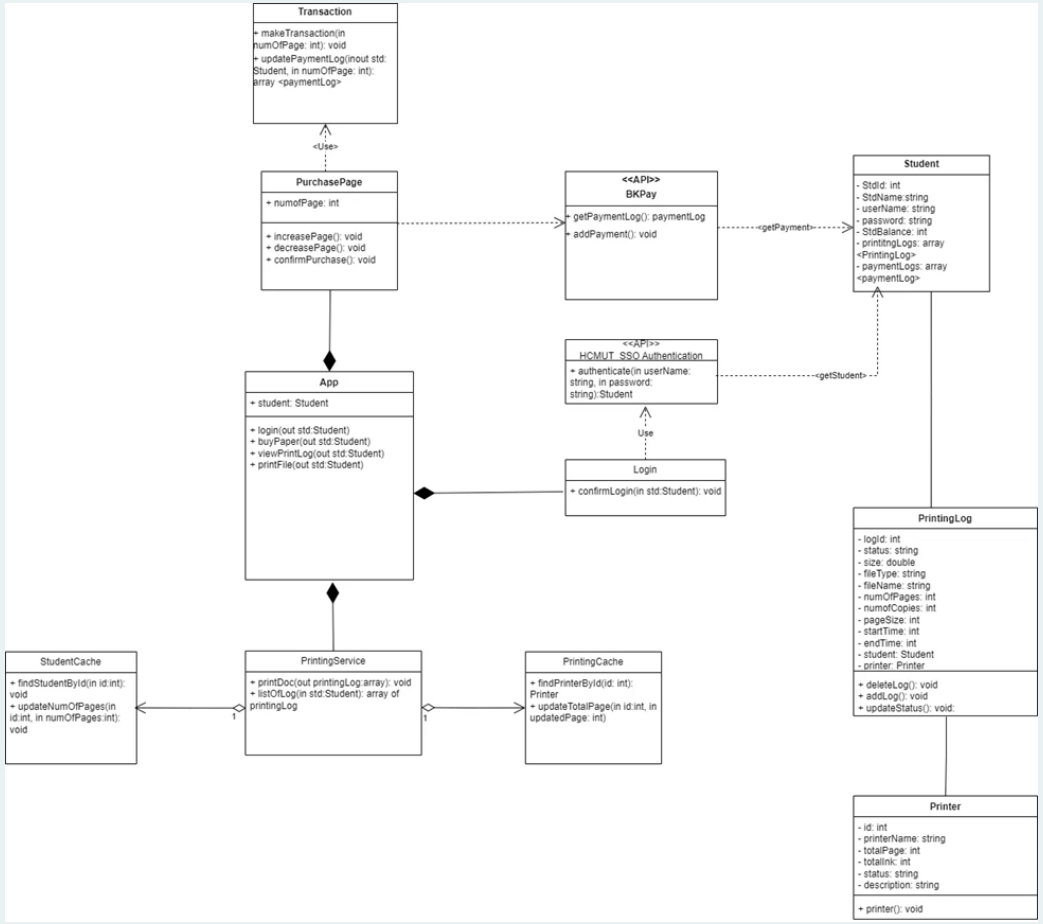
The purpose of an **activity diagram** is to model the dynamic flow of control or data in a system. It visualizes the sequence of actions or activities within a process, helping to clarify workflows, identify decision points, and highlight parallel tasks. Activity diagrams are useful for understanding, analyzing, and documenting business processes, system behaviors, and use case scenarios in both software development and process management.

Sequence Diagram



A sequence diagram illustrates how objects or components in a system interact with each other over time. It shows the order of messages exchanged between objects to carry out a specific task or process. The purpose of a sequence diagram is to visualize the flow of operations, clarify interactions between different system components, and help identify potential issues or inefficiencies in the sequence of events. It is commonly used in system design to document the behavior of a system or to analyze use cases in detail.

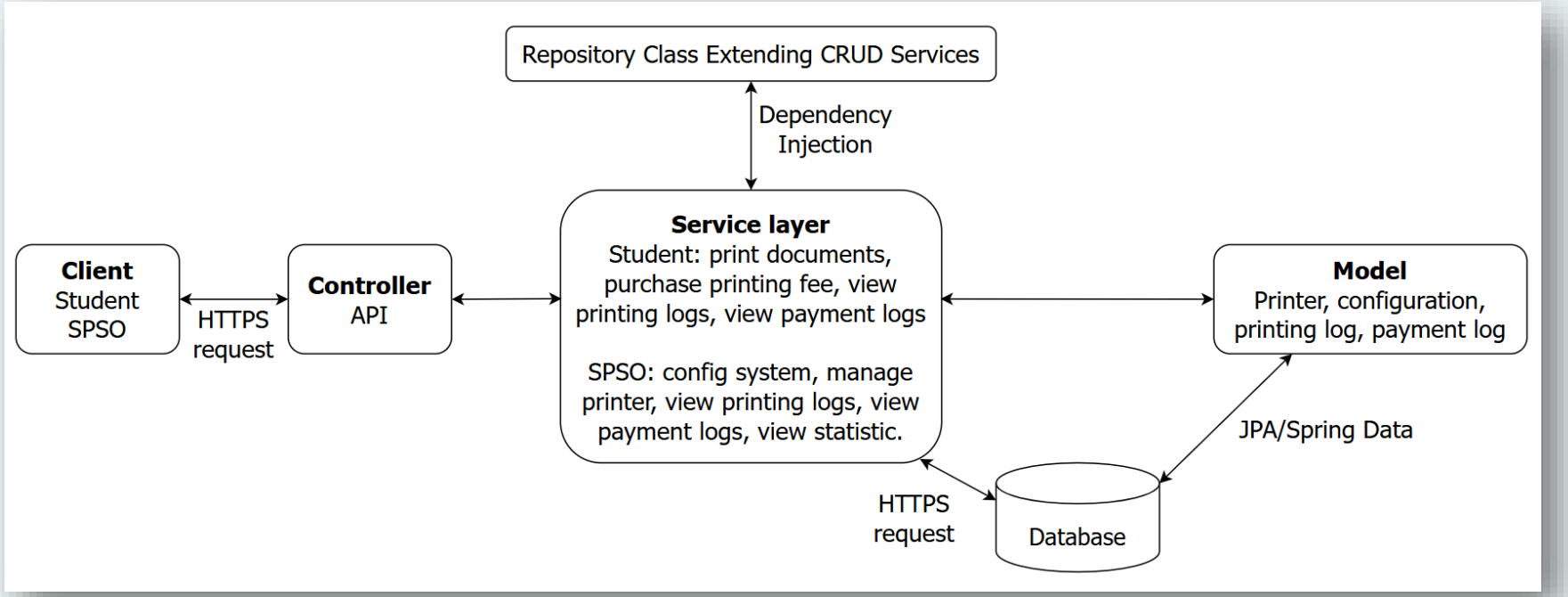
Class Diagram



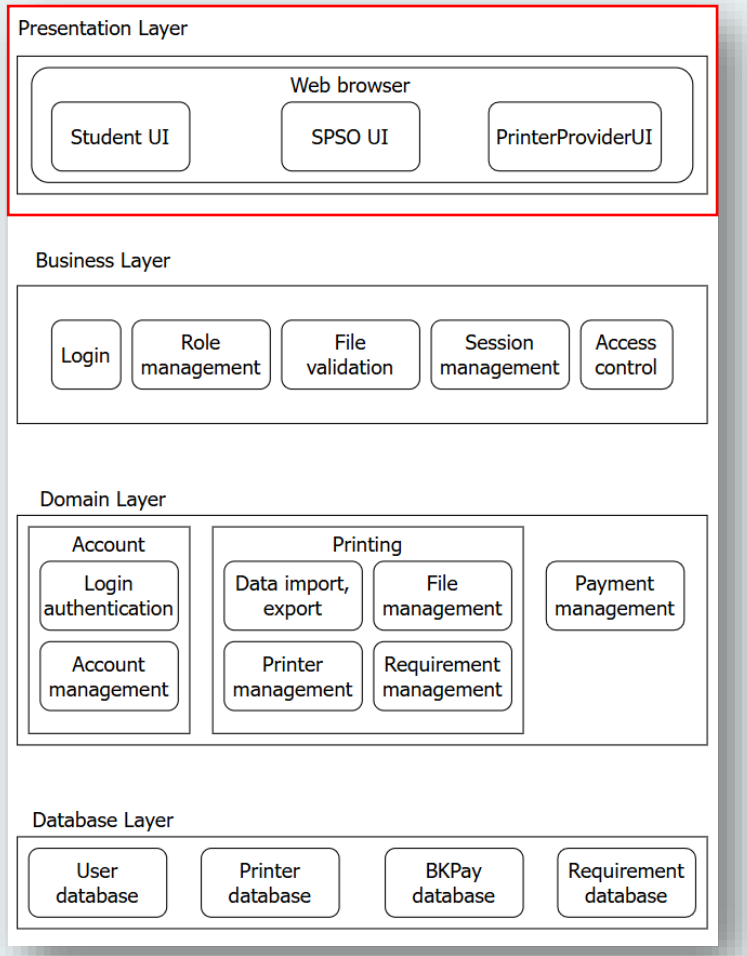
The purpose of a **class diagram** is to represent the static structure of a system by modeling its classes, their attributes, methods, and relationships. It helps to visualize the organization of a system, define the blueprint for object-oriented design, and clarify how different components interact. Class diagrams are essential for system analysis, design, and documentation, particularly in object-oriented programming.

