Mohammed V University
Faculty of Sciences
Department of Computer Science

Master's Program: Computer Science, Governance, and Digital Transformation (IGOV)

Course**:** Software Engineering

PROJECT REPORT

Digital Library

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Table of Contents

Introduction

This report outlines the process of developing a library management system for the Higher School of Education and Training. The project follows standard software engineering practices to ensure the delivery of a robust and efficient solution.

Based on the principles of software engineering, the Digital Library project aims to design and develop a software solution to address the management challenges faced by traditional libraries. The project's main objective is to create an automated, user-friendly system that streamlines library operations, including book loans, reservations, and catalog management, while improving staff and student access to resources.

A critical first step in any software engineering project is the creation of a specifications document, also known as a requirements specification. It serves as a roadmap for the entire development process, guaranteeing that the end product is in line with user needs and business goals. The specifications document lays out all necessary features, including the automation of administrative tasks, the design of the user interface, and the system's data management requirements, as well as non-functional aspects like performance, security, and scalability.

By producing a thorough specifications document, we make sure that all stakeholders have a clear understanding of the project scope and requirements, laying the groundwork for an organized development process that follows best practices in software engineering. This approach helps to manage expectations, mitigate risks, and deliver a high-quality solution that successfully satisfies both functional and non-functional requirements. Additionally, we followed the V-Cycle methodology, which guided the development process by ensuring that each phase of the project was carefully validated and verified against the initial specifications, thus guaranteeing the quality and reliability of the final product.

Problematic

Why did we choose the V-Cycle for our Digital Library project?
The V-Model offers a structured approach to software development that is crucial for ensuring the reliability and effectiveness of a system like a digital library, where quality and accuracy are paramount.
The V-Cycle facilitates the validation of each phase through corresponding testing phases, ensuring that requirements are met and that any errors or discrepancies are detected early in the development process.
By using the V-Model, we were able to create a clear and systematic development plan, where each stage has a corresponding testing phase to validate the outcomes. This helped us address potential issues before they became critical and ensured that the final product would meet both user needs and technical specifications.
The V-Cycle also allowed us to maintain traceability between requirements, design, implementation, and testing, which is essential for a project that involves a variety of stakeholders and evolving requirements.

Product Objectives:

The project's objectives are carefully defined to ensure the creation of an interactive, accessible, and secure platform, specifically tailored to meet the unique needs of the library at the Faculty of Sciences (FSR).
This product is designed specifically for students of the Faculty of Sciences, with a particular focus on those studying Computer Science and Software Engineering.
These objectives are aimed at enhancing the user experience, simplifying administrative tasks, and ensuring transparent and efficient management of the library's resources.

- ✓ Enhancement of User Experience:
  - Intuitive Interface: Design a user-friendly interface to ensure easy and intuitive navigation for both students and administrators.
  - Personalization: Provide personalized student profiles with features that cater to their specific needs.
  - Responsiveness: Ensure optimal responsiveness to guarantee a consistent user experience across various platforms and devices.

- ✓ Simplification of Administrative Tasks:
  - Book Management: Allow administrators to easily add, modify, and delete books through an intuitive administrative interface.
  - Loan Tracking: Facilitate the tracking of loan requests and book checkouts to optimize the management of library resources.

- ✓ Transparent and Efficient Resource Management:
  - Complete Catalogue: Ensure the regular update of a comprehensive catalogue of available books in the library.
  - Advanced Search: Integrate an advanced search bar to help users quickly find books by title, author, and category.
  - Request Management: Implement an efficient system to handle loan requests and ensure a transparent process.

- ✓ Security and Privacy:
  - Secure Authentication: Implement a secure authentication system to restrict access to sensitive information.
  - Data Protection: Put appropriate security measures in place to safeguard user and book data.

These objectives, focused on improving user experience and operational efficiency, define the overall vision of the Faculty of Science of Rabat Library Management project. They will guide the design, development, and evaluation processes to ensure the project's success, benefiting all students at the Faculty of Sciences, particularly those in Computer Science and Software Engineering.

Feasibility of the Library Management System Project:

The proposed library management system for the Faculty of Sciences (FSR), specifically designed for Computer Science students, is feasible from technical, operational, and financial perspectives.
Technical feasibility is ensured by using proven technologies like PHP, MySQL, and JavaScript, which are suitable for building an intuitive and scalable platform.

The system will integrate smoothly with existing university infrastructure, ensuring compatibility with student information systems and requiring minimal additional resources. Security measures, including SSL encryption and secure authentication, will safeguard user data.

