Ho Chi Minh City University of Technology

Faculty of Computer Science and Engineering

Software Engineering (CO3001)

Student Smart Printing Service

Report 4 - Task 3

Authors:	*Student's ID:*
Nguyen Thanh Thao Nhi	2152840
Ta Ngoc Nam	2152788
Le Thanh Binh	2112897
Ly Tran Phuoc Tri	2153920
Phan Gia Bao	2153210
Hoang Tien Duc	2152520
Nguyen Huu Tho	2153843

Instructors:

PhD. Truong Thi Thai Minh

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Mục lục

1 Introduction

This Requirement Document is a crucial component in the development of the BKPrint system. It carefully details the functional and non-functional requirements needed for the system's development, as well as the needs of stakeholders, system functionalities, and constraints. Furthermore, it includes a comprehensive Use-ase Diagram that illustrates system interactions and related scenarios, depicting various user interactions and system responses.

2 Domain context

2.1 Business Domain: Education

The smart printing system is aimed at serving the higher education sector, specifically within the Ho Chi Minh City University of Technology (HCMUT). The primary goal is to facilitate an efficient, user-friendly, and manageable printing service for students across various campuses of the university. The system aims to streamline the printing process, making it more convenient for the student body.

2.2 Technical Domain: Web and Mobile Applications

Technically, the system will be a web-based application accessible from multiple platforms. It will integrate with HCMUT's Single Sign-On (SSO) for secure user authentication. Payments for additional printing pages will be processed through specific online payment gateways, such as BKPay. This ensures a seamless and secure experience for the users.

2.3 User Domain

The system caters to two main types of users. Students will be able to upload documents for printing, view their printing logs, and purchase additional printing pages. On the other hand, System and Printer Service Operators (SPSO) will have administrative capabilities, such as managing printers, configuring system settings, viewing logs, and generating as well as viewing monthly and yearly reports.

2.4 Functional Domain

From a functional perspective, printers are identified by multiple attributes including ID, brand, model, a short description, and location details like campus name, building, and room number. The system allows for various printing properties to be configured, such as paper size, pages to print, and the number of copies. Additionally, the system maintains detailed logs of printing activities, including relevant details like student ID, printer ID, file name, and printing times. The system also enforces account balance restrictions, providing a default number of A4-size pages each semester, with the option to buy additional pages.

It adheres to legal and regulatory guidelines by complying with data protection laws and financial regulations related to online payment systems like BKPay.

3 Relevant Stakeholders and their needs

3.1 Student

The primary stakeholders are the students, who require a system that offers the convenience of printing documents easily from multiple locations within the campus. They also need the capability to view their printing history and track the number of pages they have printed. When their default printing quota is reached, students should have the option to purchase additional pages. A user-friendly interface that is accessible through both web and mobile platforms is essential to meet their needs.

3.2 Student Printing Service Officers (SPSO)

The Student Printing Service Officers (SPSO) are responsible for the overall management and smooth running of the printing service. They need the ability to manage printers, including adding, enabling, and disabling them across various campuses. SPSOs also require access to detailed logs of all printing activities for monitoring and troubleshooting. Configuration options are important for them, such as setting permitted file types and defining the default number of printing pages for each student. Additionally, they must have the capability to generate and view monthly and yearly usage reports for administrative purposes.

3.3 University Administration

Lastly, the University Administration has a vested interest in providing a reliable and efficient printing service that meets the needs of the student body. For budgeting and planning, detailed reporting tools are essential. The administration also needs the system to comply with all relevant regulations and standards. Maintainability is a crucial factor; thus, the system should have minimal downtimes and come with clear documentation for troubleshooting and future updates. Integration capabilities with existing systems, such as HCMUT's Single Sign-On (SSO) for authentication, are also vital for seamless operation.

