HO CHI MINH UNIVERSITY OF TECHNOLOGY
COMPUTER SCIENCE & ENGINEERING

ASSIGNMENT REPORT
Software Engineering (CO3001)

A SMART PRINTING SERVICE FOR STUDENTS AT HCMUT

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Ho Chi Minh City, 9/2023

CONTENTS

1 Task 1: Requirement elicitation **3**
1.1 Overview . . . 3
1.2 Requirements Analysis . . . 3
1.2.1 Functional Requirements . . . 3
1.2.2 Non-functional Requirements . . . 5
1.3 Use case Diagram . . . 6
1.3.1 Use case Diagram for the whole system . . . 6
1.3.2 UC Diagram for Managing printers module and specific description . . . 7
1.3.2.1 Diagram . . . 7
1.3.2.2 Login . . . 7
1.3.2.3 Manage printers . . . 8
1.3.2.4 View and Manage current printers . . . 9
1.3.2.5 Add new printer . . . 10
1.3.2.6 Select . . . 11
1.3.2.7 View and Edit Printer . . . 12
1.3.3 UC Diagram for Print document module and specific description . . . 13
1.3.3.1 Diagram . . . 13
1.3.3.2 Print document . . . 14
1.3.3.3 Upload file . . . 15
1.3.3.4 Choose printer . . . 16
1.3.3.5 Specifying the printing properties . . . 17

2 Task 2: System modelling **18**
2.1 Activity Diagram . . . 18
2.1.1 Activity Diagram for Manage Printers module . . . 18
2.1.2 Activity Diagram for Print document module . . . 20
2.2 Sequence Diagram . . . 21
2.2.1 Sequence Diagram for Modify Manage Current Printer . . . 21
2.2.2 Sequence Diagram for ADD Printer . . . 23
2.2.3 Sequence Diagram for Printing document . . . 25
2.3 Class Diagram . . . 26
2.4 Develop MVP . . . 27

3 Task 3: Architecture Design **29**
3.1 Architecture design . . . 29
3.1.1 An abstract description for each module . . . 30
3.1.1.1 Manage Printers Module . . . 30
3.1.1.2 Printing Document Module . . . 30
3.1.2 API description . . . 30
3.2 Component Diagram . . . 31

4 Task 4: Implementation - Sprint 1 **33**
4.1 Setting up an online repository and Adding documents, materials and folders 33
4.2 Usability Test 33
4.2.1 Manage Printers 33
4.2.2 Print Document 39

5 Change Log **46**

6 References **47**

CHAPTER 1
TASK 1: REQUIREMENT ELICITATION

1.1 Overview

Student Smart Printing Service (HCMUT_SSPS) is a Project that create a service helping students to print conveniently and efficiently. HCMUT_SSPS also includes a surface that allow administrators (Student Printing Service Officer) to manage the printer.

The stakeholders of HCMUT_SSPS are students, administrators (SPSO).

Students are people who use HCMUT_SSPS to print their documents. They need a convenient way to print their documents from anywhere in the campus, a method to upload document, also they have an ability to check their printing log and pay for new pages in case their account is exceed.

SPSO plays a role as administrators, who manage HCMUT_SSPS. SPSO requires these functions, first they can configure and limit the type of file the students can upload. Second, a feature to change the default number of pages. Third, an ability to alter the dates that the system will give the default number of pages to all students. Fourth, a feature to add, enable and disable a printer. Lastly, they can view the printing history of all students or a student for a time period (date to date) and for all or some printers, the report of the printing service will be generated automatically by the system.

HCMUT_SSPS provides students a convenient and efficient way to print their document. By using the service, they can print anywhere from the campus and save up money by having an ability to control which pages will be printed. The benefits of HCMUT_SSPS for SPSO are helping them in management of printing. SPSO has the features to control printing of students included (tracking printing usage, manage printers, generate reports). Hence, helping them to prevent unauthorized documents.

1.2 Requirements Analysis

1.2.1 Functional Requirements

- User authentication
  - All Users have to be authenticated by the HCMUT_SSO authentication service before accessing the system.
- Printing Document:
  - Users (students) are able to upload documents for printing.
  - Users must choose a printer from the available options.

  - As default, the printer will print the whole document with A4 and double-sided, one copy. Users should specify printing properties, including paper size, page range, single/double-sided, and the number of copies.
  - The system supports limited file types, configurable by the SPSO.

- Logging Printing Actions:
  - The system must log printing actions for all students, including student ID, printer ID, file name, printing start and end time, and the number of pages for each page size.

- Viewing Printing History:
  - At default, the system will show all the log in a current month. There will be a filter for both SPSO and students to view printing log in a specific period of times. A filter include begin day and end day which can be modified by the SPSO and students.
  - The SPSO is able to view the printing history (log) of all students or a specific student for a specified time period.
  - Students are able to view their own printing log for a time period, along with a summary of the number of printed pages for each page size.

- Managing Printing Pages:
  - The system must track the default number of A4-size pages allocated to each student for printing each semester.
  - Students should be able to purchase additional printing pages.
  - The system should integrate with an online payment system (BKPay) for payments.
  - Printing should only be allowed if the student's account balance (page count) permits it. A3 pages should be equivalent to two A4 pages.

- Printer Management:
  - The SPSO should have the ability to manage printers, including adding, enabling, or disabling them.
  - Each printers will notify the SPSO if they run out of papers.

- System Configuration:
  - The SPSO should have access to system configuration settings, including the default number of pages, distribution dates for default pages, and permitted file types.
  - SPSO can configure the default printing properties (One/Double-sided printing, paper size, number of copies).
  - The SPSO can configure the size limit for the documents. For E.G if the SPSO configure size limit is 10MB, students cannot upload a file larger than 10MB.
  - The SPSO can configure the limitation of pages for each student in a day. The student is not allowed to print over the limitation. (E.G: 100 papers).
  - In case, students want to print an amount of pages exceed the limit above, there is also alternative option. Students can get their document in specific day at SPSO_OFFICE.

- Report Generation:
  - The system should automatically generate reports at the end of each month and year.
  - The report included number of printed papers, number of users, number of failures for each printers (if they exist).
  - There is filter (month, year) to find the specific report.
  - Reports should be stored by the system and accessible to the SPSO.

1.2.2 Non-functional Requirements

- Appearance of the project:
  - The display (front - end) of website should look good on every devices
  - The display should have to mode night mode and day mode
  - The design of the project should be minimalism and simplicity.
- Some constraints:
  - The system must have concurrency feature to handle many access. The response of each operation is less than 2s.
  - The printer will start to print when a student come at its location and enter a student id to the printer.
  - The size of each file should be less than 10MB.
  - The system only allow a student to print some number of pages when it does not exceed his/her account (page) balance.
  - The pages that can be printed per day of each printer should be less than 10000. If the printer exceed the limit, students cannot choose it.
  - The system only receive printing demand from 7:00 am to 6:00 pm.
  - All documents will be deleted after 8:00 pm in order to save up memory.
- Architecture of the application:
  - The application should be based on an architecture that is easy to maintain and develop
  - The application should be easy to deploy on every platform
  - The application should be accessible through both web-based and mobile applications to cater to different user preferences and devices.

1.3 Use case Diagram

1.3.1 Use case Diagram for the whole system

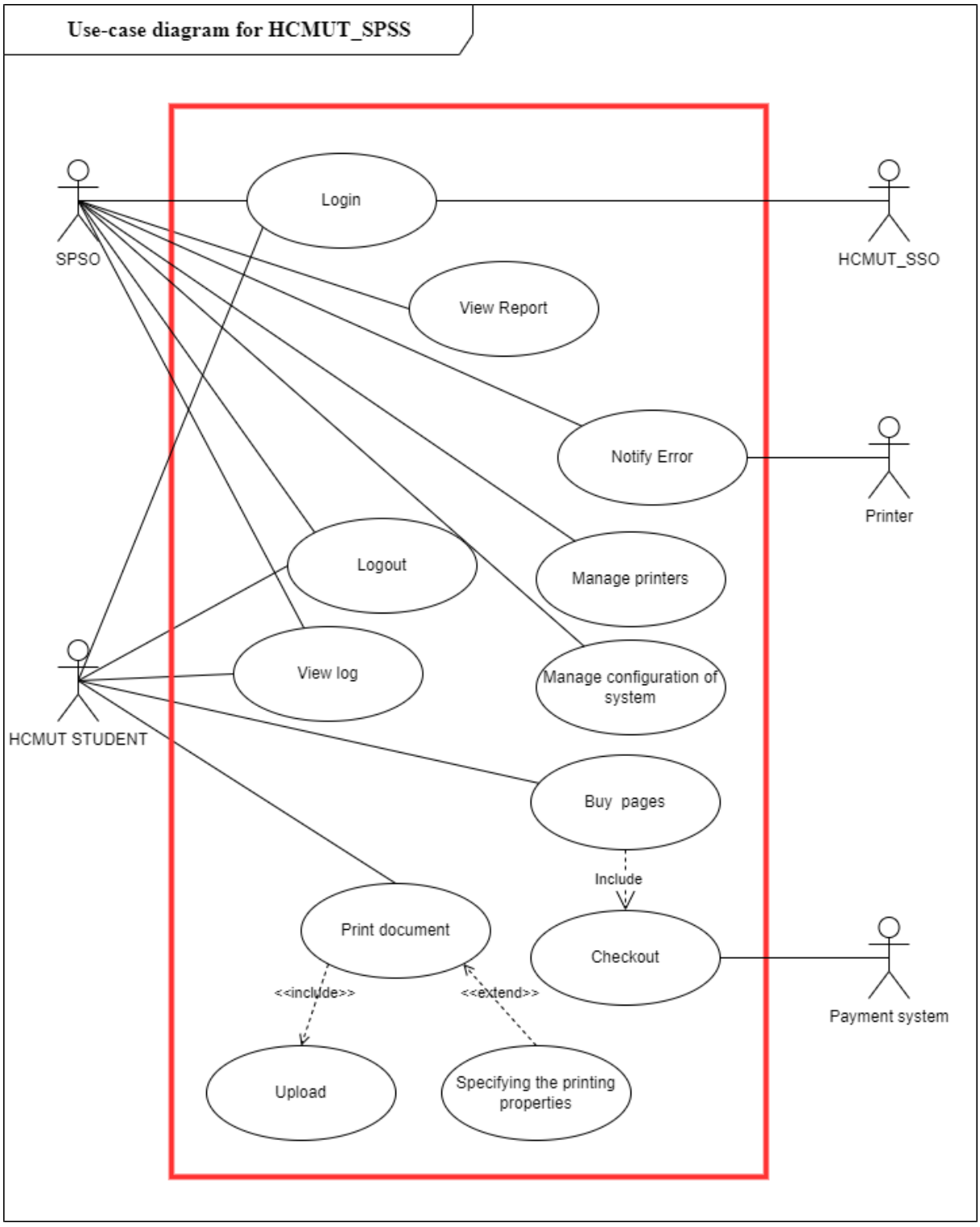

Figure 1.1: Use-case Diagram for the whole system

1.3.2 UC Diagram for Managing printers module and specific description

1.3.2.1 Diagram

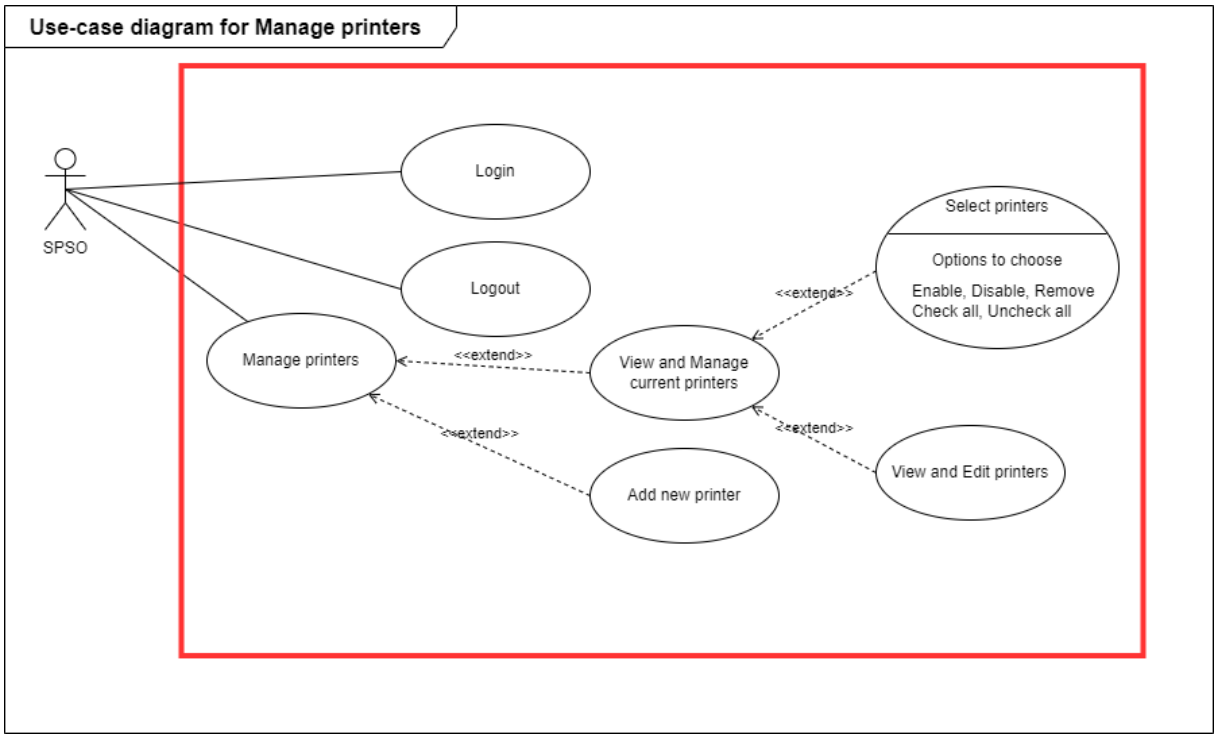

Figure 1.2: Use-case Diagram for Manage printers module

1.3.2.2 Login

Use Case	Login
Actor(s)	SPSO and HCMUT_student
Description	SPSO and HCMUT_student login to use the system
Priority	High
Pre-Conditions	Actor(s) must have HCMUT account.
Post-Conditions	Actor(s) login successfully
Basic Flow	1. Actor(s) click button "login" button to login. 2. System directs to HCMUT_SSO Login page. Actor(s) fill in their HCMUT account information 3. Login Successfully, System direct back and hence show all functions that Actor(s) can choose and cooperate with.
Alternative Flow	None
Exception Flow	**3a.** if HCMUT_SSO cannot authorize Actor's login, System don't direct back.