Architecture

Layered Architecture



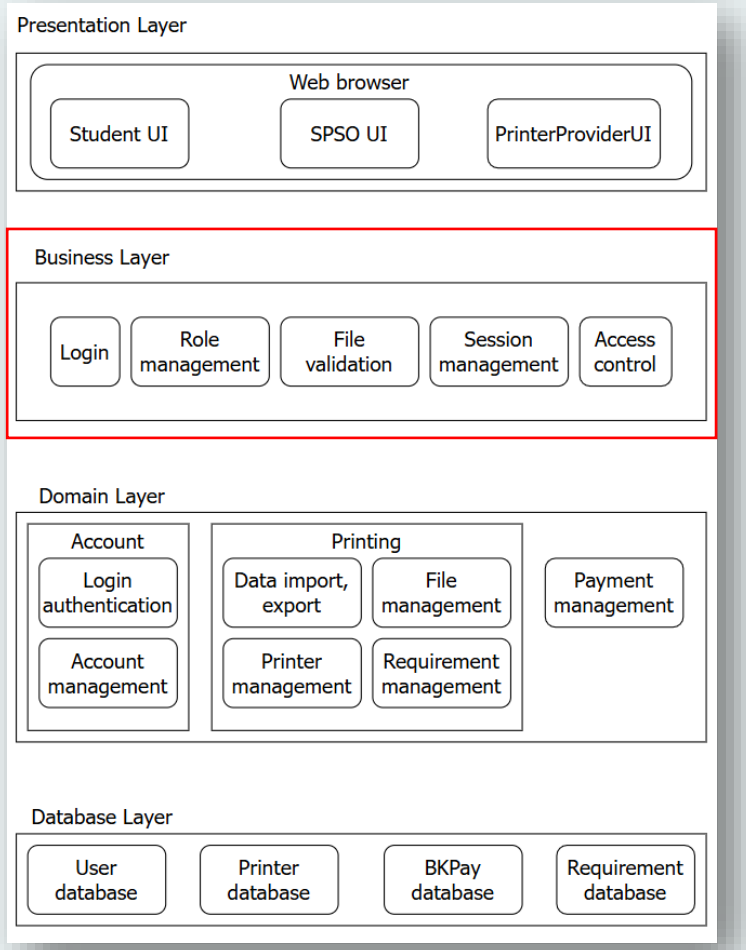
Layered Architecture



The Presentation Layer provides user interfaces tailored to specific roles.

- **Student UI** enables students to upload documents, manage printing quotas, and review printing history.
- **SPSO UI** allows Student Printing Service Officers to manage printers, view logs, configure policies, and access reports.
- **PrinterProvider UI** supports printer administrators in managing and maintaining printers. This layer depends on the Business Layer for core functions like login, file validation, session management, and access control.

Layered Architecture

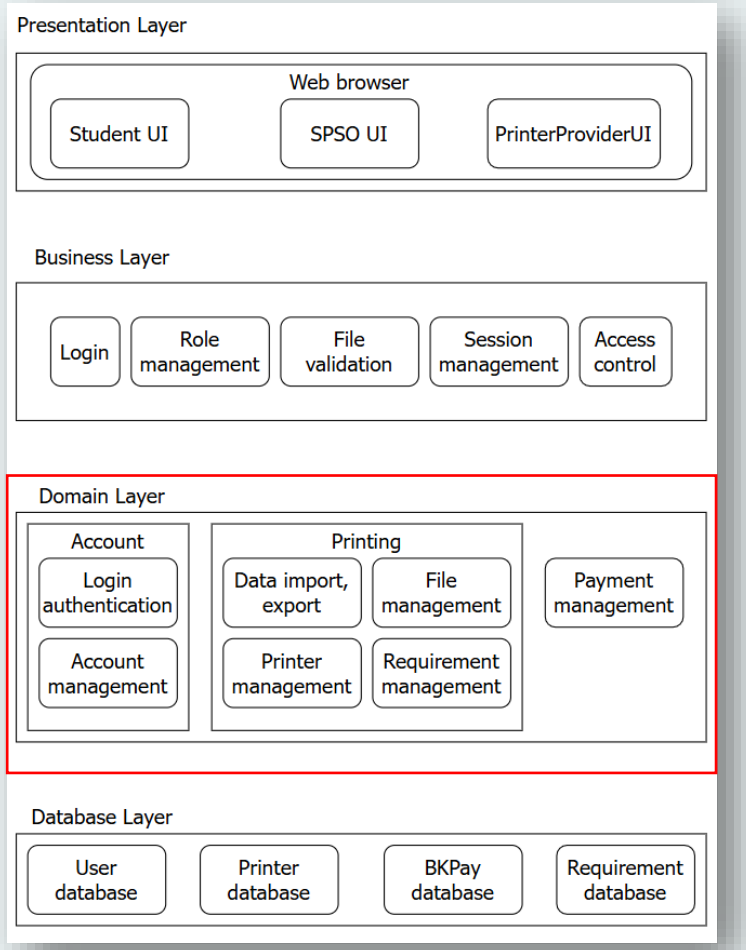


The Business Layer handles user requests, enforces rules, and manages access and sessions. Key services include

- **Login** (user authentication),
- **Role Checking** (assigning permissions),
- **File Validation** (ensuring file compliance),
- **Session Management** (secure session handling),
- **Access Control** (role-based restrictions),
- **Page Quota Management** (managing printing limits).

It collaborates with the Domain Layer for core functionalities like Account, File, and Payment Management.

Layered Architecture

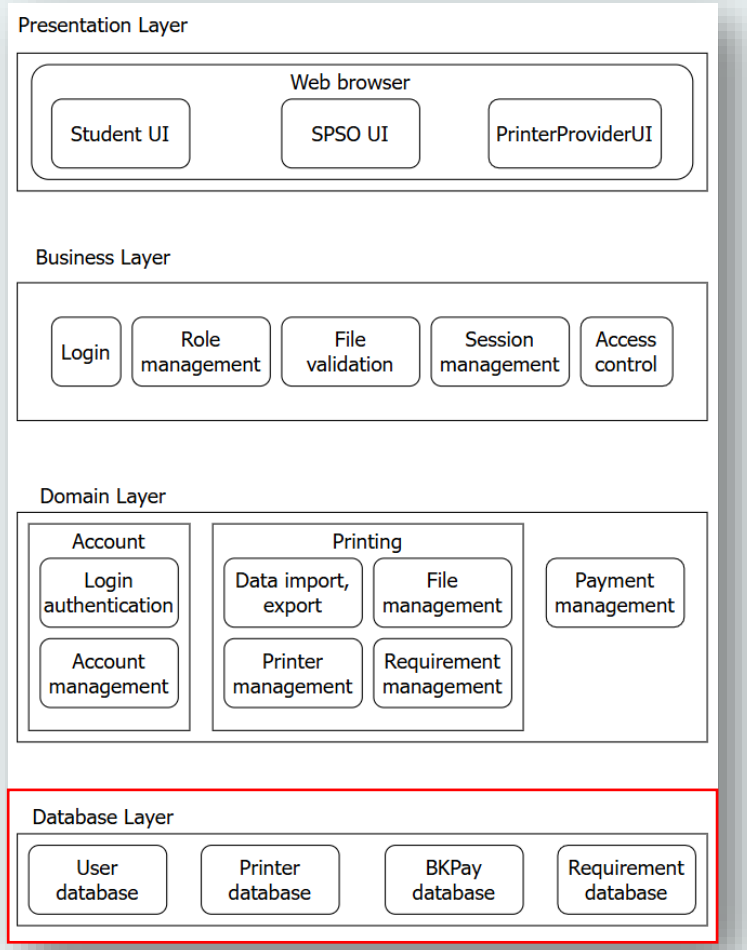


The Domain Layer contains the core business logic and operations for the printing service. Key components include

- **Login Authentication** (secure user verification),
- **Account Management** (managing profiles, quotas, and balances),
- **Data Import/Export** (file uploads and downloads),
- **File Management** (file storage and validation),
- **Printer Management** (status and configurations),
- **Requirement Management** (setting file types and quotas),
- **Payment Management** (handling transactions with BKPay).