3.4 More relevant stakeholders

IT Support Staff are essential for technical upkeep and troubleshooting, while Faculty and Staff use the system for administrative and educational purposes. Local and Campus-based Vendors, who supply paper and ink, are concerned about inventory and logistics. External Auditors review the system for compliance with standards and regulations. The Financial Department is responsible for the billing aspects and budget allocation for the printing resources. Lastly, Unions or Student Associations may advocate for student needs, ensuring

that the system is equitable and meets the demands of the student body. These diverse stakeholders each have unique needs and concerns that must be addressed for the smart printing system to be comprehensively effective.

4 Benefits of the HCMUT Student Smart Printing Service

The system has been designed to cater to the needs of stakeholders and provide them with numerous advantages. These benefits include improved efficiency and productivity, enhanced decision-making capabilities, streamlined processes and workflows, increased accessibility to information, cost savings, etc. Consider each of the stakeholders listed below.

1. **Students**

   The HCMUT Student Smart Printing Service provides students with the convenience of easily accessing printing services from various campus locations. This system allows students to monitor their printing pages and purchase additional pages as needed, offering transparency regarding their printing activities. They can easily track the number of pages printed, their printing history, and their account balance, making it simpler to manage their resources effectively. Furthermore, the system ensures the security of their uploaded documents, safeguarding their privacy and academic work.

2. **Student Printing Service Officers (SPSO)**

   The SPSO (Student Printing Service Office) can experience increased administrative efficiency through the system's tools for managing student accounts, and printers, configuring system settings, and automating report generation. This has significantly reduced manual tasks for SPSO personnel. Moreover, the system ensures the security and integrity of printing data, thereby enhancing the overall reliability of the system and maintaining the trust of users. Furthermore, the system provides tools and access to system data, enabling effective support for students in resolving printing-related issues and addressing their queries. This comprehensive approach to managing the printing service benefits both SPSO and students alike.

3. **University Administration**

   The system significantly contributes to sustainability initiatives by reducing paper waste and promoting eco-friendly printing practices. This aligns seamlessly with the university's steadfast commitment to environmental responsibility. Additionally, the system assists in meeting any external regulatory requirements related to printing services, thereby helping the university maintain compliance with established standards. Moreover, the usage data and comprehensive reports generated by the system serve as invaluable tools for effective budget planning. These insights empower

the University Administration to allocate resources judiciously and make informed financial decisions. Furthermore, the University Administration ensures that only authorized users can access the system through the HCMUT_SSO authentication service, emphasizing the importance of security and data protection.

5 Requirements

5.1 Functional requirements

5.1.1 General requirements

- Printer's information: Each printer contains printer ID, brand name, printer model, a short description and location (including campus name, building name, and room number).
- Printing log: The system has to log the printing history of students (including student ID, printer ID, file name, printing start and end time, and number of pages for each page size).
- Monthly and annual reports: The reports about the use of the printing service have to be generated at the end of each month and each year. These reports have to be stored in the system.
- Other services connection: The system has to be connected to some online payment system (like BKPay, MoMo, ZaloPay) and HCMUT_SSO authentication service.

5.1.2 Students

- File uploading: Students can upload the permitted document files for printing.
- Printer choosing: Students can choose a printer.
- Printing configuration: Students can specify printing properties such as paper size, number of pages to be printed, one or double-sided, and number of copies.
- Checking printing log: Students can view their printing history and the summary of the number of printed pages for each page size for a month.
- Checking payment log: Students can access a payment history log detailing their transactions related to purchasing additional printing pages.
- Checking printing balance: Students are given a default number of A4-size pages each semester for printing and they can view the number of remaining pages available for printing.
- Checking printing status: Students can check the status of their print jobs, including whether the job is queued, in progress, or completed.

- Buying pages: Students can buy more pages to print through BKPay, MoMo, and ZaloPay.

5.1.3 Student Printing Service Officer (SPSO)

- File type management: SPSO can limit and configure the file types which are allowed to be printed.
- Printer management: SPSO can add, enable and disable a printer.
- System configuration management: SPSO can manage other configurations of the system, including changing the default number of pages for printing each semester, changing the dates to give the default number of pages for printing to all students, and changing the valid file types allowed to be printed.
- Viewing reports: SPSO can view the monthly and annual reports of the use of the printing system anytime.
- Viewing printing log: SPSO can view the printing history of all students and all printers.