1.3.2.3 Manage printers

Use Case	Manage printers
Use Case id	UC_1
Actor(s)	SPSO
Description	SPSO manage printers
Priority	High
Pre-Conditions	SPSO login successfully
Post-Conditions	SPSO alter none or some of printers included any of these cases (New printer(s) are added, Some Printer(s) are removed, Some Printer(s) are Disabled, Some Printer(s) are Enabled).
Basic Flow	1. Actor(s) click on "Manage printers button" at home page. 2. System show 2 options included (Manage current printers and Add new printer). Actor(s) may choose any of these two to manage printer(s). 3. Actor(s) choose Manage current printers. 4. System directs to Manage current printer pages and action continue at View and Manage current printers
Alternative Flow	**3a.** Actor(s) choose Add new printer, then System directs to "Add new printer" page and action continue at Add new printer
Exception Flow	**3b.** Instead of choosing "Manage current printers" or "Add new printer", if actor(s) click "Cancel", System directs to homepage and nothing is modified.

1.3.2.4 View and Manage current printers

Use Case	View and Manage current printers
Use Case id	UC_1_1
Actor(s)	SPSO
Description	SPSO view and/or modify some or all current printers of the system. SPSO may delete, enable, disable, edit one or some printers.
Priority	High
Pre-Conditions	SPSO login successfully
Post-Conditions	Some printers are viewed and/or deleted, enabled, disabled or edited.
Basic Flow	1. Actor(s) click "Manage current printers" button at Manage printers page. 2. Following from top to bottom these are the functions in the use-case (may be included and developed in the future) - Search bar: Actor(s) enter Printer ID or Printer Model to search for specific printer. - Filter: There are Campus, Building and Brand to filter the list of printers. At default they are set to "All". - View of all printers: there is a list of all printers included their name and their basic information, their state (enable or disable). Each of component is clickable. - Select: Choose "Select" to select one or multiple printers. 3. Actor(s) click "Go back" to return to previous page.
Alternative Flow	**2a.** Search bar: If actor(s) enter an Printer ID or Printer Model on search bar. The system show an Printer that match the info given by actor(s). If none of the printers is matched, show "Not found". **2b.** Filter: The system shows all printers that match the filter given by actor(s). For example, if actor(s) use Campus1, B2, CANON as filter, the systems only shows CANON printers in B2 at Campus1. **2c.** If actor(s) click on any specific printer. Action continue at View and Edit Printer **2d.** Select: If actor(s) choose "Select", action continue at Select. **2e.** If actor(s) choose "Go back" without modify any printers. None of the printer is modified and updated.
Exception Flow	None

1.3.2.5 Add new printer

Use Case	Add printer
Use Case id	UC_1_2
Actor(s)	SPSO
Description	SPSO add printer to HCMUT_SSPS system.
Priority	High
Pre-Conditions	SPSO login successfully
Post-Conditions	Successfully add new printer with information to the HCMUT_SPSS
Basic Flow	1. Actor(s) click "Add new printer" at Manage printers page. 2. Enter Printer Details: Fill in the following information for the new printer - Printer ID: Assign a unique identification number to the printer *(Ex: P1B0001, P2B0002.... P1B code refers to printers located at branch 1, and P2B code refers to printers located at branch 2).* - Brand/Manufacturer Name: Specify the name of the printer's manufacturer. - Printer Model: Provide the model name/number of the printer. - Short Description: Add a brief description of the printer, such as its features or specifications. - Location: Specify the printer's location, including the campus name, building name, and room number where the printer is located. 3. Verify Information: Double-check the entered details to ensure accuracy and completeness. 4. Save and Update: Save the entered information to update the system's printer list. 5. Confirmation: Receive a confirmation message indicating that the printer has been successfully added to the SPSO system.
Alternative Flow	**2a. Invalid Information** - Action: Display an error message indicating the specific fields that need to be corrected. Allow the user to modify the incorrect information and resubmit. **2b. Incomplete Form Submission** - Action: Prevent form submission and display a message indicating that all fields are mandatory. Highlight the empty fields for the user to complete before submission.
Exception Flow	**1a.** In case that actor(s) click "Cancel" button, the action end and there isn't any printer to be added. The system directs back to Manage Printers page. **4a.** For some unfortunate reasons, system is incapable of adding new printer, a pop-up appears and notify "We appologize for the incovinience, printer cannot be added at the moment."

1.3.2.6 Select

Use Case	Select
Use Case id	UC_1_1_1
Actor(s)	SPSO
Description	SPSO select one or multiple printers and do any of these action (Enable, Disable, Remove)
Priority	High
Pre-Conditions	SPSO login successfully
Post-Conditions	SPSO successfully (Enable, Disable, Remove) one or multiple printers.
Basic Flow	1. Actor(s) click "Select" button at "Manage current printers" page. 2. All the components representing printers are now selectable, actor(s) manually choose printer(s) that they want to (Enable, Disable, Remove). 3. Actor(s) choose one of three options (Enable, Disable, Remove) to perform the action. 4. System pops up message asking whether actor(s) is sure about their choice. 5. Actor(s) click "Ok" to save the action. 6. System receives signal from actor(s) and alter information on the database. - For (Enable/Disable) field, 1 means Enable, 0 means Disable. - For (Remove) field, 1 means Remove. It is soft delete, the printer's data is still stored in the database and only able to be permanently deleted by database administrators.
Alternative Flow	**2a.** Alternatively, Actor(s) can choose "Check all" to select all the printers or "Uncheck all" to deselect all the printers.
Exception Flow	**3a, 5a.** In case actor(s) choose "Cancel" instead of (Enable, Disable or Remove), None of printers is changed. **System Error:** - Action: Display generic error, log issue for administrators. **Data Integrity Error:** - Action: Display an error message indicating a data integrity issue and prevent the editing process. Advise contacting system administrators to resolve the problem.

1.3.2.7 View and Edit Printer

Use Case	View and Edit Printer
Use Case id	UC_1_1_2
Actor(s)	SPSO
Description	SPSO view and edit printer information in the HCMUT_SSPS system
Priority	High
Pre-Conditions	SPSO login successfully
Post-Conditions	Printer view information about specific printer and update information successfully.
Basic Flow	1. Click on the any component that show printer's name, ID,... at Manage current printers page to view more details of a specific printer. 2. System directs to "View and Edit Printer" page. The page show all the details about printer including Printer ID, Brand/Manufacture Name, Printer Model, Short Description, Location(Campus name, Building name, room number). 3. For editing printer, Click on "Edit", the system pops up a board that includes all information mentioned above and allows actor(s) to edit. 4. Click "Save" to update the information of printer.
Alternative Flow	**3a. Invalid Information** - Action: Display an error message indicating the specific fields (ID, brand, model, description, or location) that need to be corrected. ID, model is a fill-in form and cannot be empty, ID is unique. Allow the user to modify the incorrect information and resubmit.
Exception Flow	**3b. No editing is trigger** In case actor(s) do not try to edit anything by click "edit" button and click on "Go back", there isn't change on the printer's information. **3c. Simultaneous Editing** - Action: Detect the conflict and inform users that the information cannot be edited at the moment due to simultaneous editing. Advise waiting for the current edits to finish before attempting again. **System Error:** - Action: Display generic error, log issue for administrators. **Data Integrity Error:** - Action: Display an error message indicating a data integrity issue and prevent the editing process. Advise contacting system administrators to resolve the problem.

1.3.3 UC Diagram for Print document module and specific description

1.3.3.1 Diagram

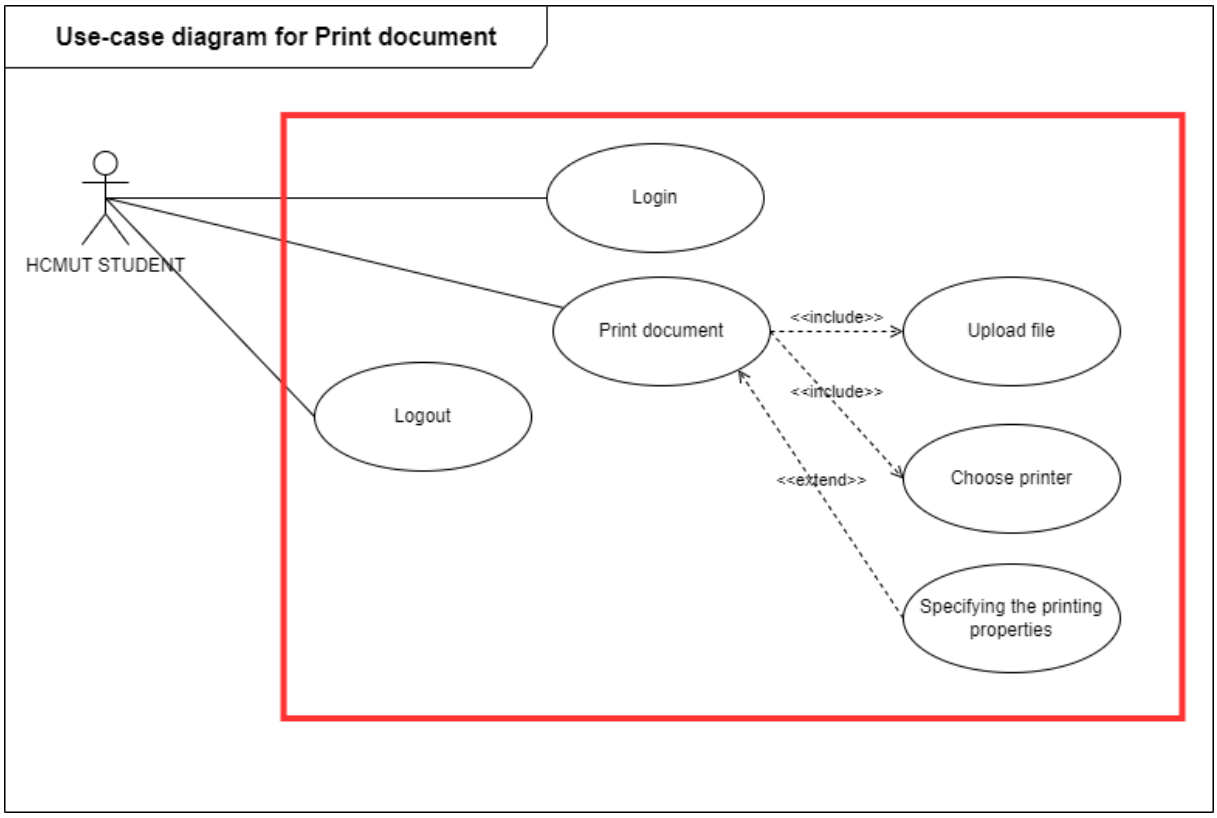

Figure 1.3: Use-case Diagram for Print document module

1.3.3.2 Print document

Use Case	Print document
Use case id	UC_2
Actor(s)	HCMUT_student
Description	HCMUT_student print documents
Priority	High
Pre-Conditions	- HCMUT_student login successfully. - Document file is uploaded and printer is chose.
Post-Conditions	HCMUT_student print their documents successfully, their account is updated.
Basic Flow	1. SPSO click on "Print Document". 2. System direct to new page and show three options included for actor(s) to choose (upload, Choose printer, Specify the printing properties). 3. Student(s) click "Print" to initiate the printing action 4. System verifies whether the file is uploaded. 5. System check if printer is chose. 6. System verifies whether page account of Actor(s) is exceeded. 7. System save verified printing information to the database. 8. Actor(s) come to the printer's location and enter their student's id to start physical printing. 9. Local system at printer's location retrieve data from database and start printing. 10. Actor(s) get their printed documents.
Alternative Flow	**2a.** Actor(s) choose "Upload" then action continue at use-case Upload file. **2c.** Actor(s) choose "Choose printer" then action continue at use-case Choose printer. **2b.** Actor(s) choose "Specifying printing properties" then action continue at use-case Specifying the printing properties.
Exception Flow	**4a.** If there is not any file uploaded, the system pops up warning board "No file is found !". Student(s) have to click "OK" to exit the pop-up and then upload file, or else printing cannot be executed. **5a.** If actor(s) have not chose a printer, A pop-up appear and warn "Please choose a printer". The Actor(s) have to exit the pop-up by click "Exit" and then choose a printer. **6a.** The system calculate the number of pages will be printed and compare it to student's account, If account is less than the papers required or account is exceed. System pops up "Your account is exceeded !", Student(s) can choose "Buy Papers", the system will then forward them to Buy Papers page or Choose "Ok" to exit the Pop-up. **7a.** For some unfortunate reasons, system is incapable of saving printing information, a pop-up appears and notify "We appologize for the incovinience, printing cannot be unachievable.".

1.3.3.3 Upload file

Use Case	Upload file
Use case id	UC_2_1
Actor(s)	HCMUT_students
Description	HCMUT students upload a file that they want to print
Priority	High
Pre-Conditions	- HCMUT_student login successfully
Post-Conditions	- HCMUT student upload file successfully: file is uploaded and temporarily stored in the system
Basic Flow	1. HCMUT student click on "Choose file" button 2. The system check whether any file is existent. 3. HCMUT student select file from their device 4. System validates the file's type. 5. System validates the file's size. 6. Actor(s) click "Upload" button 7. System notifies successful upload and the file is uploaded and stored in the system.
Alternative Flow	**2a.** If there is an existent file, a pop-up comes and ask if actor(s) want to replace the file. If yes, use-case continue at the next step, else actor(s) click "Ok" to exit the pop-up.
Exception Flow	**1a, 6a.** If Actor(s) choose exit, there is not any file uploaded or replaced. **4a.** If the file type is not supported, the system rejects the upload and notifies the user. **5a.** If the file size exceeds the limit, the system rejects the upload and notifies the user.

1.3.3.4 Choose printer

Use Case	Choose printer
Use case id	UC_2_2
Actor(s)	HCMUT_student
Description	HCMUT_student chooses one printer to print from the list.
Priority	High
Pre-Conditions	The student is logged in using the HCMUT_SSO authentication service.
Post-Conditions	The student has successfully chosen a printer for their printing task.
Basic Flow	1. Actor(s) click on choose printer. 2. System direct to page which show all printers that are available in HCMUT_SPSS. 3. There are filter for actor(s) to narrow the criteria of printers. The filter includes(Building, Campus, Room). As default, system show all printers. 4. Actor(s) click choose on the component representing the specific printer. 5. System ask if they are sure about their choice. 6. Actor(s) choose Yes(Ok) to finish choosing printer. 7. System save the choice and direct back to Print document page.
Alternative Flow	**3a.** In case actor(s) use filter. System shows all the printers that meet the condition of filter. For instance, If filter are (Campus2, H1, 303) then the system shows all printers that locate at campus2 in Building H1 and in room 303.
Exception Flow	**2a.** If actor(s) do not choose any printer and left the page by clicking "Go back", none of the printer is chose. **6a.** If actor(s) choose cancel, system exit the pop-up and none of the printers is chose.