It interacts with the Database Layer for storing and retrieving user, printer, payment, and configuration data.

Layered Architecture

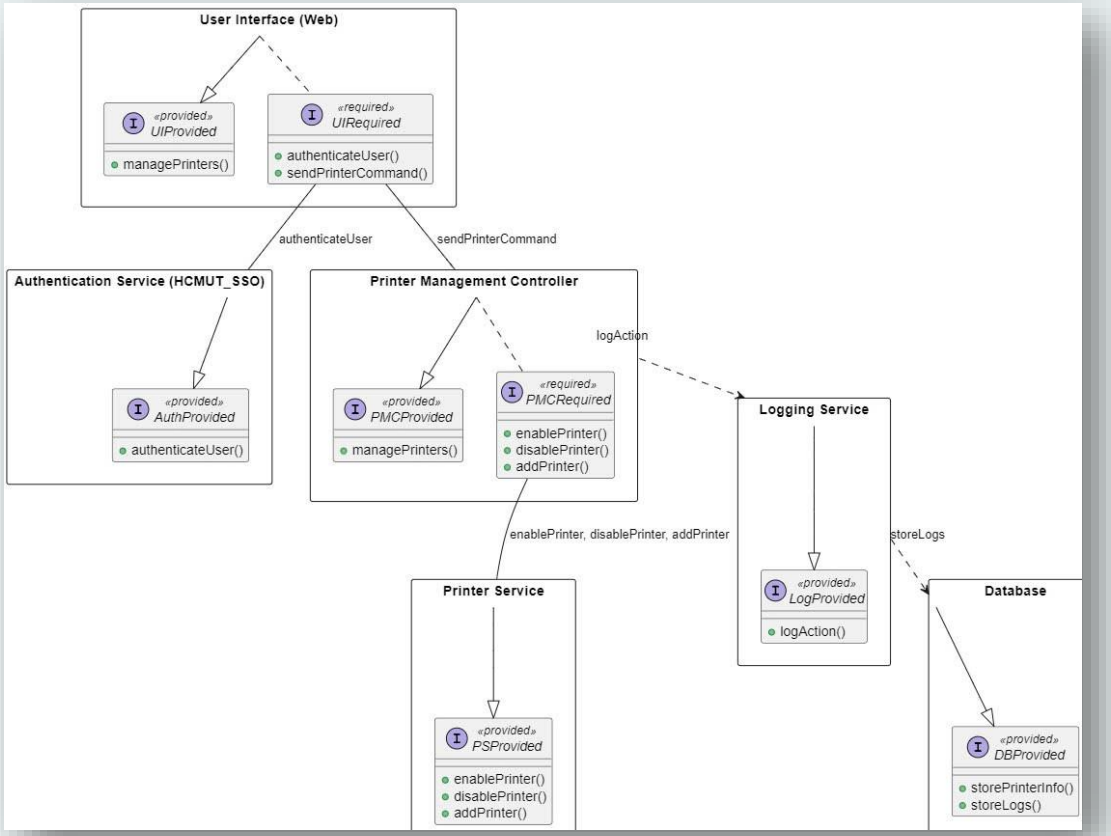


The Database Layer manages data storage and retrieval, supporting CRUD operations for system components. It includes the

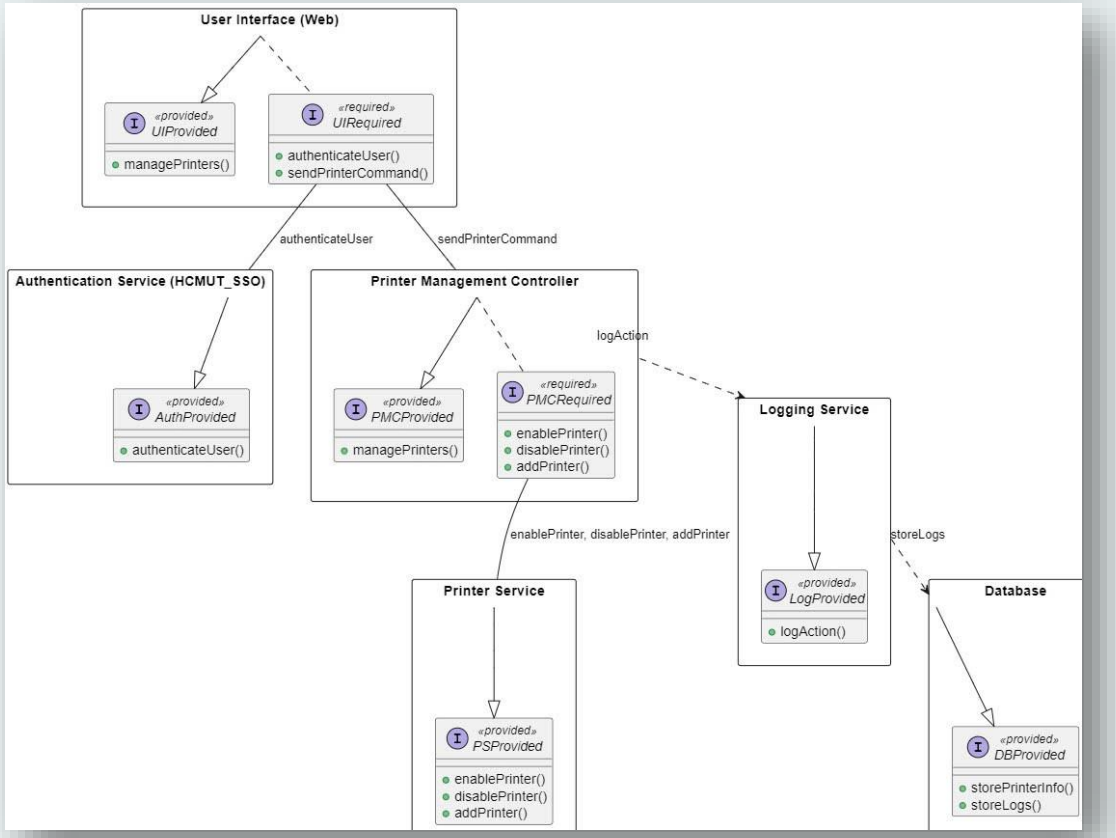
- **User Database** (user profiles, credentials, roles, quotas),
- **Printer Database** (printer details, status, configurations),
- **BKPay Database** (payment records),
- **Requirement Database** (system configurations like quotas and file restrictions),
- **File Database** (uploaded documents for printing).

This layer interacts with the Domain Layer to ensure seamless data access and functionality.

Component Architecture



Component Architecture



The **User Interface (Web)** is the system's entry point, enabling users to manage printers (**managePrinters()**) and send commands (**sendPrinterCommand()**) after authentication (**authenticateUser()**) via **HCMUT_SSO**. The **Printer Service** interacts with physical printers, executing commands to enable, disable, or add printers. The **Logging Service** records all actions (**logAction()**), storing logs and printer configurations securely in the **Database** (**storePrinterInfo()**, **storeLogs()**) for future reference and auditing.

Usability Testing

Members and Roles

The testing session took place in person with the participation of all members, including the chairperson (team leader) and the secretary. During the session, the team recorded solutions, task completion rates, comments, overall evaluations, questions, and feedback from all members.

Name	Role
Thai Quang Phat	Chairperson/Leader/Member
Phan Quang Minh	Serectary/Member
Phan Quang Nhan	Member
Phung Gia Minh Khoi	Member
Thai Quang Du	Member

Testing Methods

- Ease of finding information on the application
- Flexibility in interactions
- Accuracy in predicting which part of the application contains specific information

Task	Info Accessibility	Interaction Flexibility	Prediction Accuracy	Average
1	3	4	4	3.67
2	5	5	3	4.33
3	4	3	4	3.67
4	3	3	5	3.67
5	4	4	5	4.33
6	5	4	3	4.00
7	3	3	4	3.33

User Experience

To better understand how accessible our website is to the majority of students, we conducted a survey to gather their feedback.