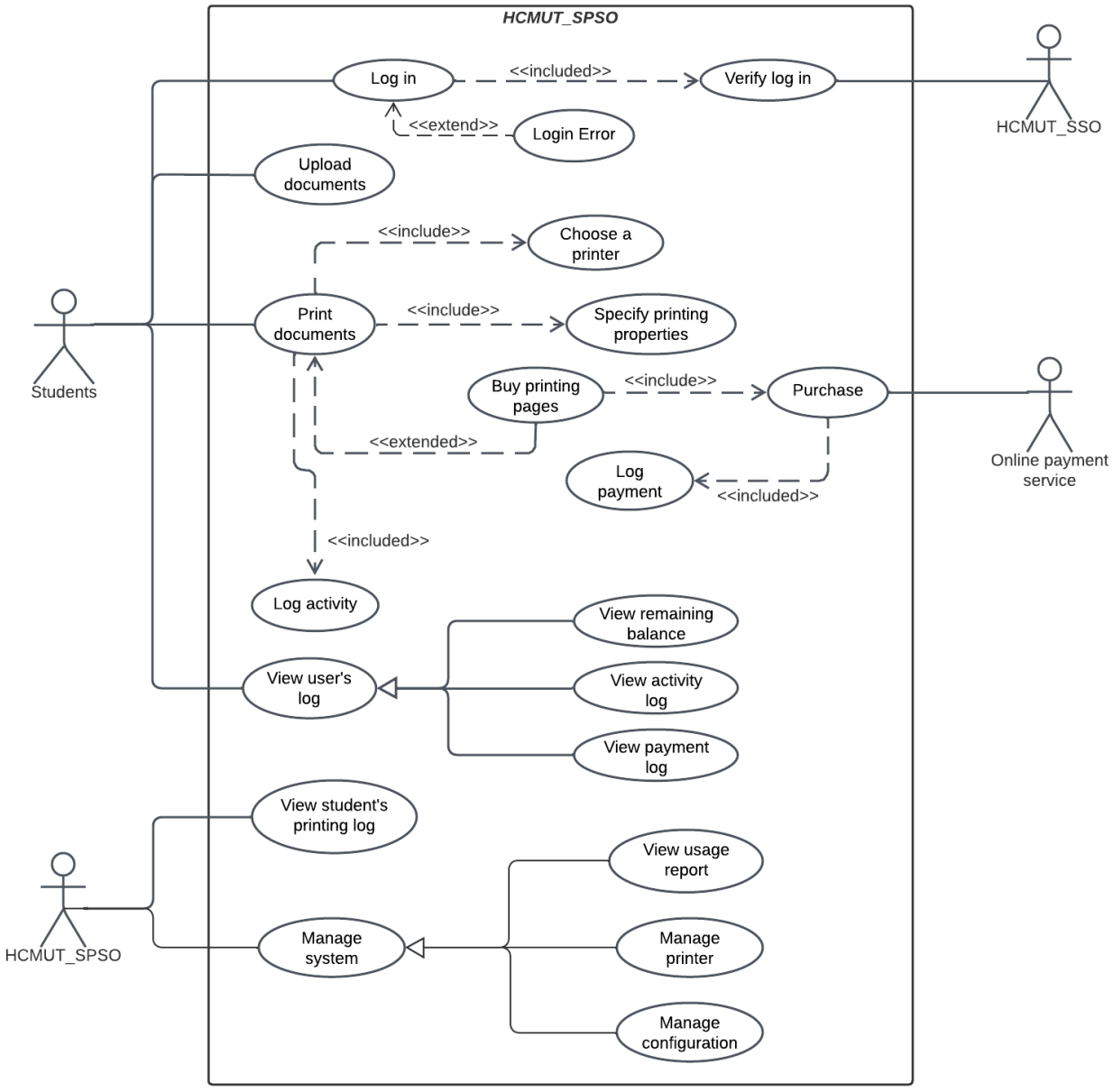
5.2 Non-Functional requirements

- Ease of use:
  + Students should be able to use the service after 10 minutes of training.
  + Administrative staff should be able to use all the functions of the system after 15 minutes of training.
- Performance:
  + Response time for user interactions (e.g., uploads, submissions, report generation) should be under 1 second when there is no network congestion.
  + Time to load the website should not exceed 2 seconds.
  + The system should be able to handle 150 concurrent users at one time.
- Capacity: Files uploaded at one time should be under 25 MB.
- Availability:
  + Users can access the web-based system 24/7.
  + The printing service should be available during office hours (6 A.M. to 6 P.M.) 7 days a week.
- Reliability: The percentage of failure that occurred should be under 5% in a month.
- Security:
  + Users can only log in to the system through one device at a time.
  + All users have to be authenticated by the HCMUT_SSO authentication service

before using the system.
+ Payment gateway should be PCI DSS compliant.