1.3.3.5 Specifying the printing properties

Use Case	Specifying the printing properties
Use case	UC_2_3
Actor(s)	HCMUT_students
Description	HCMUT_students specify the properties for printing a document.
Priority	High
Pre-Conditions	- HCMUT_students is at the "Print Document" page.
Post-Conditions	HCMUT_students specify the properties successfully and their settings are saved.
Basic Flow	1. Actor(s) click "Specifying the printing properties" button 2. There are four settings that actor(s) may need to modify. They are (choose to print one/double-sided, paper size, choose to print all pages or specific pages, set number of copies. The following steps are basic flow and also the default settings. 3. Actor(s) choose print double-sided 4. Actor(s) choose A4 as a printing paper size. 5. Actor(s) choose to print all pages. 6. Actor(s) set number of copies to one. 7. Actor(s) click "Save" button 8. The system validate all settings. 9. The system records all the student's settings.
Alternative Flow	**3a.** Actor(s) choose print one-sided. **4a.** Actor(s) choose A3 as a printing paper size. **5a.** Actor(s) choose to print one specific page, then actors have to fill in the page that they want to print (E.g: 1 means they want to print only page 1). **5b.** Actor(s) choose to print a specific range of pages, then they have to fill in the range that they want to print follow by the syntax (start_page - end_page) (E.g: 1 - 30 means they want to print from page 1 to page 30). **6a.** Actor(s) set number of copies to any number that they want (E.g: 3 means they want three copies of their document).
Exception Flow	**7a.** Instead of "Save", if actor(s) choose "Cancel", the system directs back to the Print document page and the settings are unsaved. **7b.** In some unfortunate cases (connection failure, database is damaged,..), the system may not able to save the settings. Therefore, it will pop-up and notify the failure. **8b.** At step 5 - Choose pages to print, Only numbers that belong to set N* are acceptable and start_page must be smaller than end_page. If the system catch any of invalid number, it pops up un message that instruct the actor(s) to specify the settings again.

CHAPTER 2
TASK 2: SYSTEM MODELLING

2.1 Activity Diagram

2.1.1 Activity Diagram for Manage Printers module

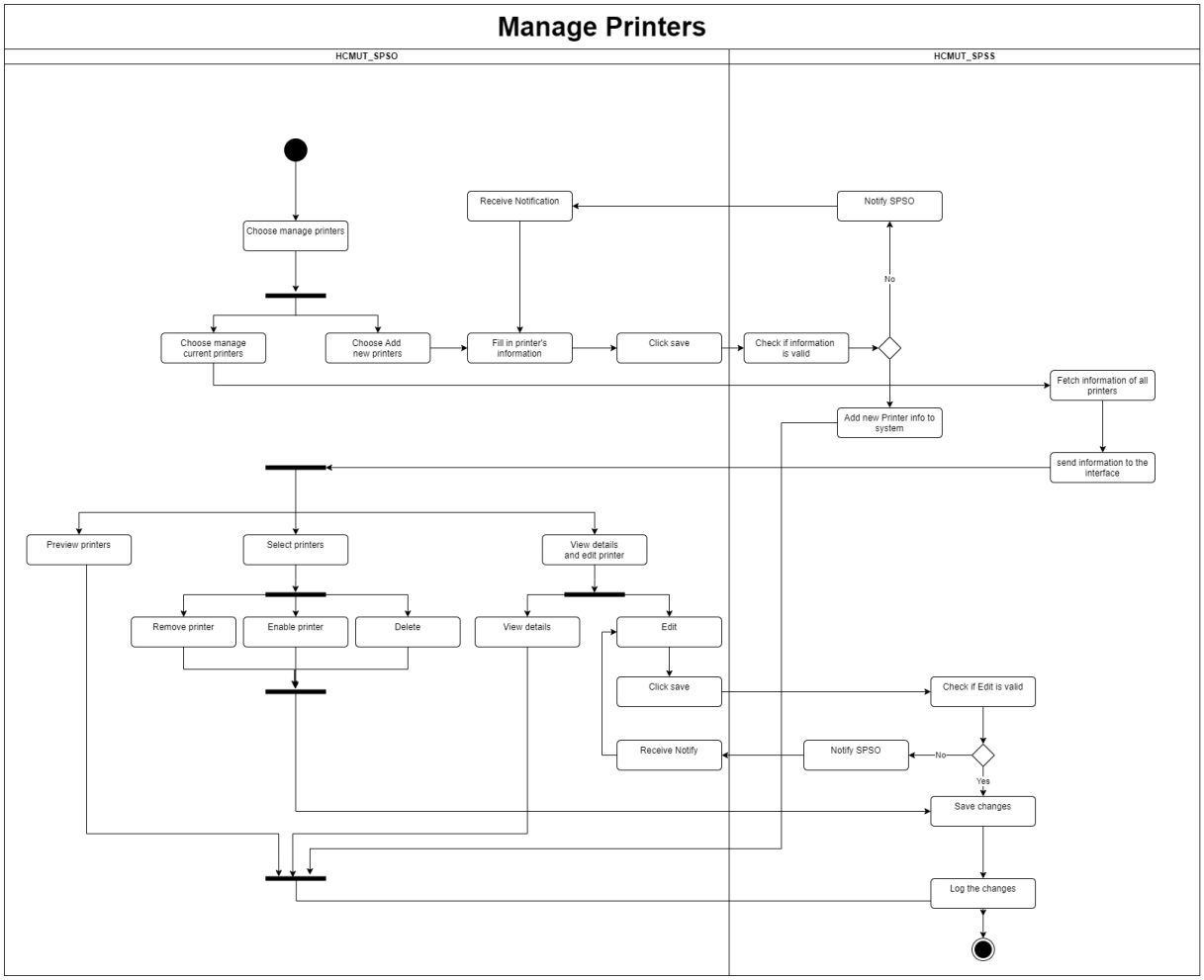

Figure 2.1: Activity Diagram for Manage Printers module

Description:

The Diagram above shows the activity flow of Manage Printers module. The stakeholder is HCMUT_SPSO. The flow starts when stakeholders choose "Manage Printers" in the home page. Then they have two options which are "Manage current printers" and "Add new printer". Therefore, the flow is divided. The stakeholder may take an action on one of those two "Manage current printers" and "Add new printer" or both.

- Manage current printers.
  - First, the system fetches all printers' information from database.
  - Send the information to interface which can be viewed by stakeholder.
  - The stakeholder has an ability to perform one of three or all the action. They are Preview printers, Select Printers, View details and edit printer.
  - For Select Printer, the stakeholder can enable, disable or delete after selecting.
  - For View details and edit printer, the stakeholder view more details of a specific printer and edit them or may just view.
  - After stakeholder edits printer, the HCMUT_SPSS check whether the changes are valid. If they are valid, they are saved, else SPSS forces stakeholder to edit again or nothing changes.
  - All the actions then lead to one point.

- Add new printer.
  - First, The stakeholder needs to fill in the form which requires printer's information. Then they click "save" to enter their action.
  - The SPSS check if the information is valid or if any field is left empty. If everything is valid, the SPSS save the printer's information and stores it in the database, else SPSS force stakeholder to correct the information or nothing is added.

All the flows above lead to one point and the SPSS logs any changes performed.

2.1.2 Activity Diagram for Print document module

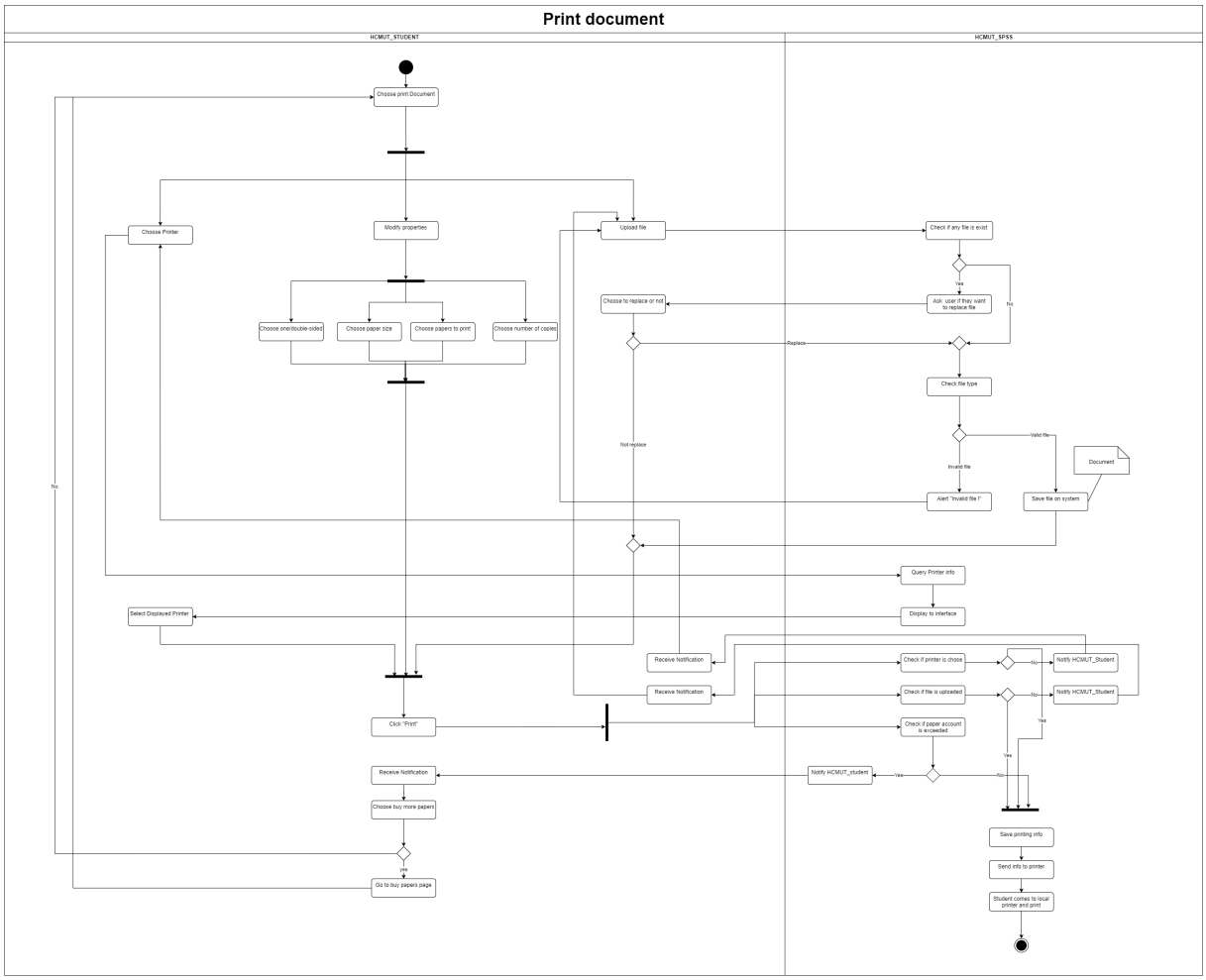

Figure 2.2: Activity Diagram for Print document module

Description:
The Diagram above shows the activity flow of Print document module. The stakeholder is HCMUT_Student. The flow starts once HCMUT_student click on "Print document" in the home page. Then, there are three action that HCMUT_student should do, they are Choose printer, Modify Properties, Upload file.

- For Choose printer
  . - The SPSS fetch available information from the database. - HCMUT_Student chooses a printer.
- For Modify Properties
  - The properties are set defaultly by the SPSS, HCMUT_student can modify properties to suit their expectation.
- For Upload file
  - HCMUT_Student upload file, the system check if any file is uploaded, if yes, SPSS ask if HCMUT_Student wants to replace, if yes file is replaced, if no SPSS keeps the old file.

All flows above lead to one point. Then, SPSS check these constraints (File is uploaded, Account is not exceeded, Printer is chose).
If all constraints are met, SPSS saves the printing information, logs it and sends it to the printer that HCMUT_Student has chose. HCMUT_Student comes to the printer, enter their student id to complete the action and get their printed document.
If some or all the constraints are failed, SPSS force HCMUT_Student to correct their action or else, nothing is saved and they cannot print anything.

2.2 Sequence Diagram

2.2.1 Sequence Diagram for Modify Manage Current Printer

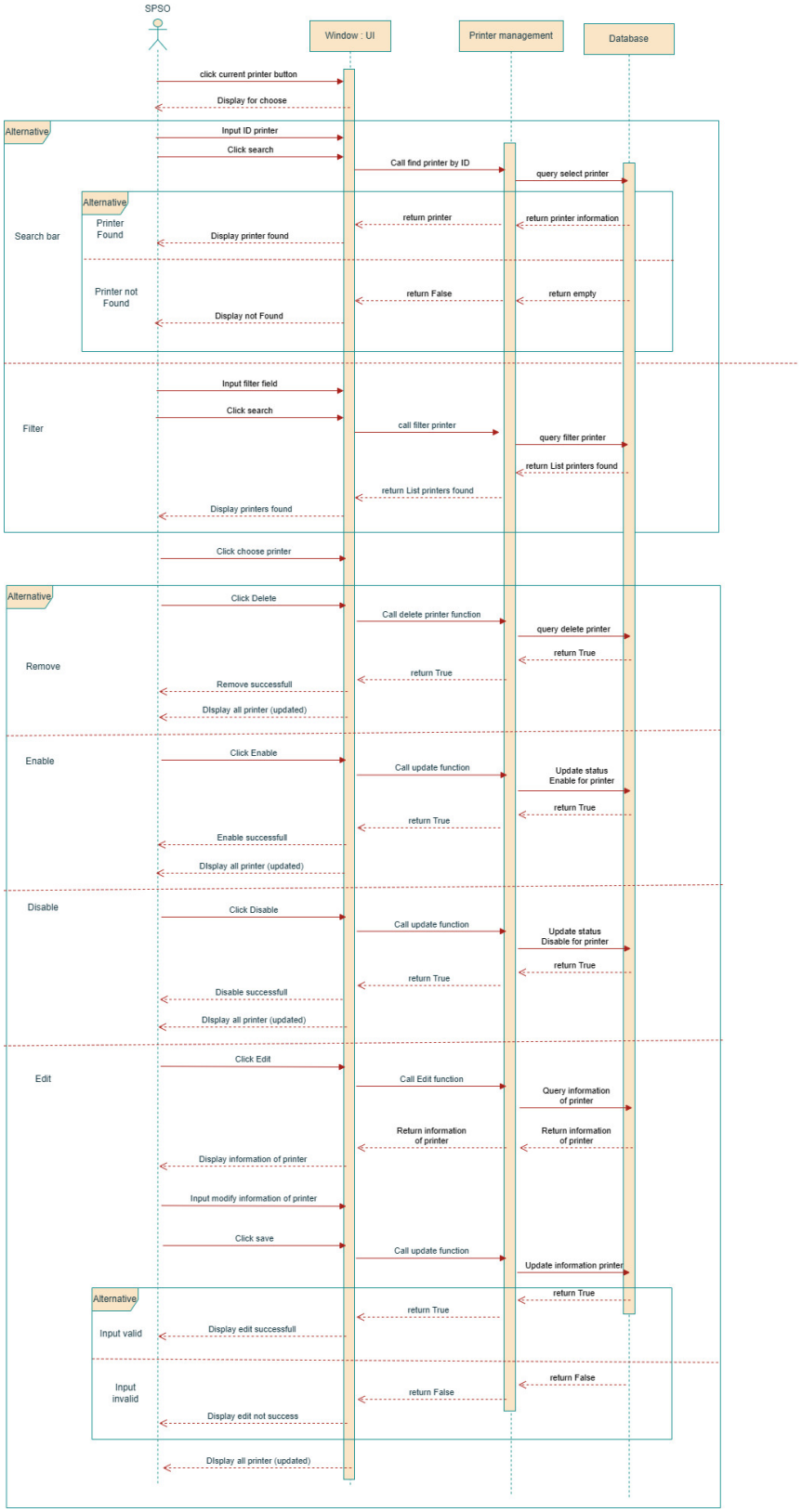

Figure 2.3: Sequence Diagram for Modify Manage Current Printer

1. When the user (SPSO) clicks the current printer button; Windows-UI will respond by displaying the Modify current print page interface with all printers in the system.