Operationally, the system is user-friendly, with easy navigation for both students and administrators. The university's IT department will provide basic training and manage ongoing support. Given that the target users are tech-savvy Computer Science students, adoption is expected to be quick.

Financially, the project is cost-effective as it relies on open-source technologies, minimizing software expenses. The main costs are related to development and minimal ongoing maintenance. The system is expected to deliver significant benefits by reducing administrative overhead and improving resource management, making it a sustainable investment.

In conclusion, the project is highly feasible, leveraging existing resources and technologies to provide a practical, cost-effective solution for managing library resources at FSR.

In summary, the project is extremely viable and makes use of current technologies and resources to offer a workable, affordable solution for FSR library resource management.

I. Specification Document

The purpose of this document is to provide detailed specifications for the development of a Library Management System. This system will meet the functional and technical requirements, ensuring an intuitive and efficient solution for the Faculty of Sciences, Rabat. The system aims to facilitate library operations, including user and book management, as well as administrative oversight, providing a robust and user-friendly platform for both students and administrators.

1. Functional Specifications

The **Functional Specifications** serve as the foundation for the development of the Library Management System. This section translates the requirements into actionable and detailed functionalities. It provides a clear description of how the system will operate, the features it will support, and the interactions users will have with it.

1.1 User Interface

The Library Management System is designed to ensure compatibility and optimal performance across major platforms. The application runs seamlessly on the latest versions of Google Chrome and Mozilla Firefox browsers and it supported on Windows, Linux, and Mac operating systems, providing users with a consistent experience regardless of their environment.

The user interface is the cornerstone of the system, designed to provide an intuitive and engaging experience for all users. This phase includes :

Home Page

- A welcoming interface displaying the primary features of the system.
- Intuitive navigation links to other sections of the system.

Navigation Menu

- Accessible sections include "Home," "About Us," "Services," and login options for students and administrators.
- Clear distinction between user roles.

1.2 User Management

This phase covers all functionalities related to user registration, authentication, and account management:

Student Registration

- A comprehensive form capturing the following fields:
    - Full Name
    - Email Adresse
    - Student ID
    - Field of Study
    - Semester
    - Password
- Validation for required fields and secure password criteria.

Login Functionality

- Role-based login for students and administrators.
- Secure authentication using hashed passwords.

1.3 Student Profile

This phase focuses on providing students with personalized access to their data and functionalities:

Personal Information

- Display of personal details with an option to update them.

Wishlist Management

- Functionality for students to add books to a personal wishlist for future reference.

Password Management

- Feature to reset or change the password.

Logout

- Secure logout functionality.

Field List and Book Categories

- A list of available fields of study linked to their respective book categories.

Book Search

- Search functionality by title, author, or category.
- Results displayed in a structured format.

1.4 Administrative Features

This phase includes tools for the administrative management of the library system:

Secure Login

- Authentication for administrative accounts.

Book Management

- CRUD (Create, Read, Update, Delete) operations for managing book records.

Borrowing Requests Management

- Track and manage book-borrowing requests from students.

2. Technical Specification

2.1 Security

Security is a critical aspect of the system, ensuring the protection of sensitive data and system integrity:

SQL Injection Protection

- Use of prepared statements for database queries to prevent SQL injection attacks.

Data Encryption

- Encryption of sensitive user data such as passwords.

2.2 Testing and Validation

This phase ensures the system meets functional requirements and user expectations:

Test Scenarios

Test scenarios will be defined for each functionality to ensure system reliability and usability.

User Feedback

Collect user feedback to confirm that the system meets the specified requirements and expectations.

3. System Architecture

This phase establishes the technological framework and tools required for development:

The system will be a web-based application, structured as follows:

- **Frontend:** Developed using HTML, CSS, and JavaScript for a responsive and user-friendly interface.
- **Backend:** Implemented in PHP, managing business logic and database interactions.
- **Database:** MySQL database for storing user data, book records, and borrowing transactions.

4. Deliverables

This phase outlines the tangible outcomes of the project:

1. Fully functional Library Management System.
2. Documentation, including user guides and system manuals.
3. Test reports and validation results.

5. Project Timeline

The Library Management System project is structured to ensure timely delivery, with the final product scheduled for completion by January 9. The following timeline outlines the phases leading to this milestone:

Conclusion

This specification document outlines a comprehensive plan for the Library Management System. By adhering to these specifications, the system will meet the defined functional and technical requirements, ensuring a robust and efficient solution for the Faculty of Sciences, Rabat. The phased approach ensures systematic progress, delivering a high-quality application tailored to the needs of its users.