PHIẾU KHẢO SÁT TRẢI NGHIỆM NGƯỜI DÙNG VỚI HỆ THỐNG IN ẤN THÔNG MINH TẠI HCMUT (SPSS)

Chào mọi người, chúng mình là nhóm 12, đến từ lớp CC01. Hiện tại chúng mình đang thực hiện đề tài xây dựng một hệ thống quản lý in ấn thông minh tại HCMUT (Student Smart Printing Service).

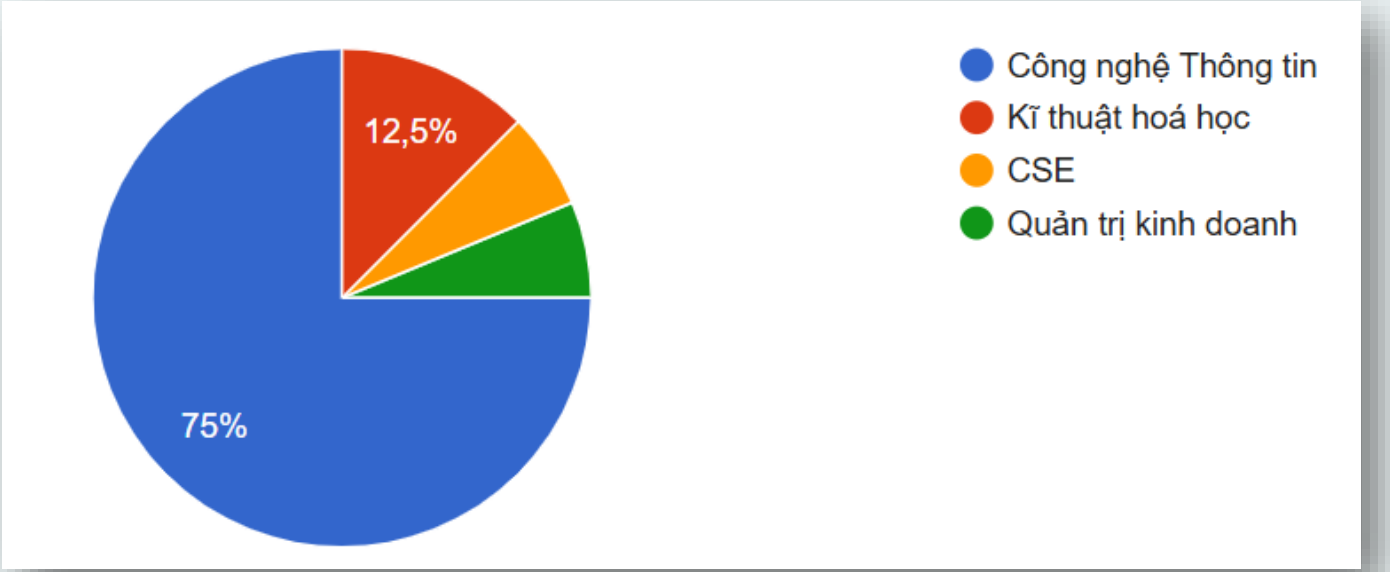
Bên dưới đây là các hình ảnh hệ thống của chúng mình, chúng mình rất mong nhận được một số góp ý của các bạn để hệ thống của chúng mình được hoàn thiện hơn. Chúng mình cảm ơn các bạn rất nhiều

phat.thaiquang2004@hcmut.edu.vn Chuyển đổi tài khoản

* Biểu thị câu hỏi bắt buộc

Major Students

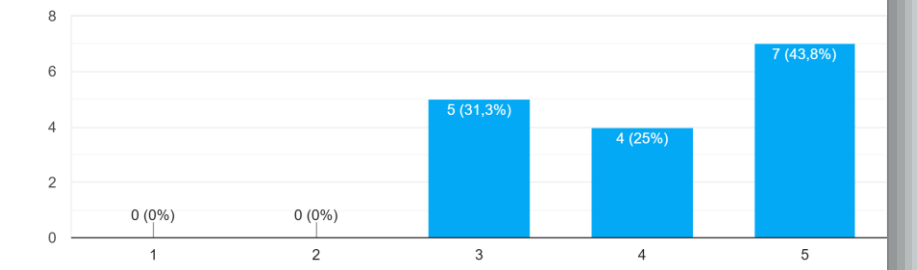
The majority of students who attended the survey are professioned in information technology (IT), this can be seen as a non benefit since we need feedbacks from students who doesn't have much knowledge of software engineering, only then we can have more general feedbacks.



Results

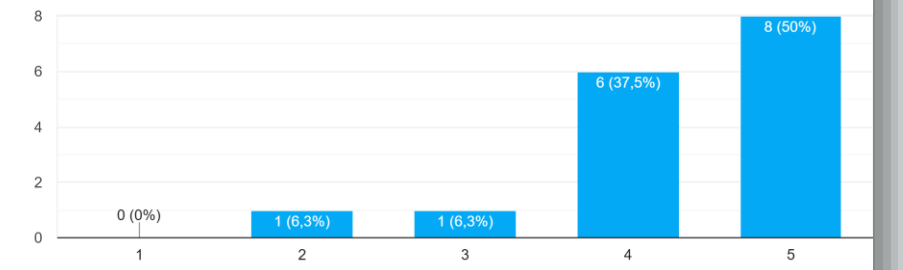
Trang chủ
16 câu trả lời

Home page



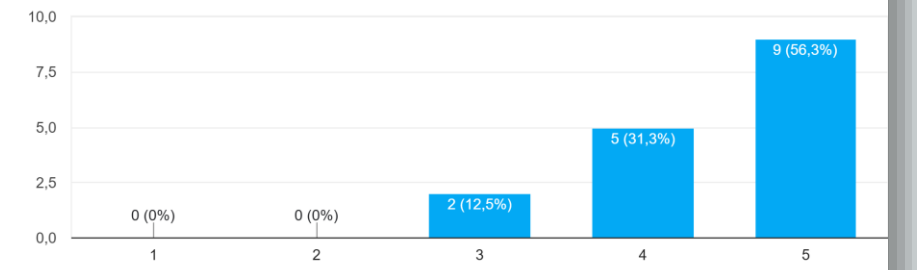
Trang đăng nhập
16 câu trả lời

Login page



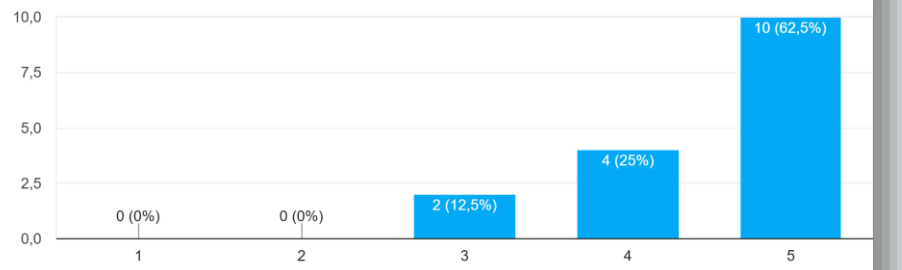
Các dịch vụ dành cho sinh viên
16 câu trả lời