- Scalability: The system should be scalable to adapt to the increasing number of users and printers during exam seasons.
- Compatibility: The website should be compatible with common web browsers such as Chrome, Safari, Edge, Opera, and Firefox.
- Portability: The website should be able to run on the new versions of the common web browsers (Chrome, Safari, Edge, Opera, Firefox) without changing behaviours and performance.

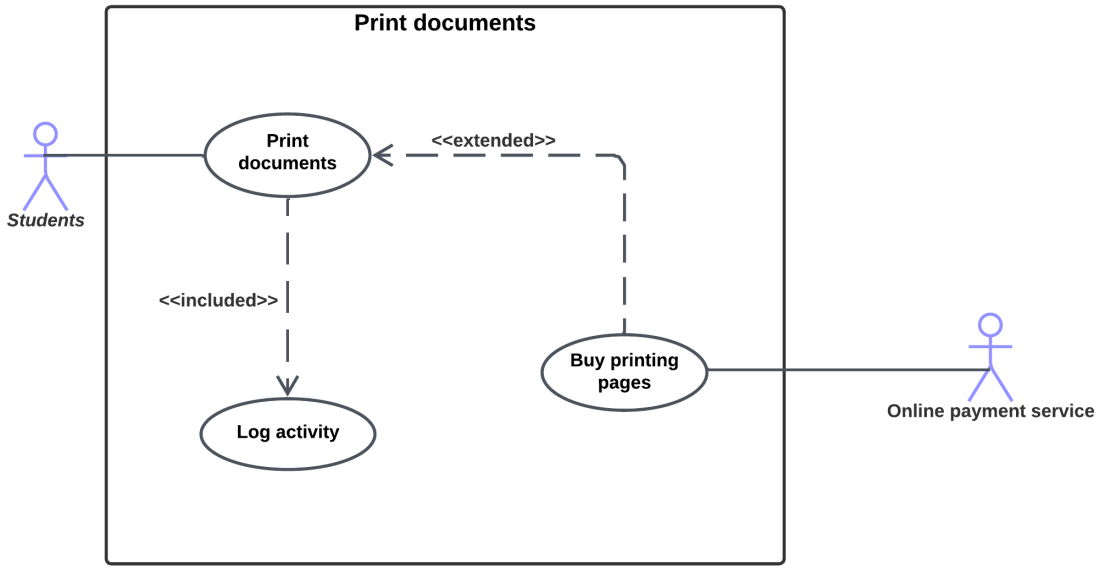
6 Use-case Diagram for the whole system



Hình 1: The HCMUT_SSPS Use-case Diagram

7 Use-case Diagram for "Print Document" module

7.1 Use-case Diagram



Hình 2: Printing Document

7.2 Use-case Scenarios

7.2.1 Use case: Printing Document

Use Case ID	01
Use Case Name	Print Document
Actor	Student, HCMUT SSO, Online payment service
Description	The process of a student printing a document with HCMUT_SSPS
Trigger	Click the ***In ngay*** button.
Preconditions	The student has logged into the system through HCMUT_SSO, has successfully uploaded one document file and has selected printer for printing.
Postconditions	The document is successfully printed according to the specified printing properties