II. Model Software Development Life Cycle

1. Overview of the V-Model

The V-Model is a procedural model for planning, executing, and controlling projects, especially in software development and systems engineering. It ensures that all requirements are considered and met throughout the entire project course. The V-Model is divided into two phases: the left side of the V represents the specification phase and the right side represents the integration phase. During the specification phase, the requirements are defined, and the developed systems are tested and assembled in the integration phase.

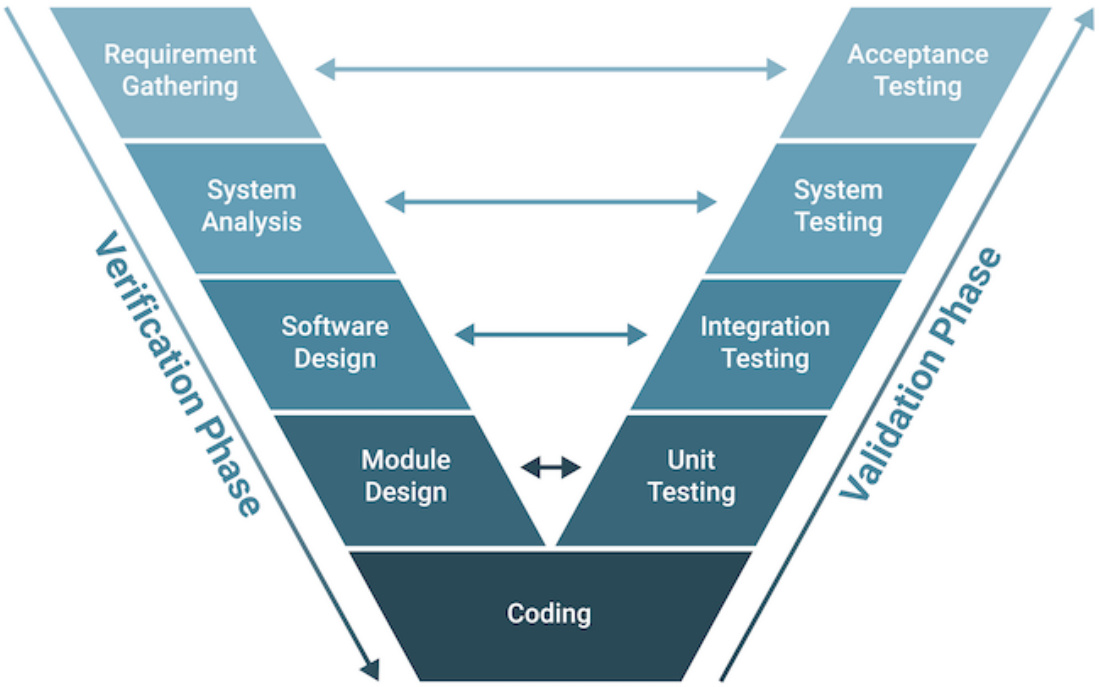


Figure 1: V model

2. Benefits of the V-Model for This Project

- **Early Detection of Defects:** By validating at each phase, issues can be identified and corrected early in the development process.
- **Clear Structure:** The V-Model provides a clear and logical structure for the project, making it easier to manage.
- **User Involvement:** Frequent validation with users ensures that the final product aligns with their needs and expectations.
- **Comprehensive Testing:** Each phase's corresponding testing phase ensures thorough verification and validation of the system.

3. Phases of the V-Model

The V-Model (Verification and Validation Model) is adopted for this project to ensure thorough testing and quality assurance at each phase of development. This model follows a sequential process where development and testing phases are directly related.

3.1. Verification Phase

✓ **Requirements Analysis**

- Gather and document user and system requirements (functional and non-functional).
- Deliverable: Software Requirements Specification (SRS).

✓ **System Design :**

- Define system architecture and high-level design based on requirements.
- Deliverable: System Document.

✓ **Module Design :**

- Break down the system into individual components Design.
- Define system architecture, user interface design, and database schema
- Deliverable: Module Design Document.

✓ **Implementation :**

- Develop the system based on design specifications using chosen
- Write code for the user interface, backend, and database interactions.
- Deliverable: Source Code.

3.2. Validation Phase

✓ **Unit Testing :**

- Test individual components.
- Deliverable: Unit Test Report.

✓ **Integration Testing:**

- Integrate modules and verify their interaction.
- Deliverable: Integration Test Report.

✓ **System Testing :**

- Test the complete system to ensure all requirements are met.
- Deliverable : System Test Report.

✓ **User Acceptance Testing**

- Prepare for user acceptance testing by defining UAT scenarios based on user requirements.