2. Here users can quickly select the printer that needs editing using the filter and printer search functions (both functions are optional - alternative).

    - To search for a printer by ID, the user enters the printer ID in the Input box and clicks the Search button, then Window-UI will call the find_printer_by_ID function in Printer_management; Printer_management will then execute the query_select_printer function to the database; There will be 2 cases:
        - If the above ID exists in the database, the database will return the printer information with the corresponding ID to Printer_management, and Printer_management will return the printer to Windows-UI. Windows-UI will then implement the display function to show the printer information.
        - If the above ID does not exist in the database, the database will return empty to Printer_management, and Printer_management will return False to Windows-UI. Windows-UI will execute the display function to show "No printer found."
        - To filter printers, users select information in the fields and press the Search button. Then, Windows-UI will call the filter_printer function in Printer_management. Printer_management will execute the query_filter_printer function to query the database. The database will return a list of matching printers to Printer_management, which will then return this list to Windows-UI. Finally, Windows-UI will execute the display function to show all printers in this received list.

3. The user selects the printer that needs Modify

4. Users may have the following interaction needs: Remove, Enable, Disable, Edit; These functions are optional- alternative:

    - To remove a printer: the user clicks the delete button, Window-UI will call the Delete_printer function to Printer_management; Printer_management will then execute the query_delete_printer function to the database; When the database is successfully deleted, it will return True to Printer_management; Printer_management then returns True for Windows-UI; Windows-UI then issues a Remove_successfull message and displays the entire (updated) printer list.
    - To enable the printer: the user clicks on the enable button, Window-UI will call the update_printer function to Printer_management ; Printer_management will then execute the enable_printer function to the database; After updating the printer status and enabling the database, it will return True to Printer_management; Printer_management then returns True for Windows-UI; Windows-UI then issues the Enable_successfull message and displays the entire (updated) printer list.
    - To Disable the printer: the user clicks the disable button, Window-UI will call the update_printer function to Printer_management; Printer_management will then execute the disable_printer function to the database; After updating the printer status to disabled, the database will return True to Printer_management; Printer_management then returns True for Windows-UI; Windows-UI then issues the message Disable_successfull and displays the entire (updated) printer list.
    - To edit printer information:
        - The user clicks on the Edit button, Window-UI will call the edit_printer function to Printer_management; Printer_management will then execute the query_information_printer function to the database; The database will return all printer information Printer_management; Printer_management will then return this result to Windows-UI, and Windows-UI will implement the Display_information_printer function to display all printer information.
        - User enters editing information and clicks Save
        - Windows-UI will call the update_printer function to Printer_management; Printer_management will then execute the update_information_printer function to the database; Here there are 2 cases:

* If the database checks and finds that the edited information is appropriate, it will update the information and return True to Printer_management; Printer_management then returns True to Windows-UI; and Windows-UI will then issue an Edit_successfull message and display the entire (updated) printer list.
* If the database checks and finds that the edited information is inappropriate, return False to Printer_management; Printer_management then return False to Windows-UI, and Windows-UI will then issue the message Edit_not_successfull and display the entire list of printers.

2.2.2 Sequence Diagram for ADD Printer

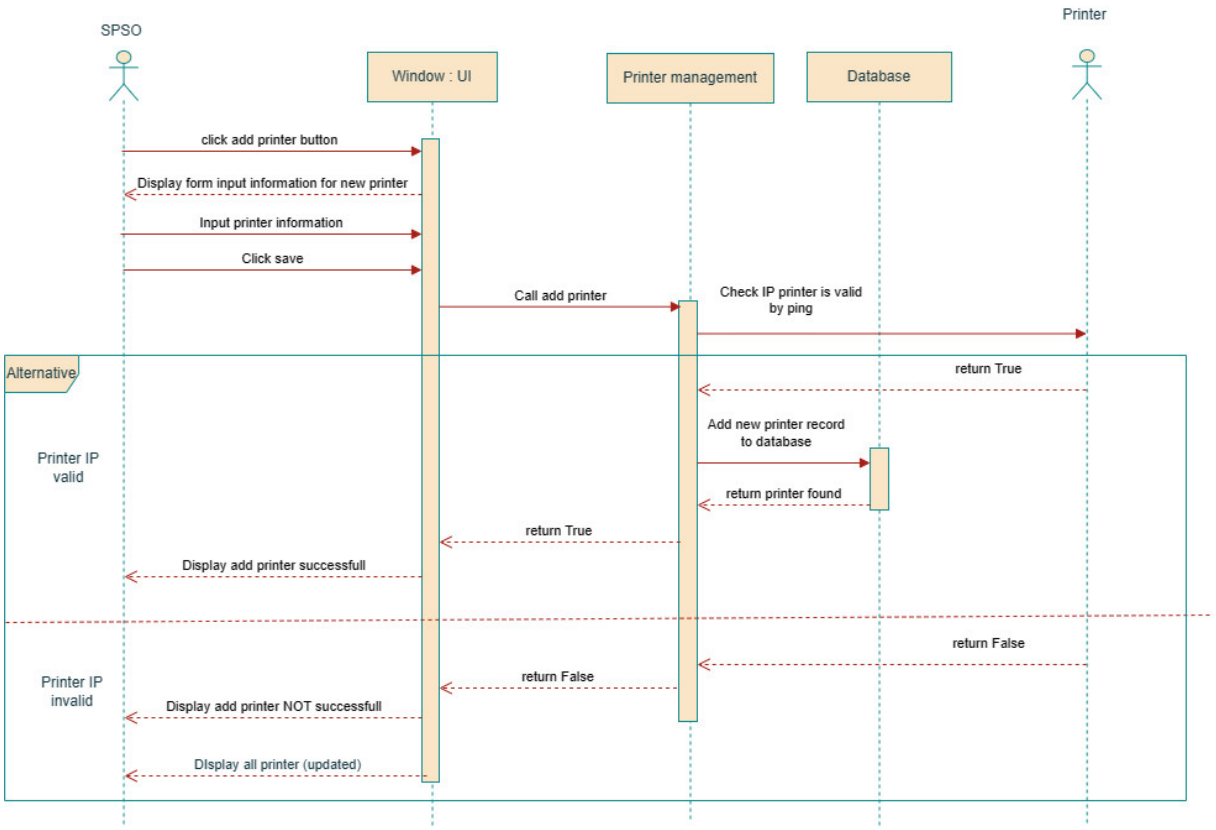

Figure 2.4: Sequence Diagram for ADD Printer

Sequence:

- When the user (SPSO) clicks the add printer button; Windows-UI will respond by displaying the Display form input information for the new printer interface
- The user enters printer information and clicks save
- Windows-UI will call the add_printer function to Printer_management
  - Printer_management will then execute the check_IP_printer function to ping the printer, here there are 2 cases:
    * If the printer has a response (return True), Printer_management will call the add_new_printer function to the database. After the database is successfully saved, it will return True to Printer_management; Printer_management then returns True to Windows-UI, and Windows-UI issues the add_printer_successfull message and displays the entire (updated) printer list.

* If the printer does not respond (return False), Printer_management will return False to Windows-UI, and Windows-UI will issue the add_printer_NOT_successfull message and display the entire printer list.

2.2.3 Sequence Diagram for Printing document

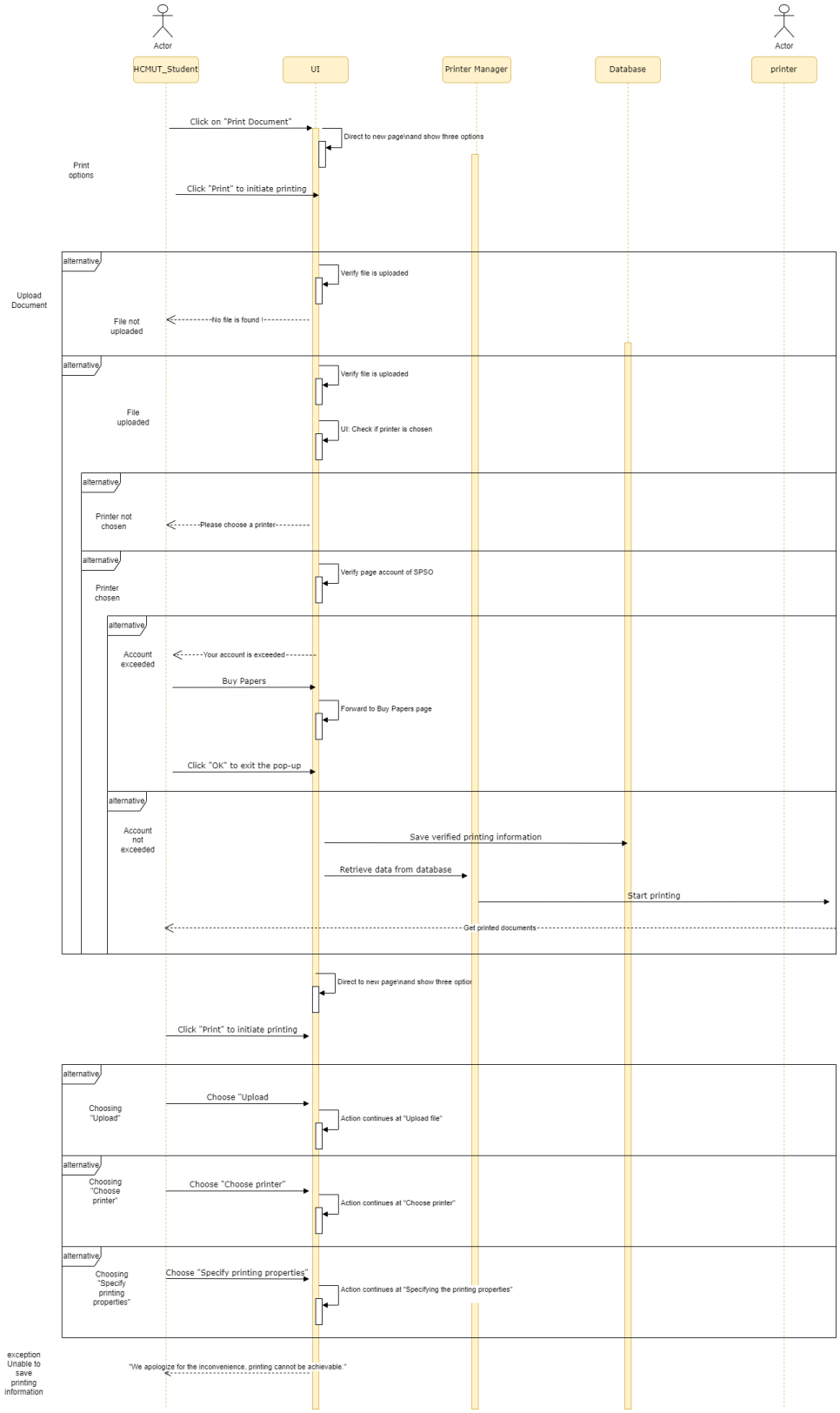

Figure 2.5: Sequence Diagram for Printing document

Description: The sequence diagram decribes a step-by-step interaction between the HCMUT_Student and the user interface (UI) in the context of the document printing process. As the HCMUT_student initiates the "Print Document" operation, the UI presents three primary options: "Upload," "Choose printer," and "Specify printing properties." The HCMUT_student selects "Print," leading to an intricate decision tree. It involves verifying the presence of uploaded files, the selection of a printer, and checking the HCMUT_student's page account. Alternative pathways address scenarios like the absence of a file or chosen printer and exceeding the page account, guiding the HCMUT_student through potential solutions, such as purchasing additional pages. In the successful path, printing information is saved in the database, retrieved by the PrinterManager, and printing commences.