Normal Flow	1. Student chooses a printer and press ***Hoàn thành*** button. 2. The system accepts and displays the choosing properties session. 3. Students customize printer settings, including paper size, page selection, single or double-sided printing, and the number of copies. 4. Students press the ***In ngay*** button. 5. The system checks the student's remaining pages. 6. Printers start printing documents and the system shows the after-print page. 7. The system logs the printing activity.
Alternative Flows	*None*
Exceptions	*Exception 1: At step 6: The student's remaining pages is not enough* 6a. The system will ask the users to buy more pages, users will purchase for the buying page using an online payment service and the system will log this activity. *Use case continue from step 5.* 6b. If the users decide not to purchase additional pages, the system cancels the print job. *Use case end and return to the homepage.* 6c. If the payment transaction fails for any reason, the system provides options for the student to retry the payment or cancel the print job. *Use case end and return to the homepage.* *Exception 2: At step 7: Printer out of paper* 3d. The system displays a message and asks the user to choose another printer *Use case continue from step 1.*

Notes and Issues	If, during the printing process, technical issues occur such as paper jams, printer errors, or network problems: • Instead of manually selecting a printer, the system can automatically select the default printer and printer settings. • The system detects the issue and displays an error message. • The system may prompt the student to select a different printer if available. • The student can choose to retry the print job or cancel it. • If the student retries and the issue is resolved, the printing process continues.

7.2.2 Use case: Buy printing pages

Use Case ID	02
Use Case Name	Buy printing pages
Actor	Student, Online payment service
Description	Student can buy more pages for their printing activities
Trigger	Student clicks the ***In ngay***button or students click on ***Mua thêm giấy*** button
Preconditions	After choosing printing properties, student clicks ***In ngay*** button but the remaining pages are insufficient, or student intends and navigate to account page to purchase additional pages.
Postconditions	The student's new remaining pages are updated
Normal Flow	1. The system displays a window containing information on the price per page, the quantity of pages needed, and issues relevant warnings. 2. The student enters the number of pages. 3. The system automatically adjusts the total price. 4. The student choose ***Thanh toán*** button to make a transaction with Online payment service.
Alternative Flows	None

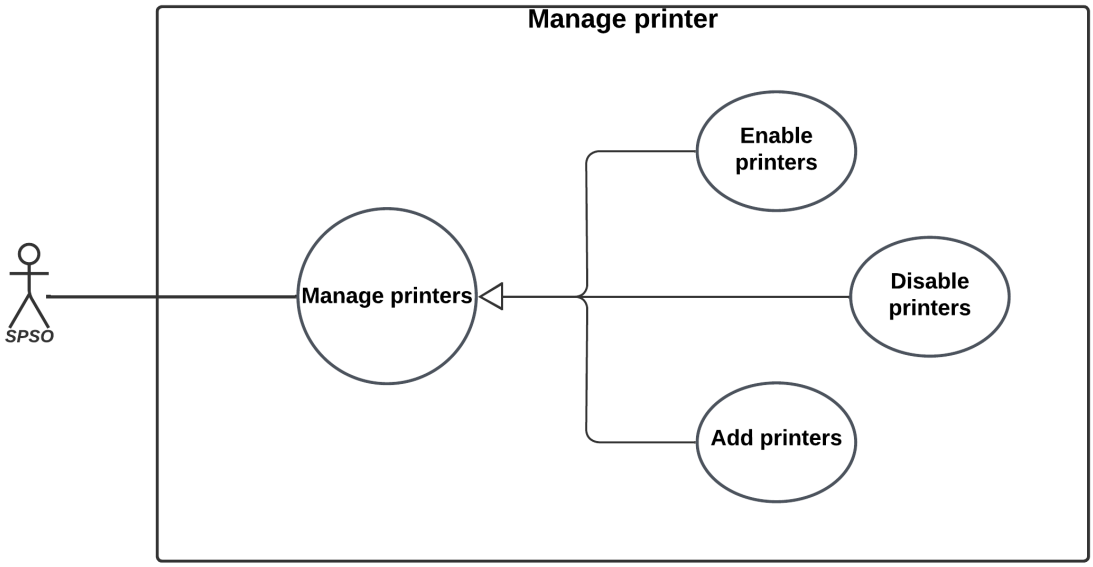
Exceptions	*Exception 1: At step 1* 1a. If the student click the ***Hủy giao dịch*** button instead of the ***Mua thêm trang*** button, go back to the printing window. *Use case end.*