Student Services



Dịch vụ in tài liệu
16 câu trả lời

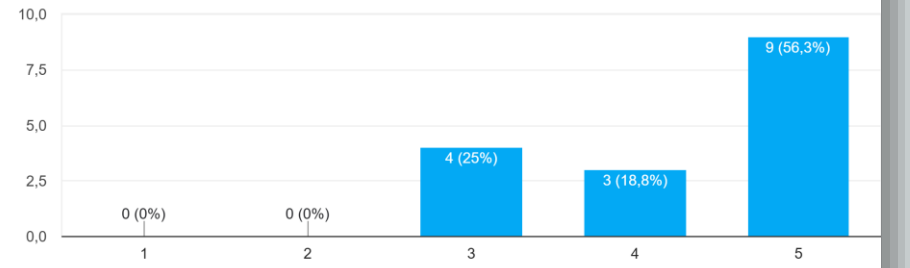
Printing Services



Results

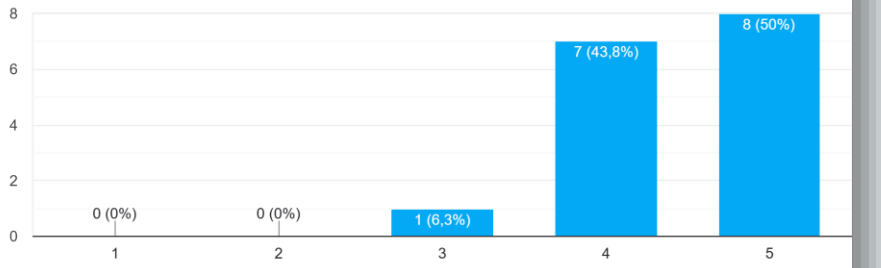
Chọn máy in
16 câu trả lời

Choose Printers



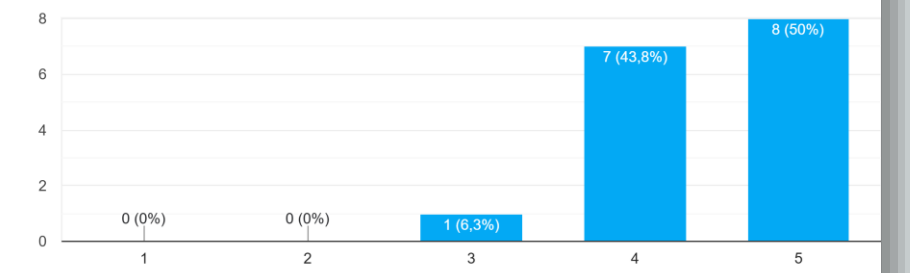
Cài đặt thông số giấy in
16 câu trả lời

Configure paper



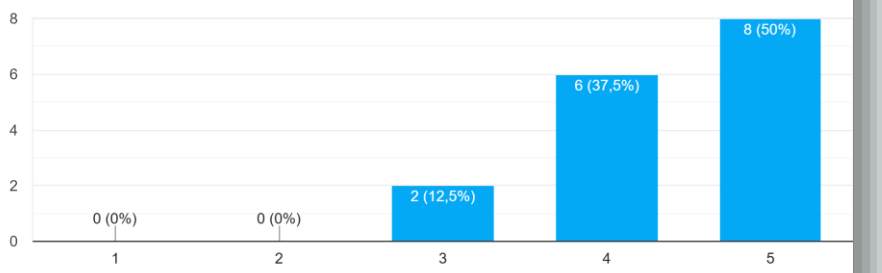
Xem lịch sử tài liệu đã in
16 câu trả lời

View Printing History



Xem lịch sử mua thêm giấy
16 câu trả lời

View Purchase History

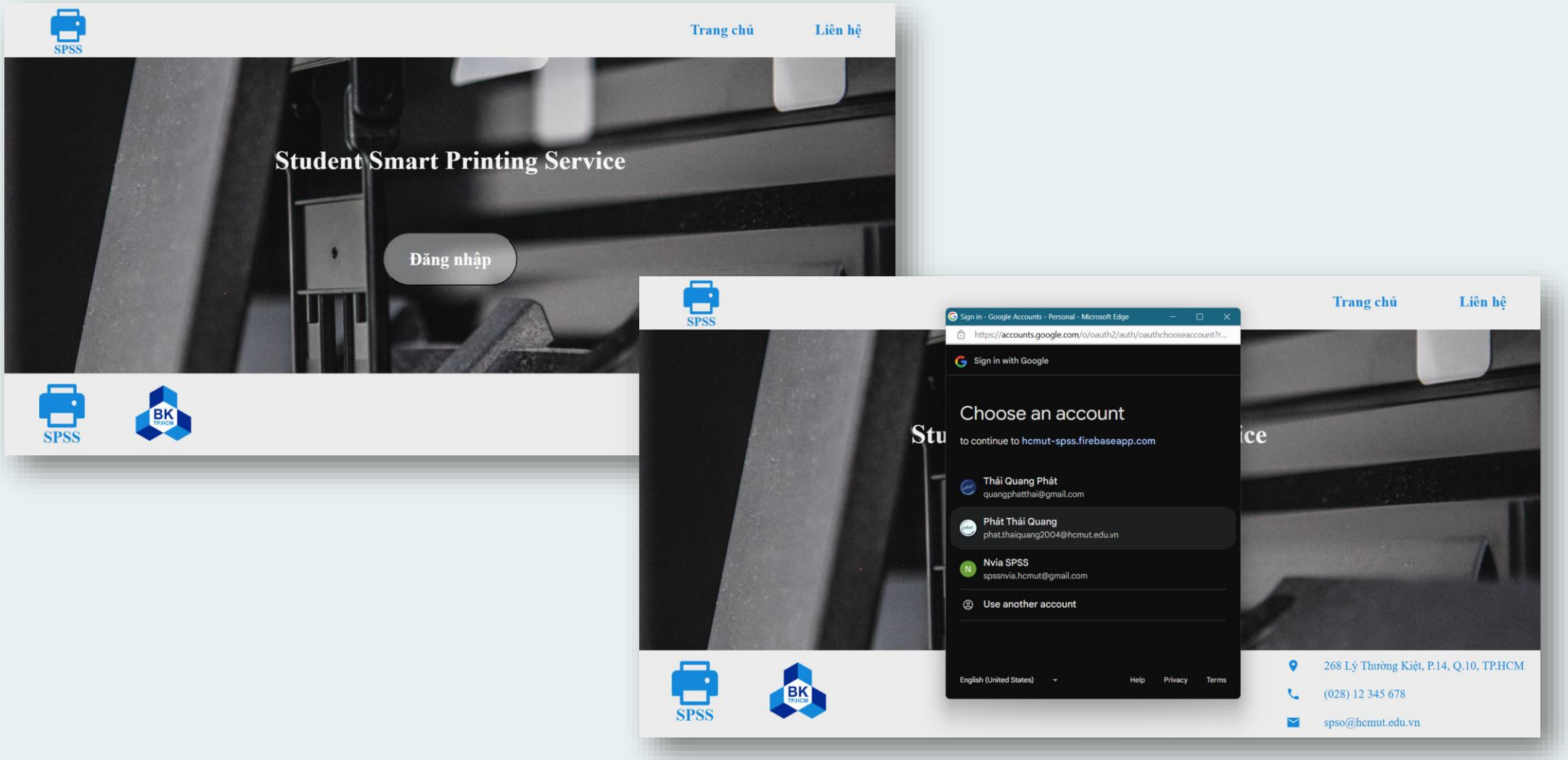


Conclusion

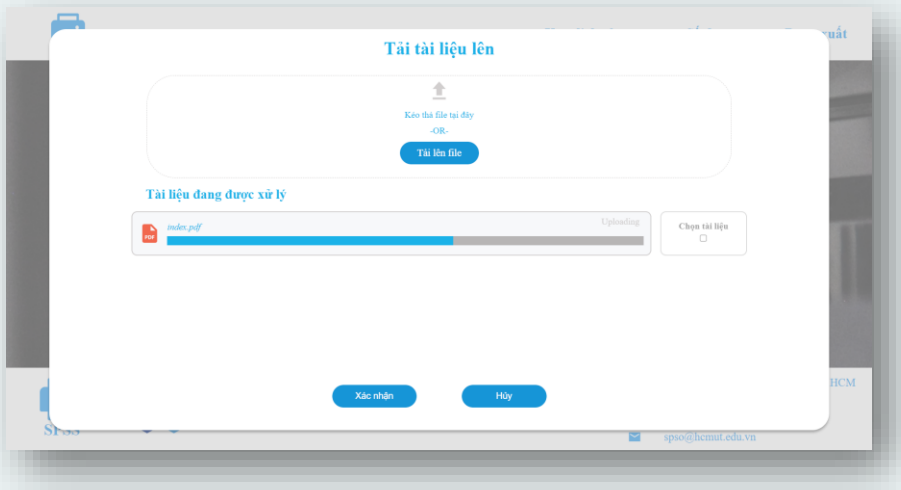
The results show that our service aligns well with students' interests, indicating strong potential for user adoption. Among the features, the printing functionality stands out as the most favored, reinforcing its importance as the system's core feature. However, the login page received the lowest score, suggesting it garners less student interest and requires improvement to enhance user experience.