2.3 Class Diagram

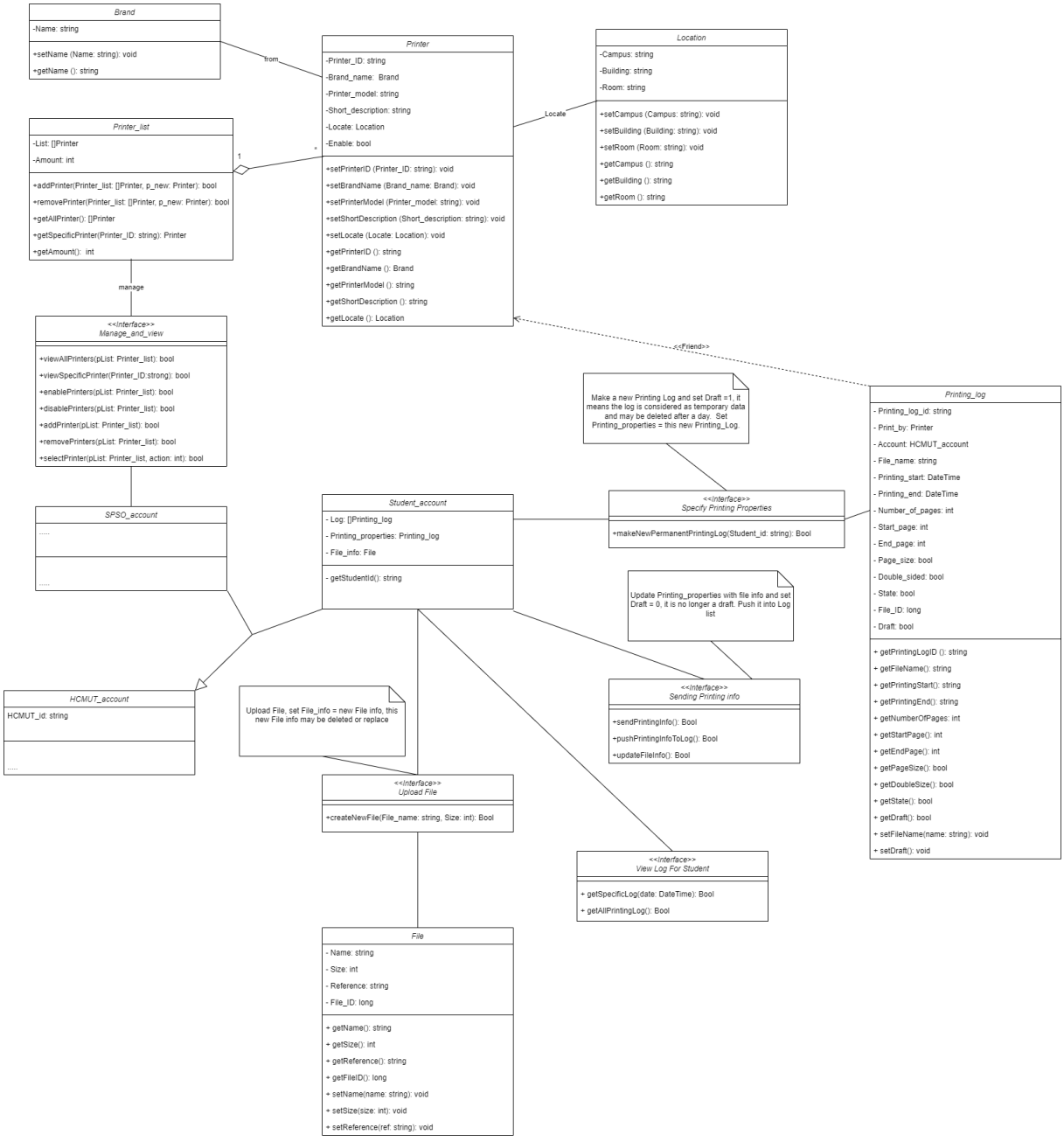

Figure 2.6: Class Diagram for Manage Printers and Print document

Description: The diagram above is a class diagram that we plan to develop for Manage printers and Print document module.

2.4 Develop MVP

Description: For the User Interface, we have decided to develop as a website. In order to have an overview of the appearance of the website, please visit these two links:

- Prototype: Have an overview how the website may look like with linked frames
- Full view: Explore more by an ability to zoom in and out, view every frames in the same screen.

Some demo frame:

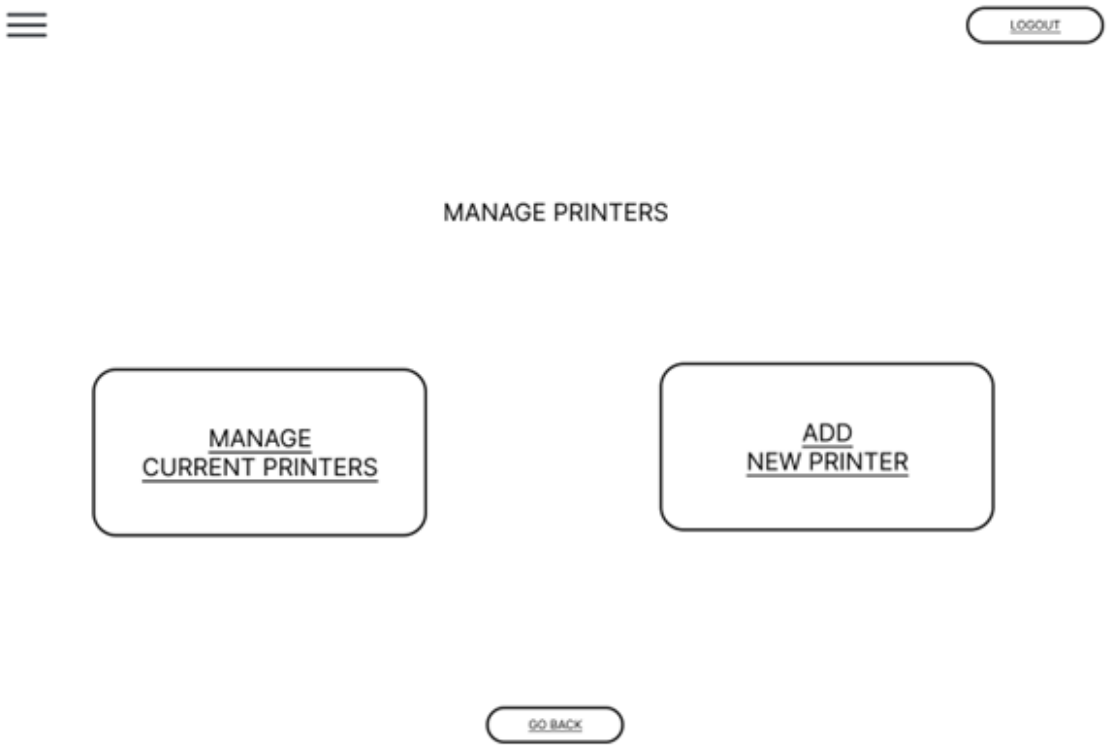

Figure 2.7: Wireframe of Manage printers

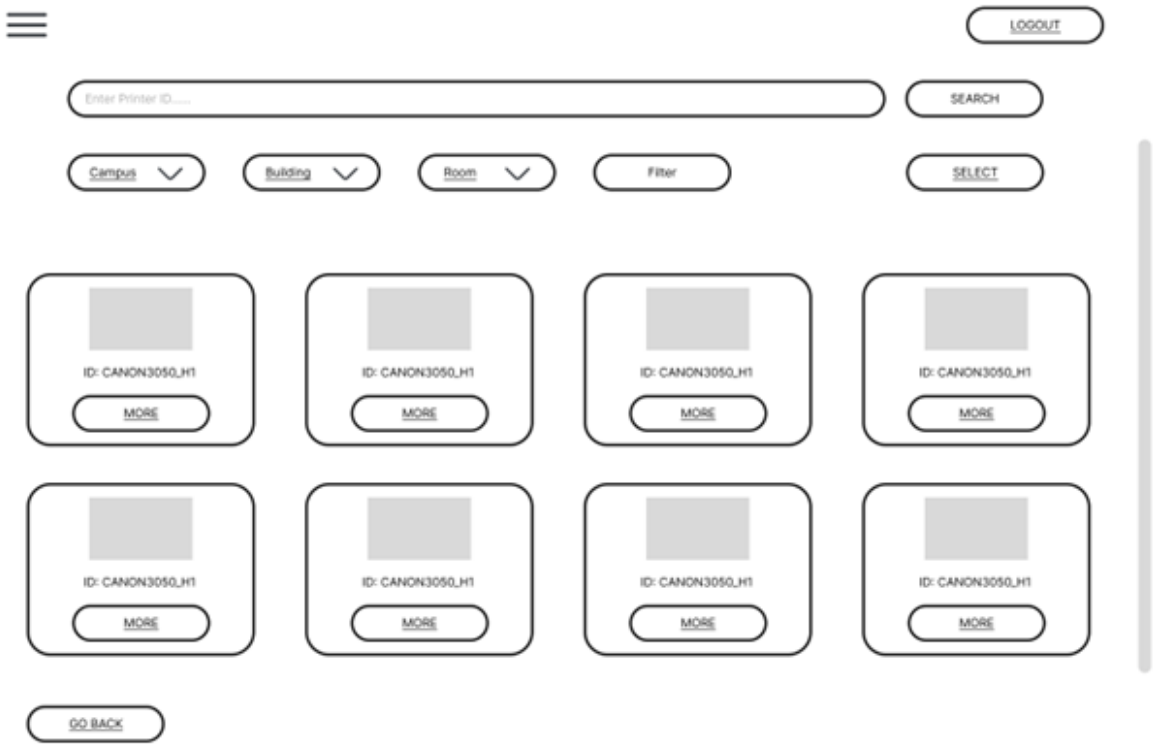

Figure 2.8: Wireframe of Manage current printers

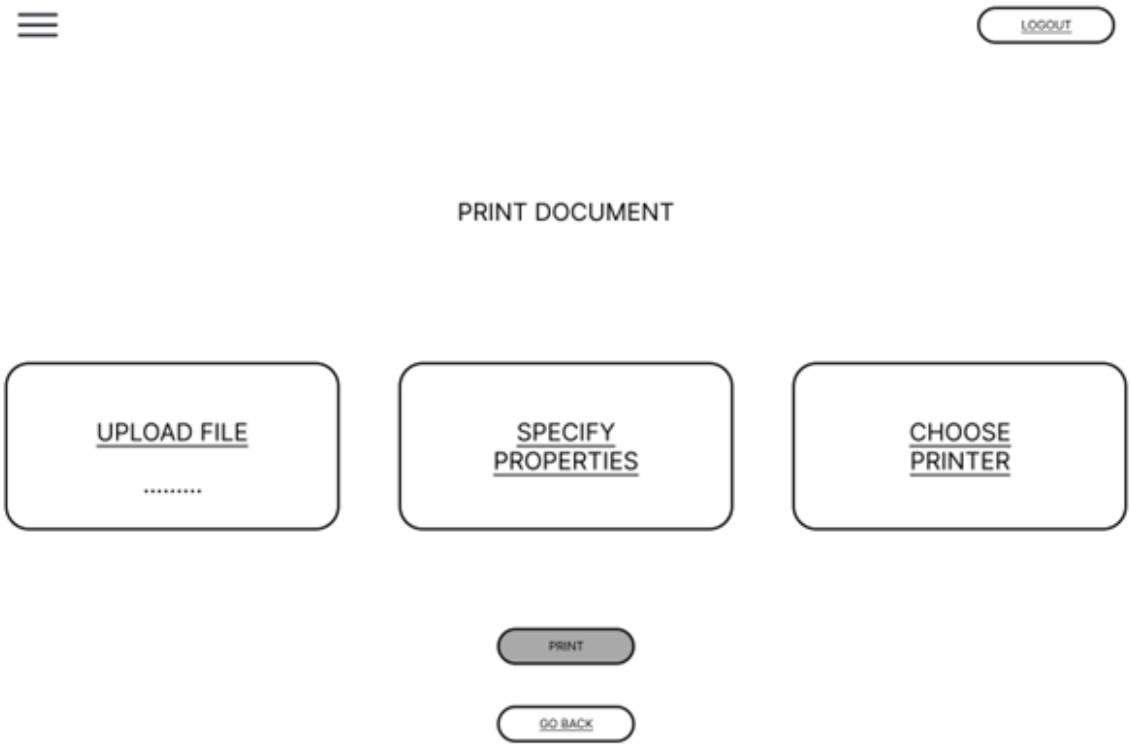

Figure 2.9: Wireframe of Print document

CHAPTER 3
TASK 3: ARCHITECTURE DESIGN

3.1 Architecture design

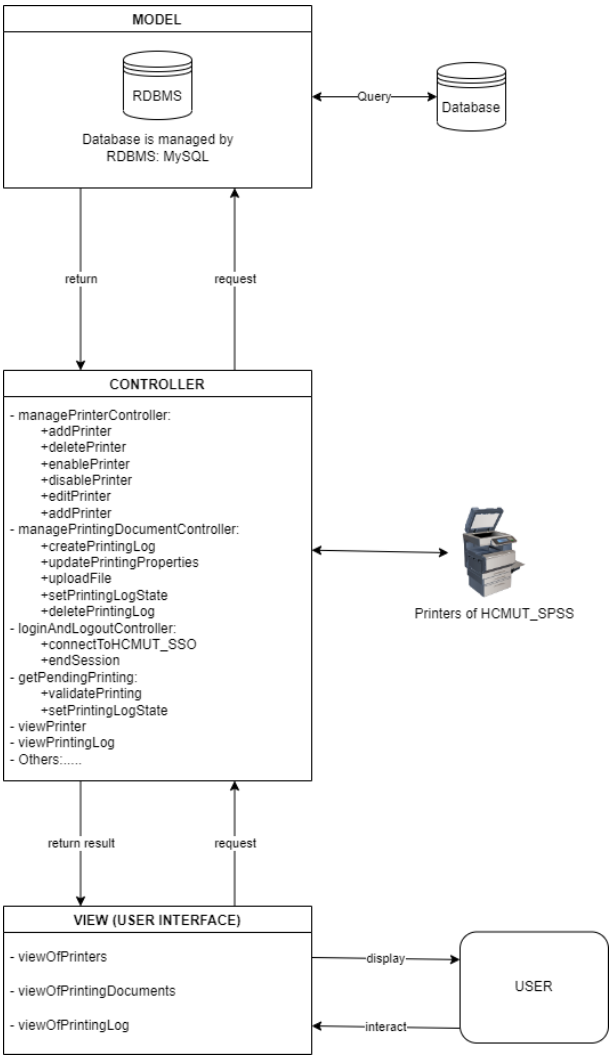

Figure 3.1: Architectural Diagram

3.1.1 An abstract description for each module

3.1.1.1 Manage Printers Module

Module	Input	Output	Function
Add Printer	Information of new Printer (Printer ID, Printer Model, Short Description, Campus name, Building name, room number)	New Printer is added to the database	addPrinter
View and Manage current printers	None	View all printers and functions to manage them (Select, View details and Edit)	viewPrinter
Select	None	One or some printers are (enabled, disabled, deleted)	enablePrinter disablePrinter deletePrinter
View and Edit Printer	Information to update	View details about a printer and information is updated.	editPrinter

3.1.1.2 Printing Document Module

Module	Input	Output	Function
Specifying the printing properties	Printing setup (one/double-sided, paper size, printing range, number of copies)	Created printing log is updated	updatePrintingProperties
Upload file	Document file, accepted file type	File is uploaded and stored in HCMUT_SPSS repository	uploadFile
Choose printer	Printer ID	Printer is updated in printing log	updatePrintingProperties
Print Document	HCMUT_ID	State of Printing log is set to pending (waiting for printing)	setPrintingLogState

3.1.2 API description

- **User interface (View)**
  User interface displays all the essential views included (View of all Printers, View of details,. . .) and they have been illustrated through an MVP that we have presented above. User interface also send input by the User and call the method in controller to perform action (E.g: add, enable, disable printers,. . . .).

- **Controller**
  Controller is bunch of method which perform action triggered by User. Controller is connected to Database Management System and includes SQL command. Controller then receive result and response to view.

- **Model**
  Basically, We consider RDBMS as an main model. RDBMS retrieve command from controller and then query it from database. Then RDBMS return the query result.

- **Overview**
  User interact with the system through User interface (view). Then the view calls methods in controller, the controller performs action by querying through a RDBMS. Controller then return result to view and view display the result.