7.2.3 Use Case: Log activity

Use Case ID	03
Use Case Name	Log activity
Actor	HCMUT SSO
Description	When the document is printed successfully, the system logs this activity.
Trigger	The printing process is successfully finished.
Preconditions	The document is successfully printed.
Postconditions	The system successfully logs the current printing activities
Normal Flow	1. After successfully printing the document, the system logs that printing activity.
Alternative Flows	None
Exceptions	None

8 Use-case Diagram for "Manage System" module

8.1 Use-case Diagram



Hình 3: Manage system

8.2 Use-case Scenarios

8.2.1 Use case: Manage Printers

Use Case ID	11
Use Case Name	Manage Printers
Actor	SPSO administrators
Description	The SPSO administrators can perform some operations on printers such as add, enable, disable
Trigger	Administrators click the ***Quản lí hệ thống*** button
Preconditions	Administrators have successfully logged into the system through HCMUT_SSO, a particular homepage appeared for admin role.
Postconditions	Navigate to the particular administrator's dashboard for managing printers.
Normal Flow	1. The system displays admin dashboard. 2. Admins view printing activities of all students, list of all printer's information, modify printer's status or the time that reports are automatically generated or configure them.
Alternative Flows	None
Exceptions	None

8.2.2 Use case: Enable Printer

Use Case ID	12
Use Case Name	Enable Printer
Actor	SPSO administrator
Description	SPSO administrator can enable a printer
Trigger	SPSO administrator clicks the ***Khởi động*** button on the ***Tùy chọn*** column at the printer which needs to be enabled
Preconditions	Admins are in the management page, which has ***Quản lý hệ thống - Máy in*** section
Postconditions	The chosen printer will be enabled
Normal Flow	1. The system changes the status of the printer into ***Đang hoạt động*** and saves that status.
Alternative Flows	None
Exceptions	No

8.2.3 Use case: Disable Printers

Use Case ID	13
Use Case Name	Disable Printers
Actor	SPSO administrator
Description	SPSO administrator can disable a printer
Trigger	SPSO administrator clicks the ***Buộc dừng*** button on the ***Tùy chọn*** column at the printer which needs to be disabled
Preconditions	Admins are in the management page, which has ***Quản lý hệ thống - Máy in*** section
Postconditions	The chosen printer will be disabled
Normal Flow	1. The system changes the status of the printer into ***Ngưng hoạt động*** and saves that status.
Alternative Flows	None
Exceptions	No

8.2.4 Use case: Add Printers

Use Case ID	14
Use Case Name	Add Printers
Actor	SPSO administrators
Description	The SPSO administrators add new printers to the system

Trigger	Administrators click the ***Thêm máy in*** button
Preconditions	Administrators have navigated to the management dashboard.
Postconditions	The newly added printer is showed in the printer list.
Normal Flow	1. The system displays a blank area. 2. Administrators fill in all information about the new printers (ID, brand, position, state) 3. Admins click ***Thêm máy in*** button.
Alternative Flows	None
Exce ptions	*Exception 1: At step 1* 1a. If the SPSO administrators add a printer that already exists, the system will generate a notification indicating that this printer has already existed. *Use case continue at step 1.*

9 Conclusion

The development journey of BKPrint relies heavily on this document as a guiding compass. It encompasses the expectations of stakeholders, system functionalities, and interaction scenarios, providing a clear roadmap for system implementation. This document serves as a valuable tool in steering the development process in the right direction.