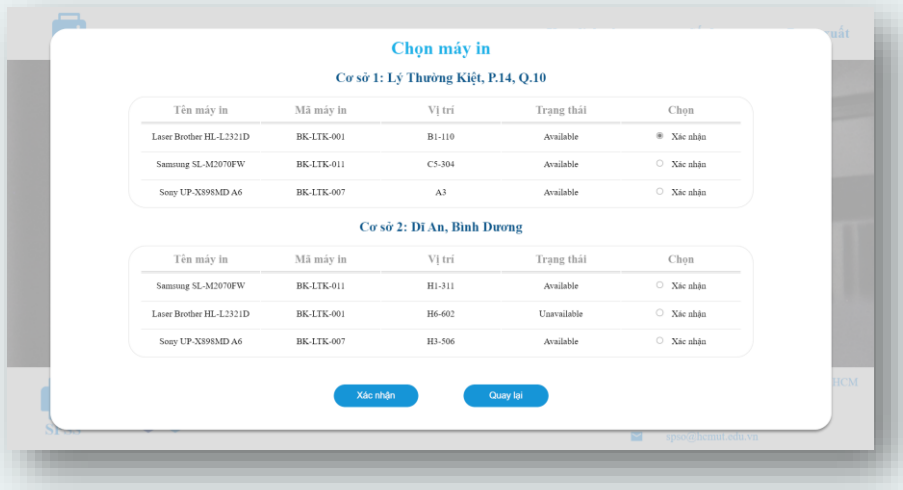
Demonstration

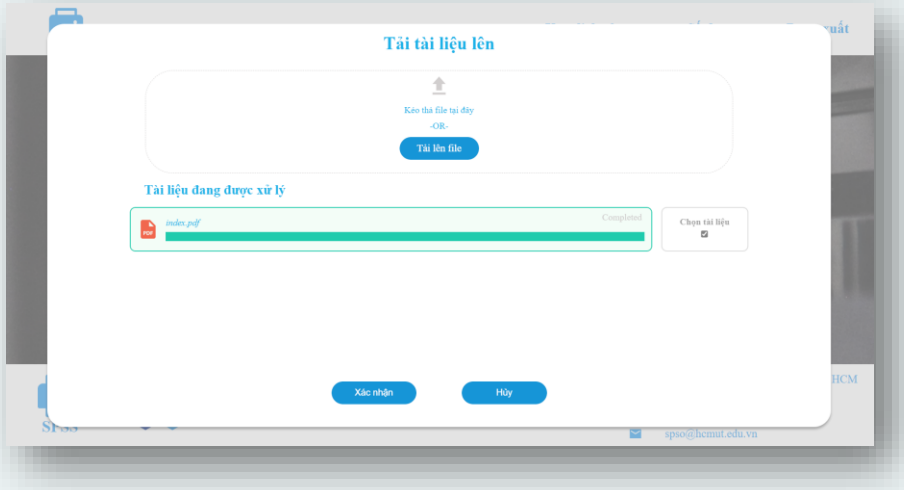
Homepage and Login

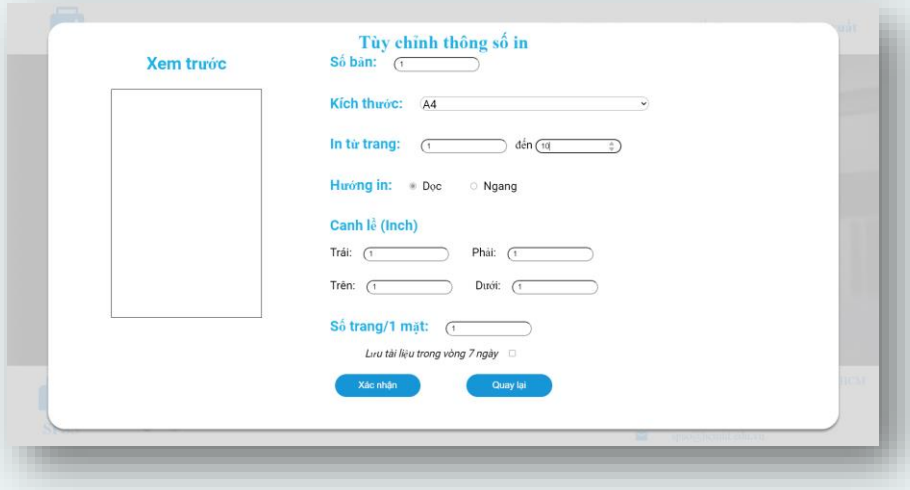


Student Printing Service

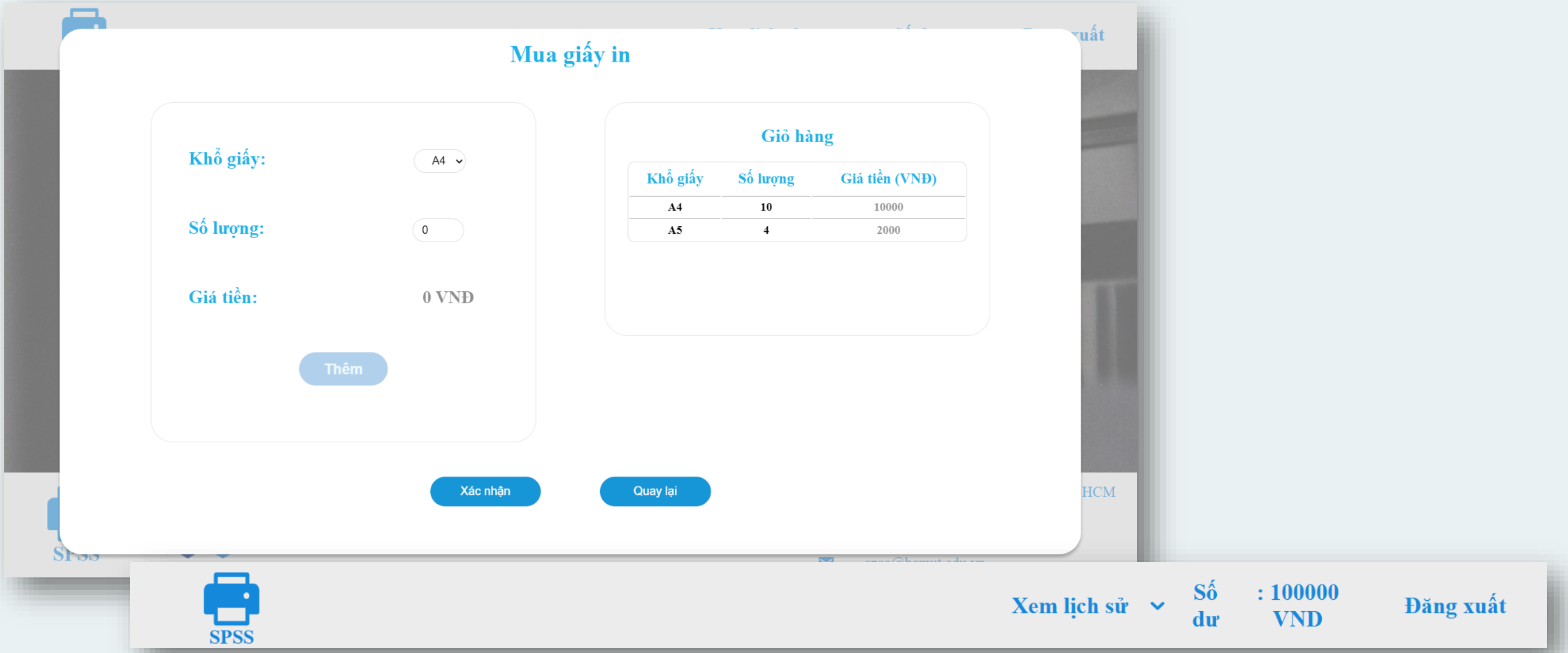




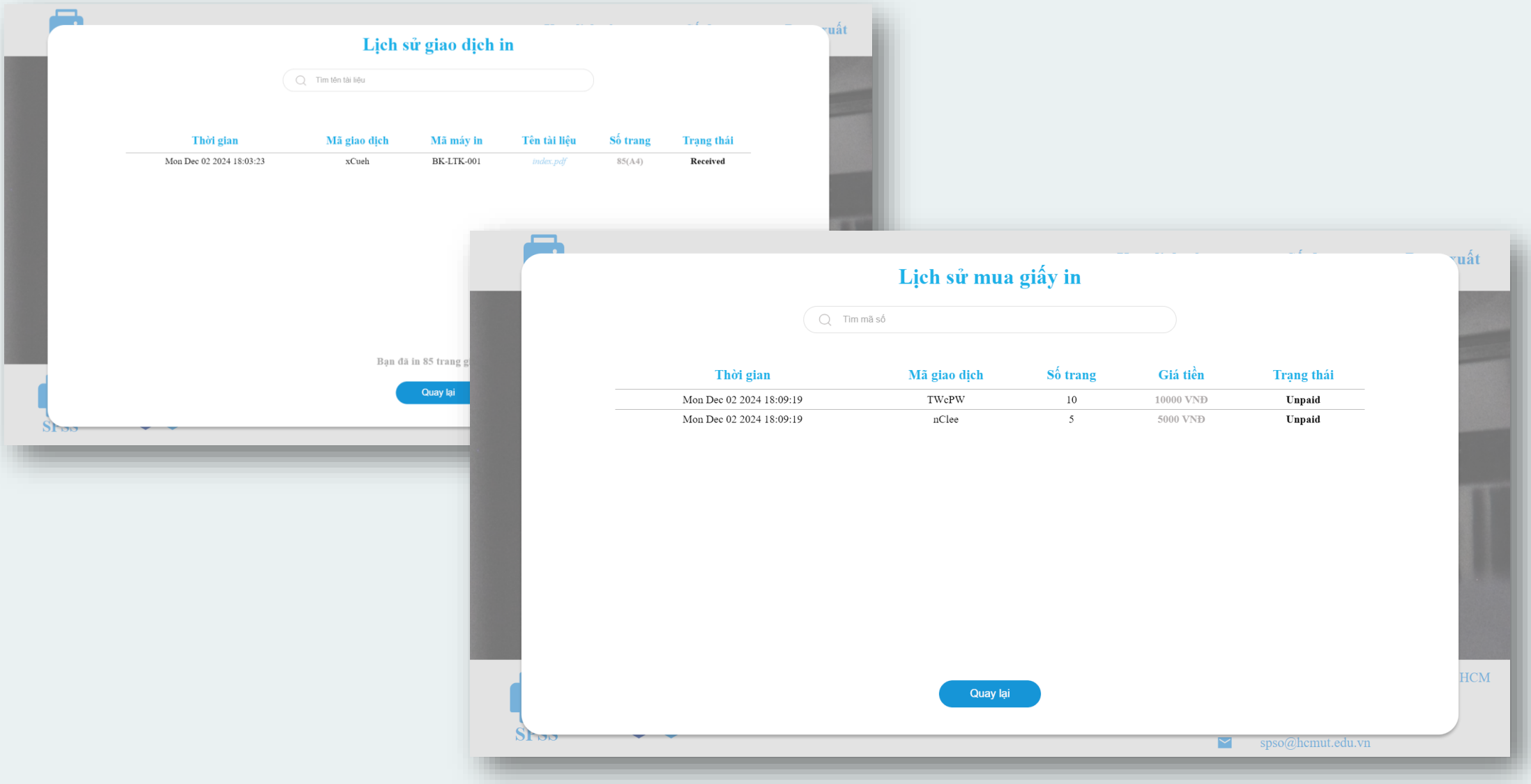




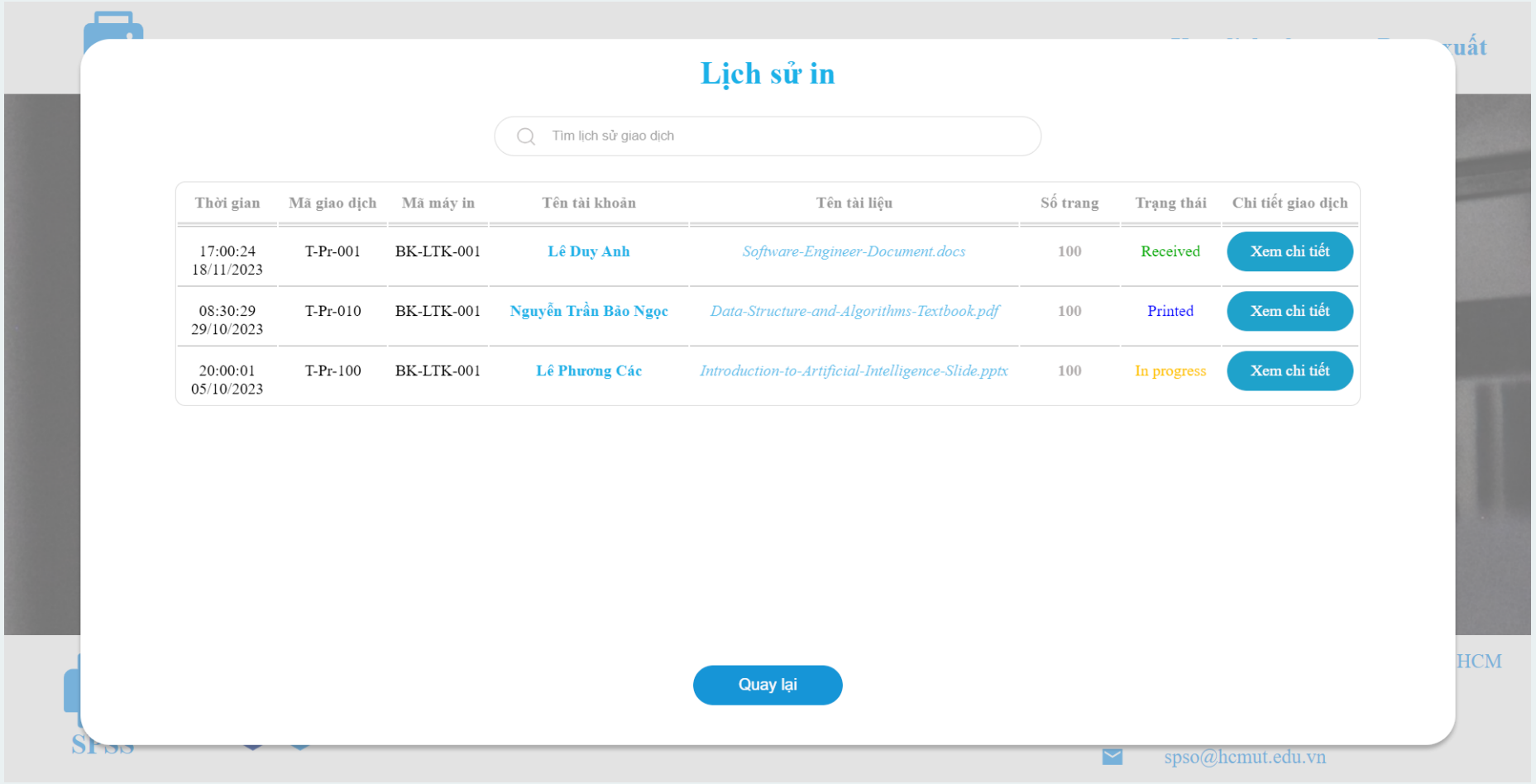
Buying Printing Pages



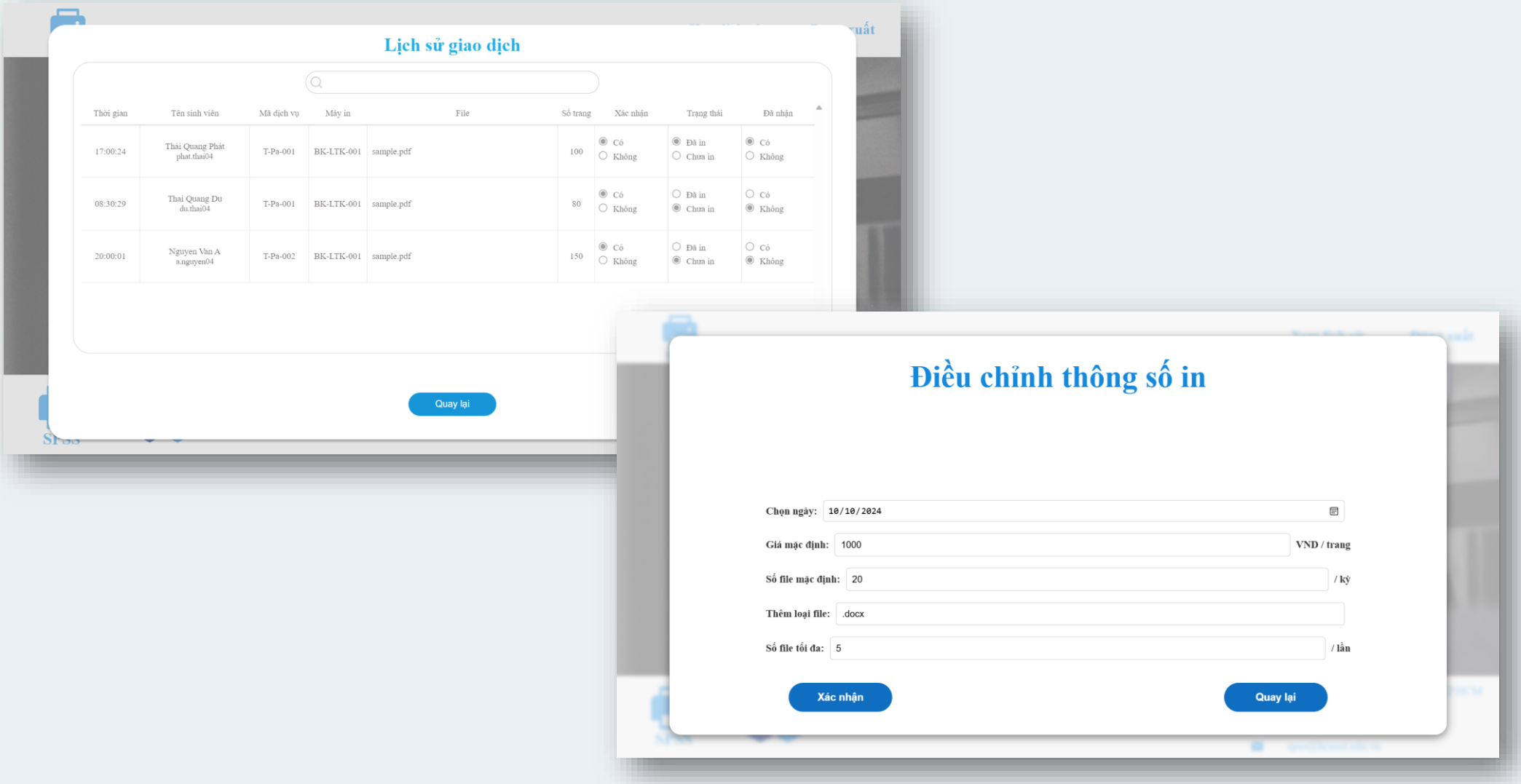