3.2 Component Diagram

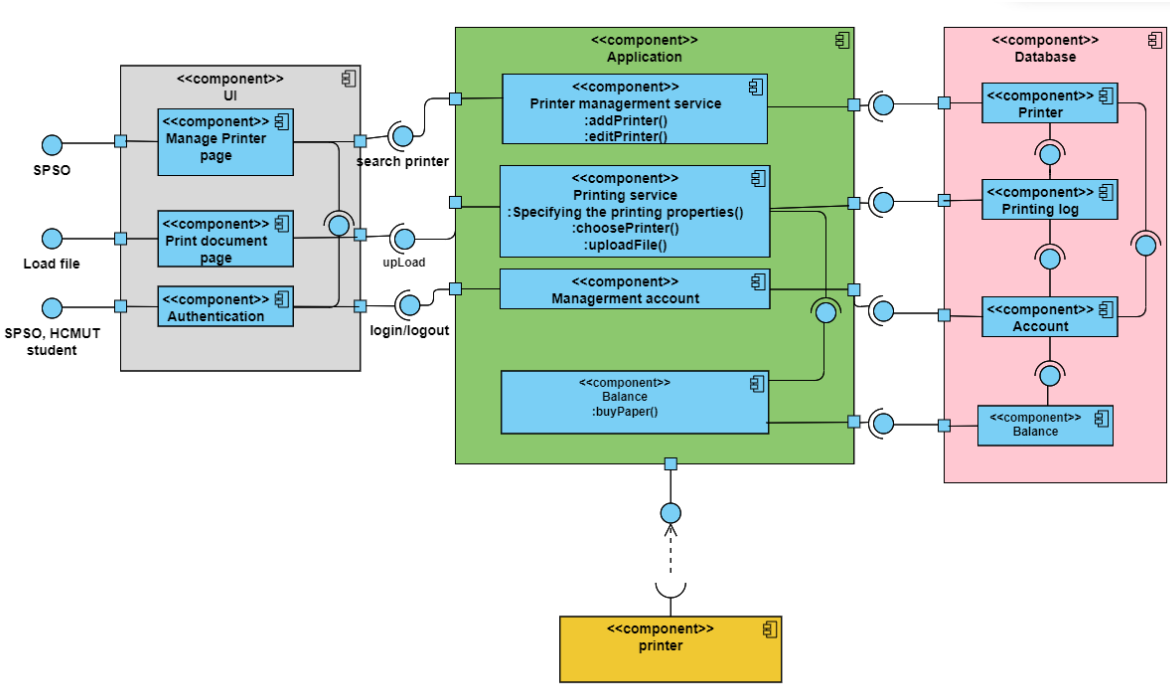

Figure 3.2: Architectural Diagram

Description:
This component diagram describes a printing system. This system includes the following components:

- **Application:** An application is a software with which users interact to submit print requests. Applications can be deployed in many different ways, such as web applications, desktop applications, or mobile applications.
- **Printer:**A printer is a physical device that performs printing. The printer can be connected to the computer using a cable or over a network.
- **Data:**Data is the document that needs to be printed. Data can be text, images, or both. Data can be stored locally on the computer or in a database.
- **Printer management service:** The printer management service is responsible for managing printers. This service includes functions such as adding printers, editing printers, and deleting printers. This service can be deployed as a web service or a local service.
- **Printing service:** The printing service is responsible for printing documents. This service includes functions such as defining print parameters, selecting a printer, and printing documents. This service can be deployed as a web service or a local service.
- **Administrative account:**The administrative account is used to manage the printing system. This account can be created using an application or using a database.
- **Database:** The database stores information about printers and documents. The database can be stored locally on the computer or in the cloud.

The data flow in the printing system is as follows:

- The user interacts with the application to send a print request.
- The application sends a print request to the printer management service.

- The Printer Management Service identifies available printers to print documents.
- The printer management service sends a print request to the printing service.
- Printing services determine printing parameters for documents.
- The Printing service chooses a printer to print documents.
- Document printing service.
- Documents are printed on the printer.

CHAPTER 4
TASK 4: IMPLEMENTATION - SPRINT 1

4.1 Setting up an online repository and Adding documents, materials and folders

This is the Github repo of the project: Github repo

4.2 Usability Test

We have taken an Usability Test using group of 5 users. The Usability Test is divided into two section included (Manage Printers and Print Document. For each section, we instructed participants to use the system and research their experience by using multiple choice questions. We use figma prototype as an object to experience. The link of figma prototype has been provided above.

4.2.1 Manage Printers

This is the link of the survey

1. **ADD PRINTER/MANAGE CURRENT PRINTER**
   In this Question, we research the behavior of participants in using ADD PRINTER/MANAGE CURRENT PRINTER.

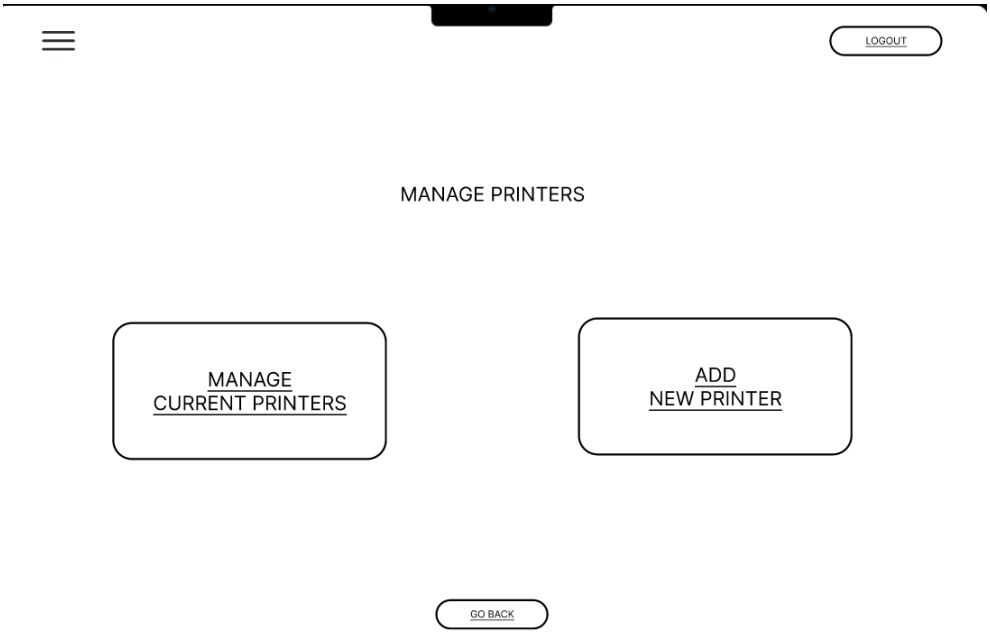

Figure 4.1: MANAGE CURRENT PRINTERS - ADD NEW PRINTER button

According to the survey, there are 20% of participants find it a little curious to understand this task.

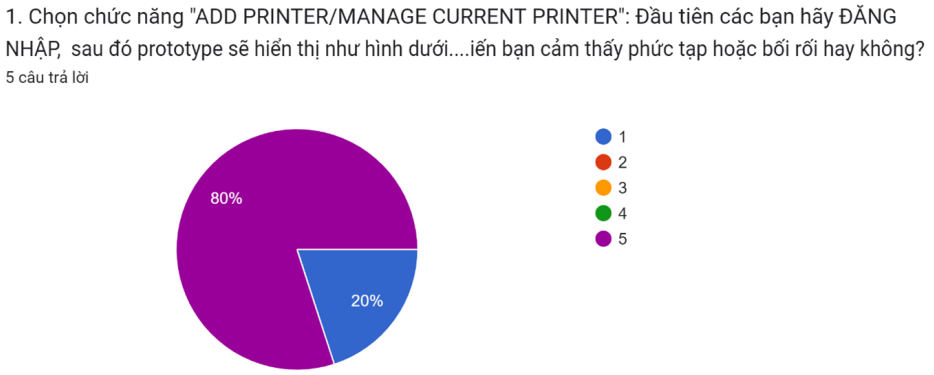

Figure 4.2: Chart illustrates the result of Question 1

2. **ADD NEW PRINTERS**
   In this Question, we research the behavior of participants in using ADD NEW PRINTERS.

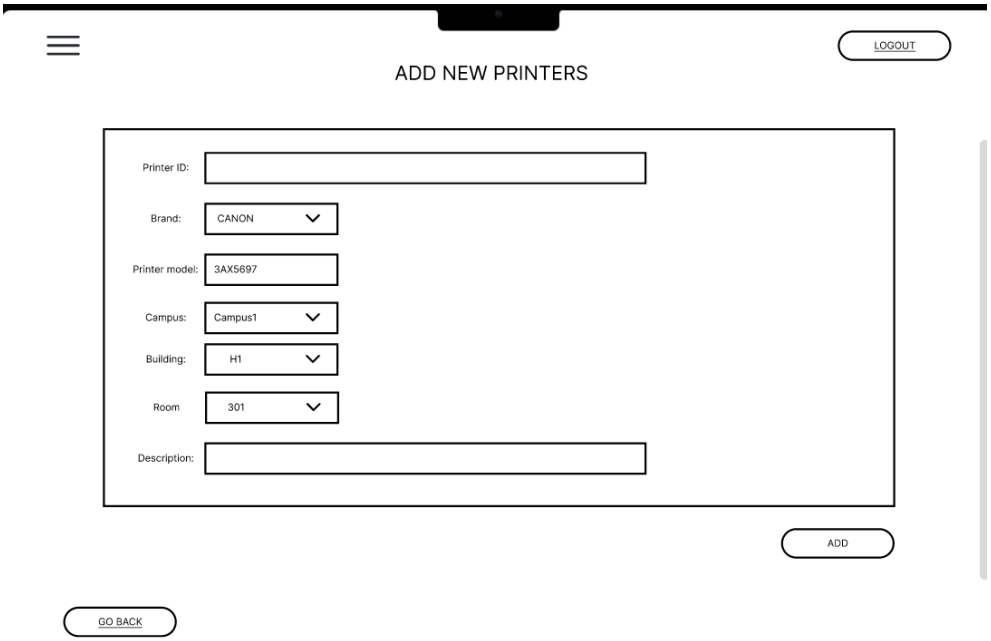

Figure 4.3: ADD NEW PRINTER page

According to the survey, there are 20% of participants choose 3 and 20% choose 4, which means 40% of them find it a little curious to handle this task.

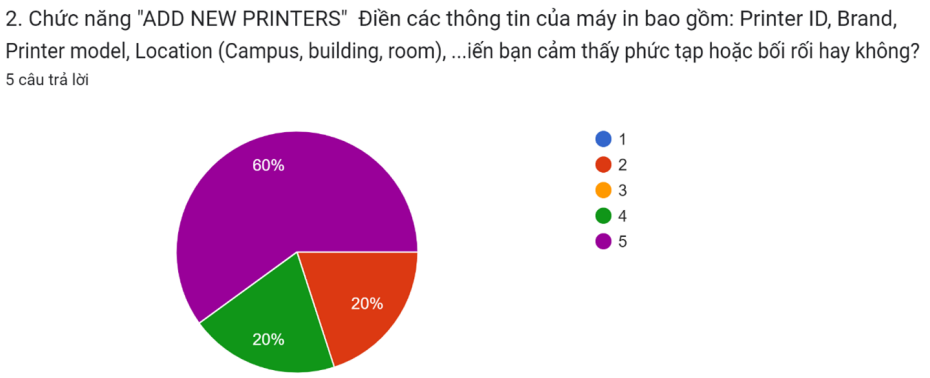

Figure 4.4: ADD NEW PRINTER page

3. **SEARCH AND FILTER** In this Question, we study the behavior of participants in using SEARCH and FILTER. As a prototype, these features do not have built completely and are described in detail.

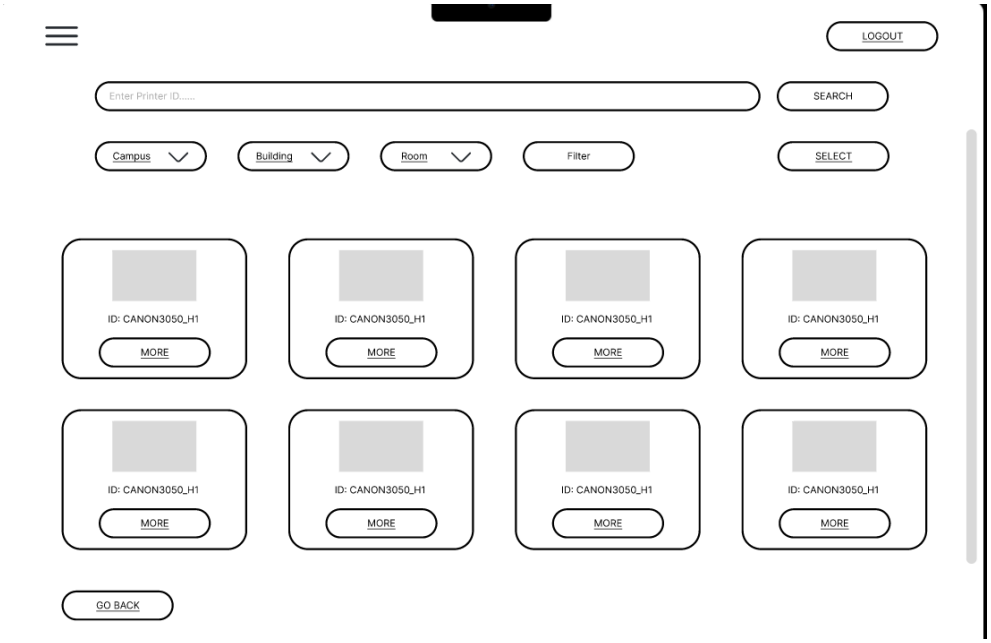

Figure 4.5: SEARCH and FILTER page

According to the survey, there are 20% of participants find it a little ambiguous to handle the task.

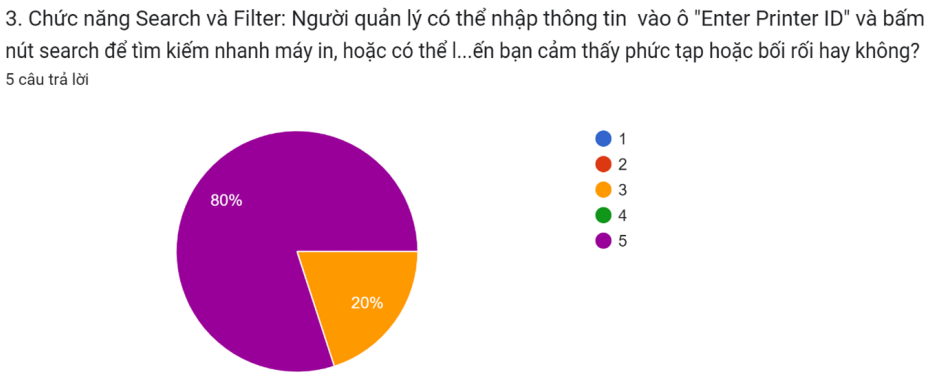

Figure 4.6: Chart illustrates the result of Question 3

4. **SELECT** In this question, we study the behavior of participants in using SELECT feature.

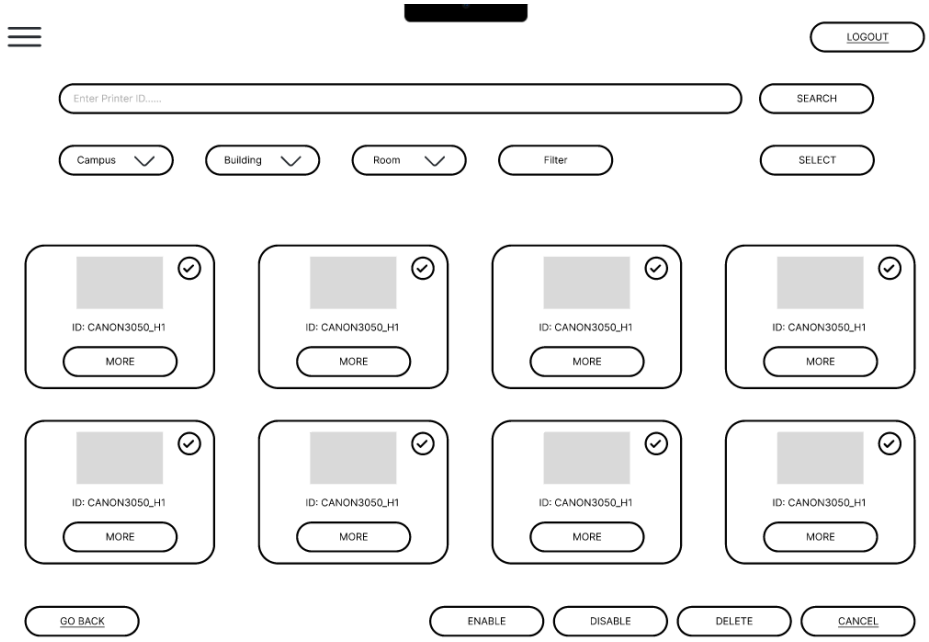

Figure 4.7: SELECT page

According to the survey, there is 1 out of 5 participant find it curious to handle the task.

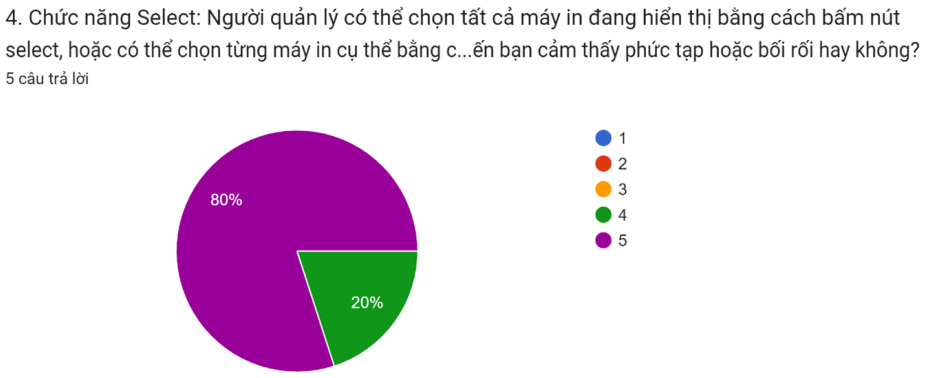

Figure 4.8: Chart illustrates the result of Question 4

5. **ENABLE, DISABLE, DELETE**
   In this Question, we study the behavior of participants in using ENABLE, DISABLE and DELETE. As a prototype, these features are not fully built and incapable to interact. They are described in detail.
   ENABLE, DISABLE, DELETE are placed inside SELECT feature, so that the page stays the same as SELECT page.
   According to the survey, 5 out of 5 participants find it easy to get on well with the tasks.

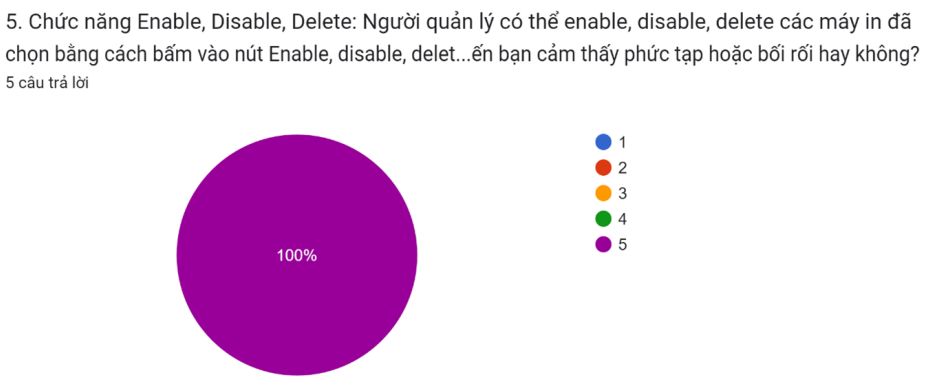

Figure 4.9: Chart illustrates the result of Question 5

6. **VIEW AND EDIT**
In this Question, we study the behaviour of participants in using VIEW AND EDIT feature. The feature is not fully built and is described in detail.

Figure 4.10: VIEW AND EDIT page

According to the survey, there is 1 out of 5 participant find it curious to handle the task.

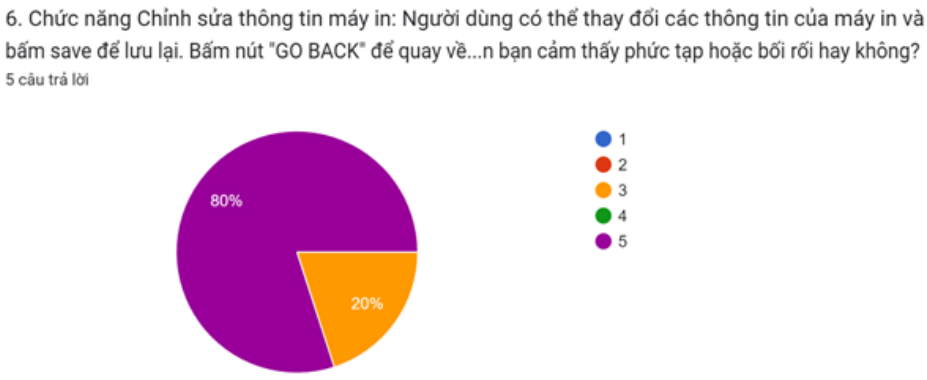

Figure 4.11: Chart illustrates the result of Question 6

4.2.2 Print Document

This is the link of the survey

1. **CHOOSE PRINT DOCUMENT**
   In this task, we research the behavior of participants on using PRINT DOCUMENT button in our UI.

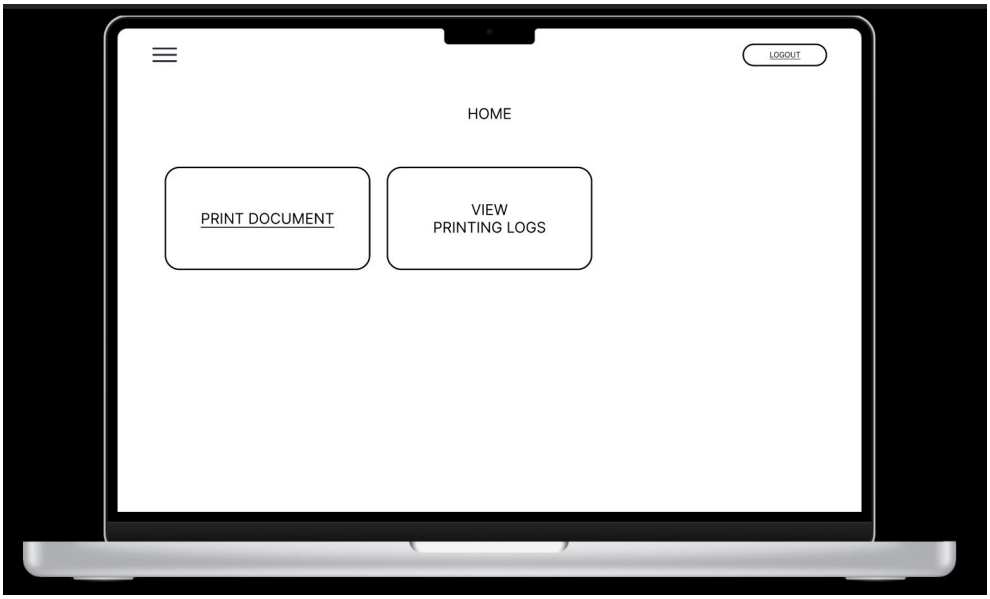

Figure 4.12: PRINT DOCUMENT - button at Home page

According to the survey, 5 out of 5 participant find the task is easy to handle and get used to. Here is the chart.

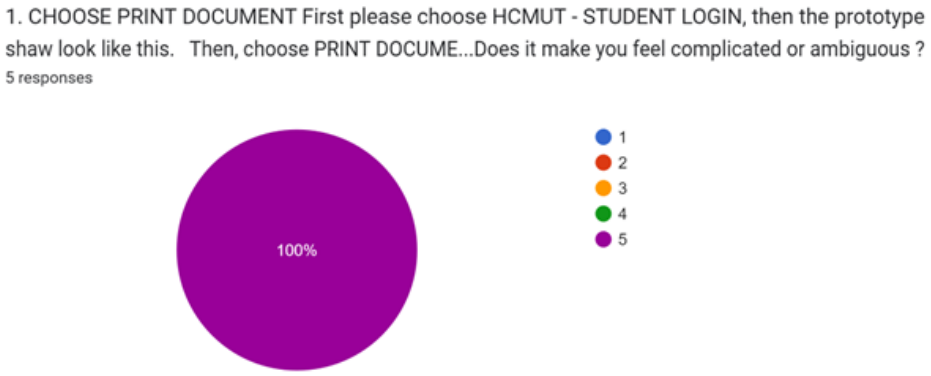

Figure 4.13: Chart illustrates the result of Question 1

2. **CHOOSE UPLOAD FILE**
   In this task, we research the behaviour of participants on using UPLOAD FILE.
   This is the main page of module PRINT DOCUMENT.

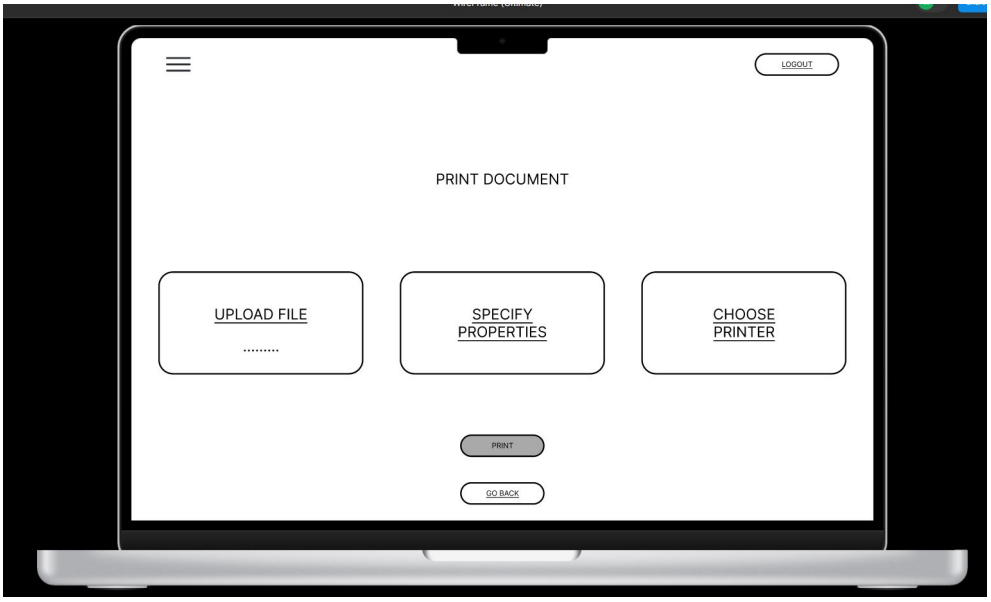

Figure 4.14: PRINT DOCUMENT MAIN PAGE

This is the page that prototype direct to after participants click UPLOAD FILE - button. Since it has been just a prototype, the behavior of UPLOAD FILE button does not seem natural and logical, it will be improved soon on real UI.

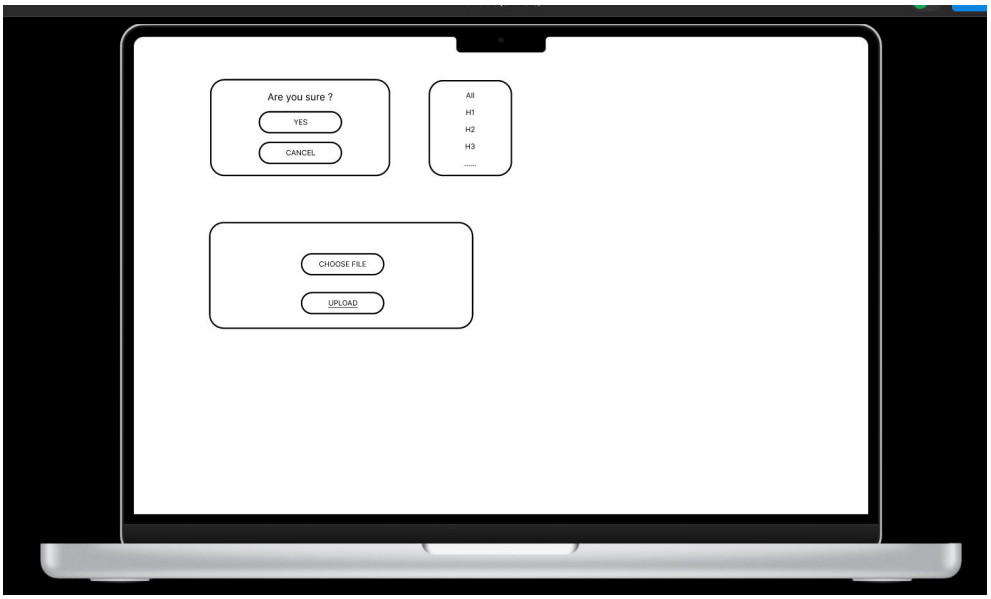

Figure 4.15: After click UPLOAD FILE

According to the survey, there are 20% of participants find this task ambiguous. This is because of the unatural behaviour of the prototype that we have mentioned above.