Viewing Print and Purchase History



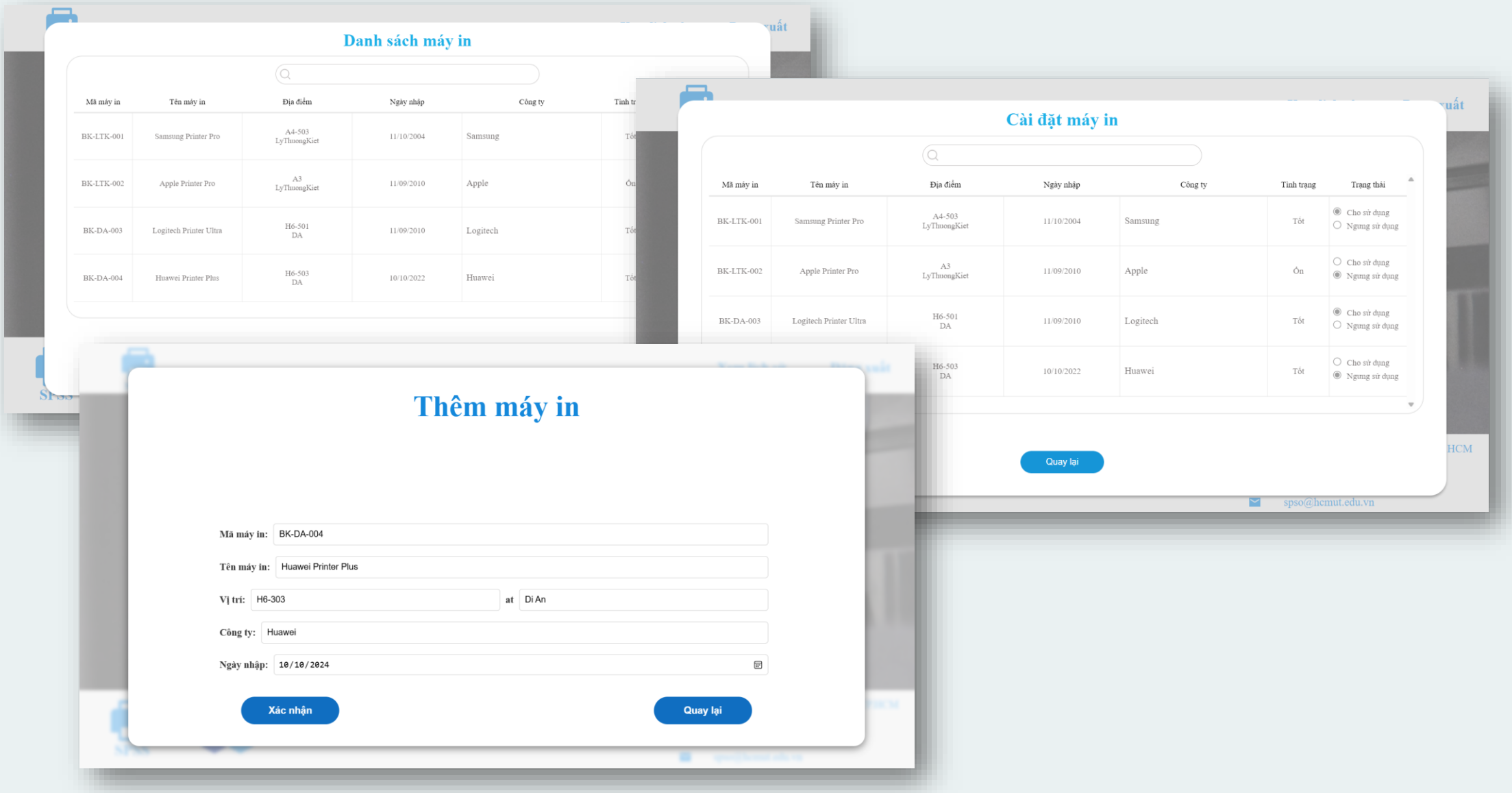
Viewing Student's Printing Activity



View Past Printings and Configuration



View Printers, Status and Adding



Conclusion

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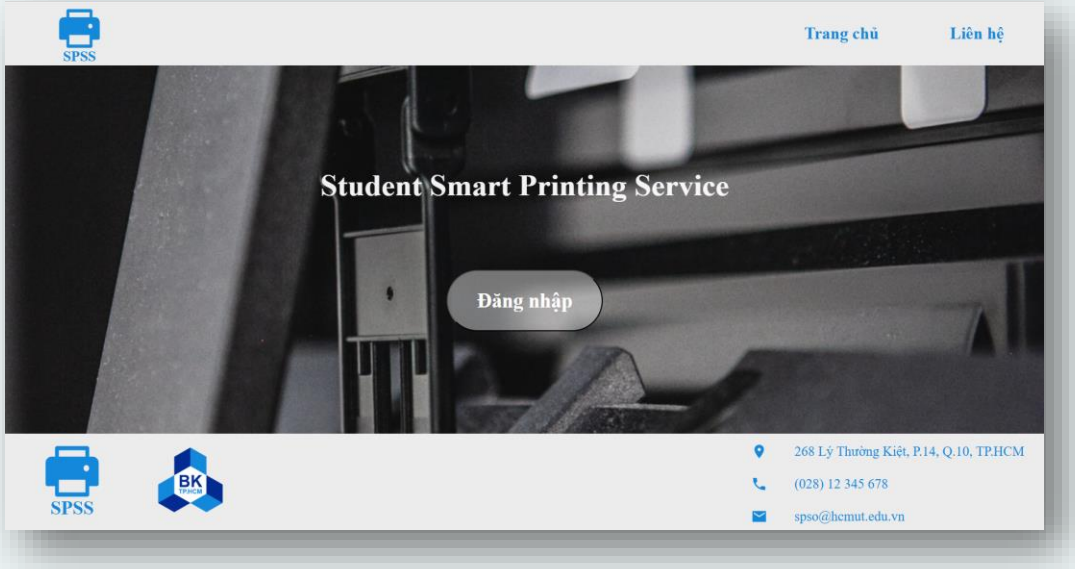
Building the Student Smart Printing System web application taught us valuable skills in teamwork, agile development, and using modern web technologies like React and Firebase. We gained hands-on experience in user authentication, role-based access, debugging, and optimizing performance. This project strengthened our problem-solving abilities and highlighted the importance of communication and iterative development.



Thank you for your attention