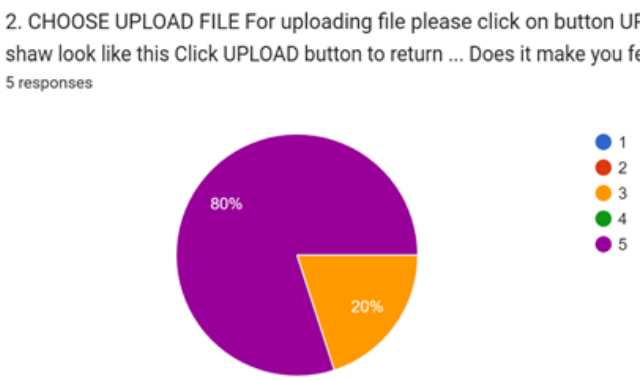

Figure 4.16: Chart illustrates the result of Question 2

3. **SPECIFYING PROPERTIES**
   In this task, we research the behaviour of participants on using SPECIFY PROPERTIES.

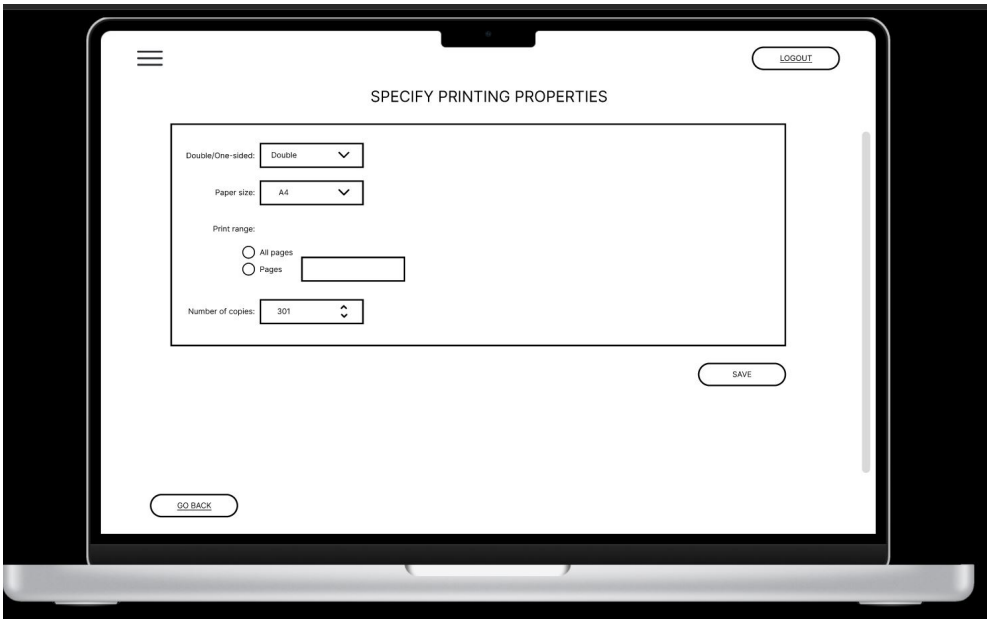

Figure 4.17: SPECIFY PROPERTIES page

According to the survey, 5 out of 5 participants find the task easy to handle.

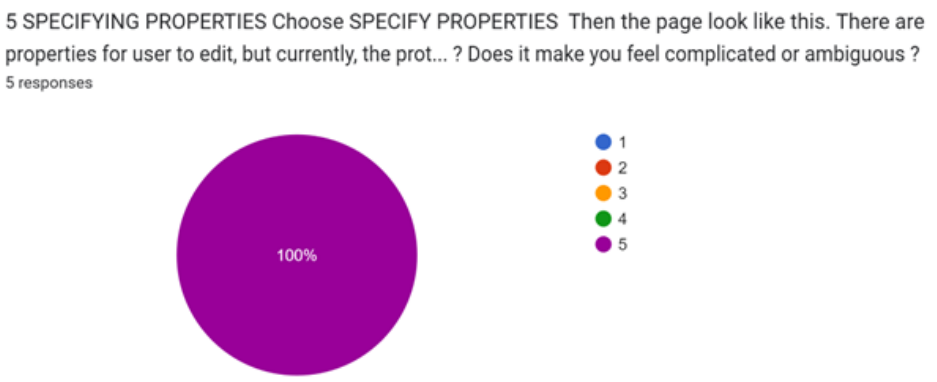

Figure 4.18: Chart illustrates the result of Question 3

4. **CHOOSE PRINTER**
   In this task, we research the behaviour of participants using CHOOSE PRINTERS.

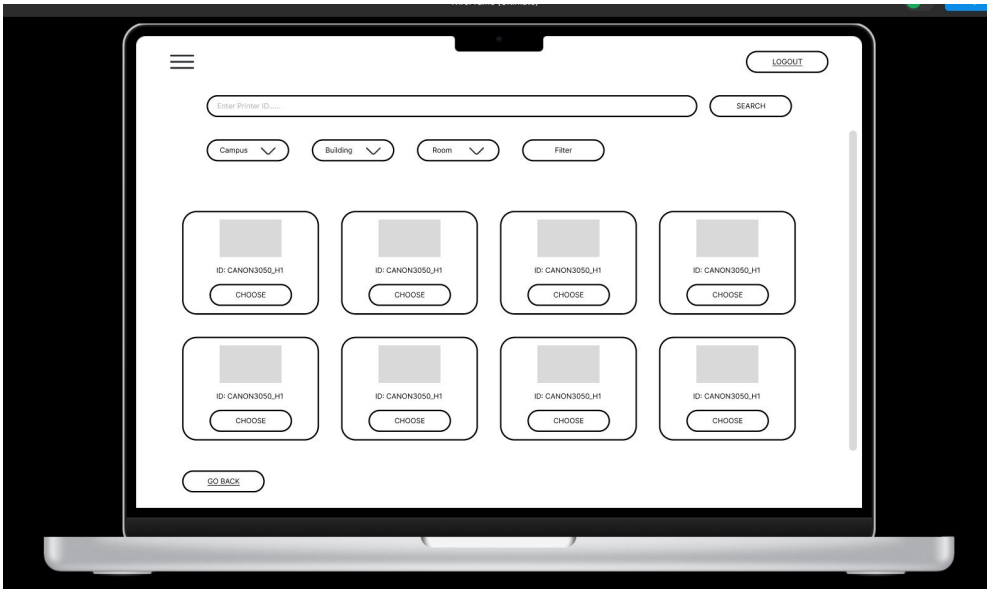

Figure 4.19: CHOOSE PRINTER page

According to the survey, 5 out of 5 participants find the task easy to handle.

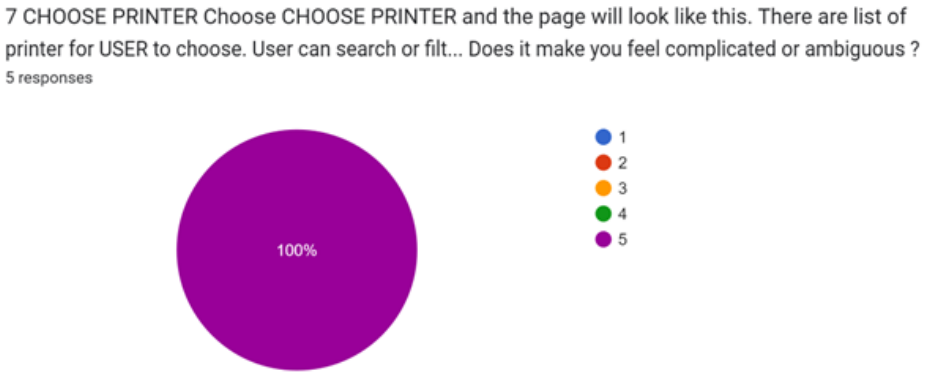

Figure 4.20: Chart illustrates the result of Question 4

5. **QUESTION 5:**
   In this question, we research participants'experience and ask them if they could get along well with our system quickly. According to the survey 5 out of 5 find it easy to get along well with the system.

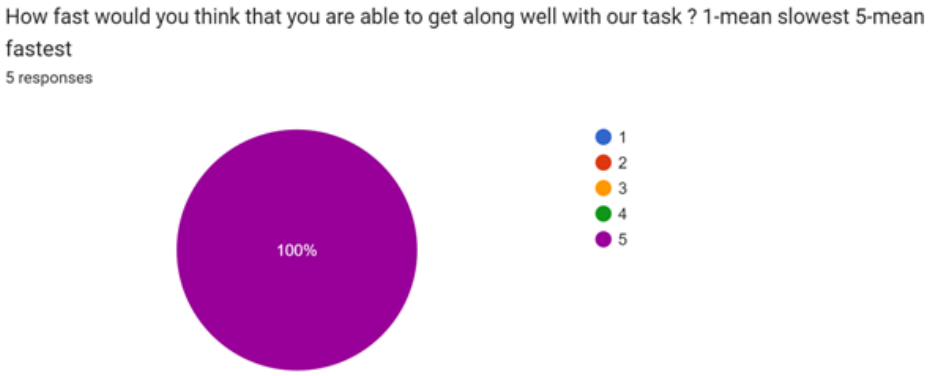

Figure 4.21: Chart illustrates the result of Question 5

6. **QUESTION 6**:
   In these questions, we ask them if we need to improve for better usability and also their suggestions. According to the survey, 60% of them think that we should do more for improvements.

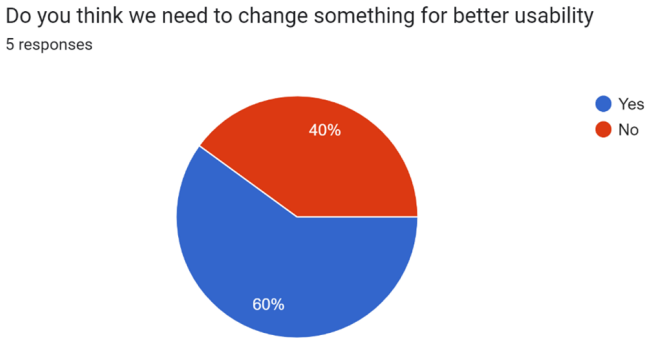

Figure 4.22: Chart illustrates the result of Question 6

7. **QUESTION 7**:
   Here is their suggestions:

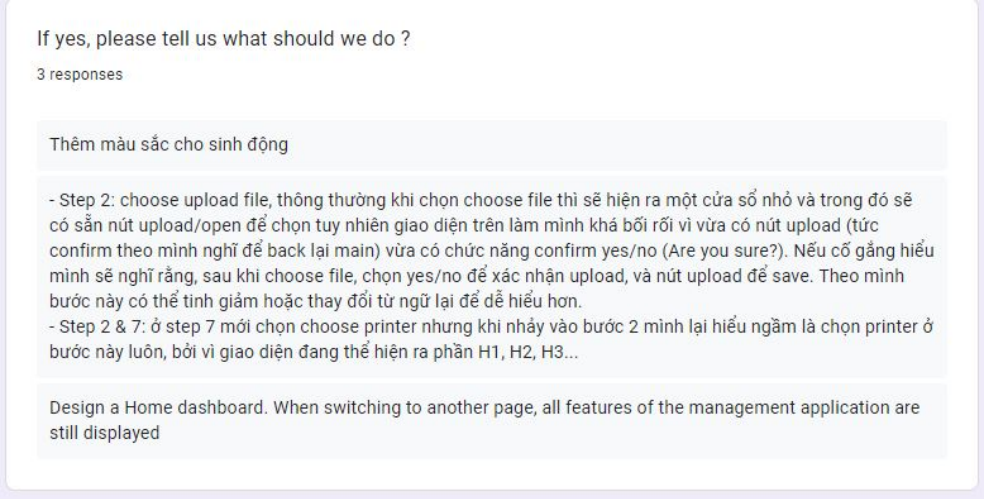

Figure 4.23: Suggestions from participants.

8. **QUESTION 8**:
   In this question, we ask the participants whether they could understand the system without any instruction. There are 20% of them find it hard to understand the system if there isn't any instruction.

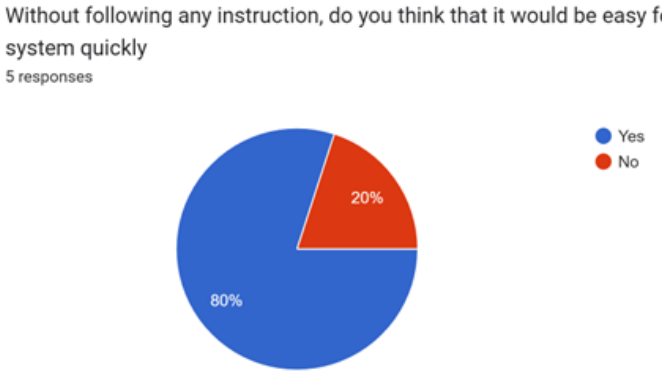

Figure 4.24: Chart illustrates Question 8

9. **QUESTION 9**:
   In this question, we research if how long would it take them to understand the system without any instruction. There are 60% choose "Under 5 minutes", 20% choose "Under 10 minutes" and 20% choose "Under 15 minutes".

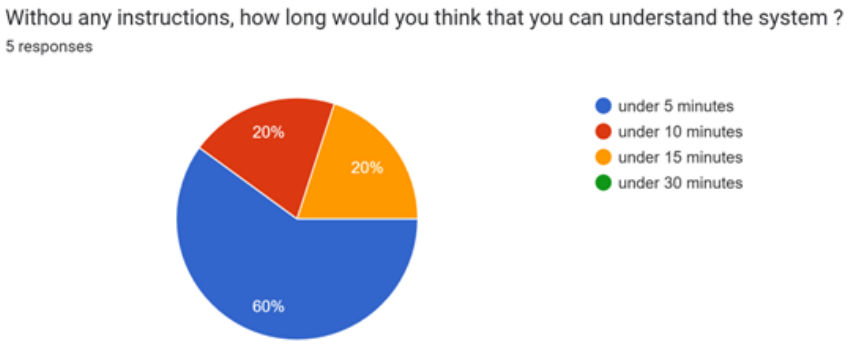

Figure 4.25: Chart illustrates Question 9

CHAPTER 5
CHANGE LOG

Date	Updated contents
09/17/2023	Task 1.1 and 1.2 have been updated. Functional requirements and Non - functional requirements have been available.
09/20/2023	New member has joined the team. His name is Nguyen Khoa Nam and id is 2011649.
10/01/2023	Task 1.3 has been updated. Use-case Diagram for the whole system, UC Diagrams of Manage printer and Print Document module and their specific descriptions are included.
15/10/2023	Task 1 is updated.
21/10/2023	Task 2 - System modelling is updated.
9/11/2023	Task 3 is updated.

CHAPTER 6
REFERENCES

(1) Ian Sommerville *Software Engineering (10th ed.), ISBN 978-0133943030, Pearson*

(2) Thinhnotes.com *Viết đặc tả Use Case sao đơn giản nhưng hiệu quả?*

(3) Thinhnotes.com *Use Case Diagram và 5 sai lầm thường gặp*

(4) Visual Paradigm - Activity diagram

(5) Visual Paradigm - Class diagram

(6) Raw Latex on Overleaf Raw Report