✓ **Conduct UAT with end-users to validate the system against their needs.**

- Deliverable: User Acceptance Test Report.

Conclusion

The V-Model ensures a clear and organized development process by linking every step to its testing phase. This approach helps us catch issues early and stay focused on meeting the project's goals. It is an effective way to deliver a reliable and user-friendly Library Management System.

III. Conception

This phase under Library Management System project goes into the characteristics of the architecture and functions as per the requirements these functions have conformed to. This phase denotes a very critical time, as it translates the requirements specification into an architecture design that actively determines the course the implementation is recommended to follow. This project is represented by two diagrams to demonstrate its conception:

Class Diagram: This diagram indicates the static structure of the system, showing the classes, their attributes, methods, and the relationships between them. It identifies the key entities, such as Users, Books, Loans, and Administrators, and how they interact with each other in the system.

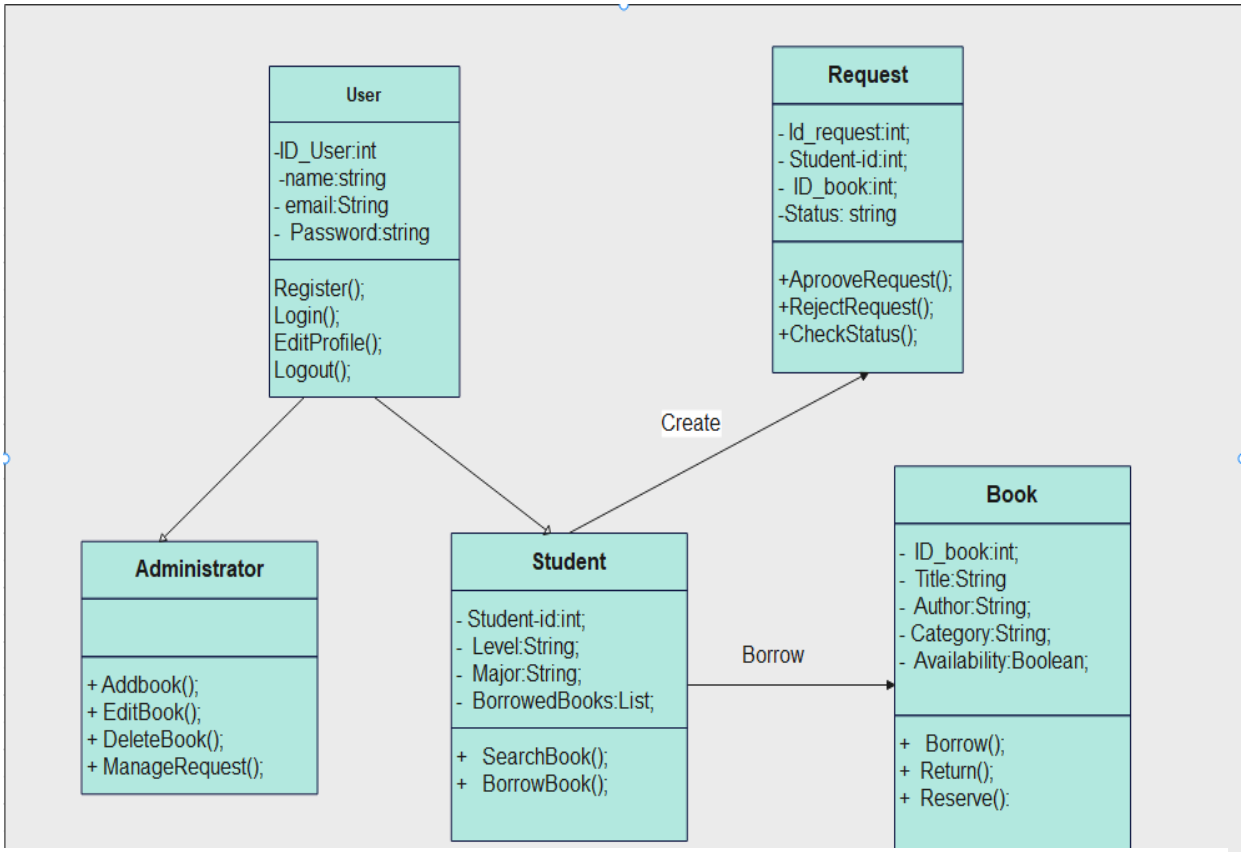


Figure 2: Class Diagram

Use Case Diagram: This exhibits the dynamic circumstances of the system by showing the interactions of users with the system. It identifies the main actors (Students, Administrators) and their respective actions, such as borrowing books, returning books, and managing records.

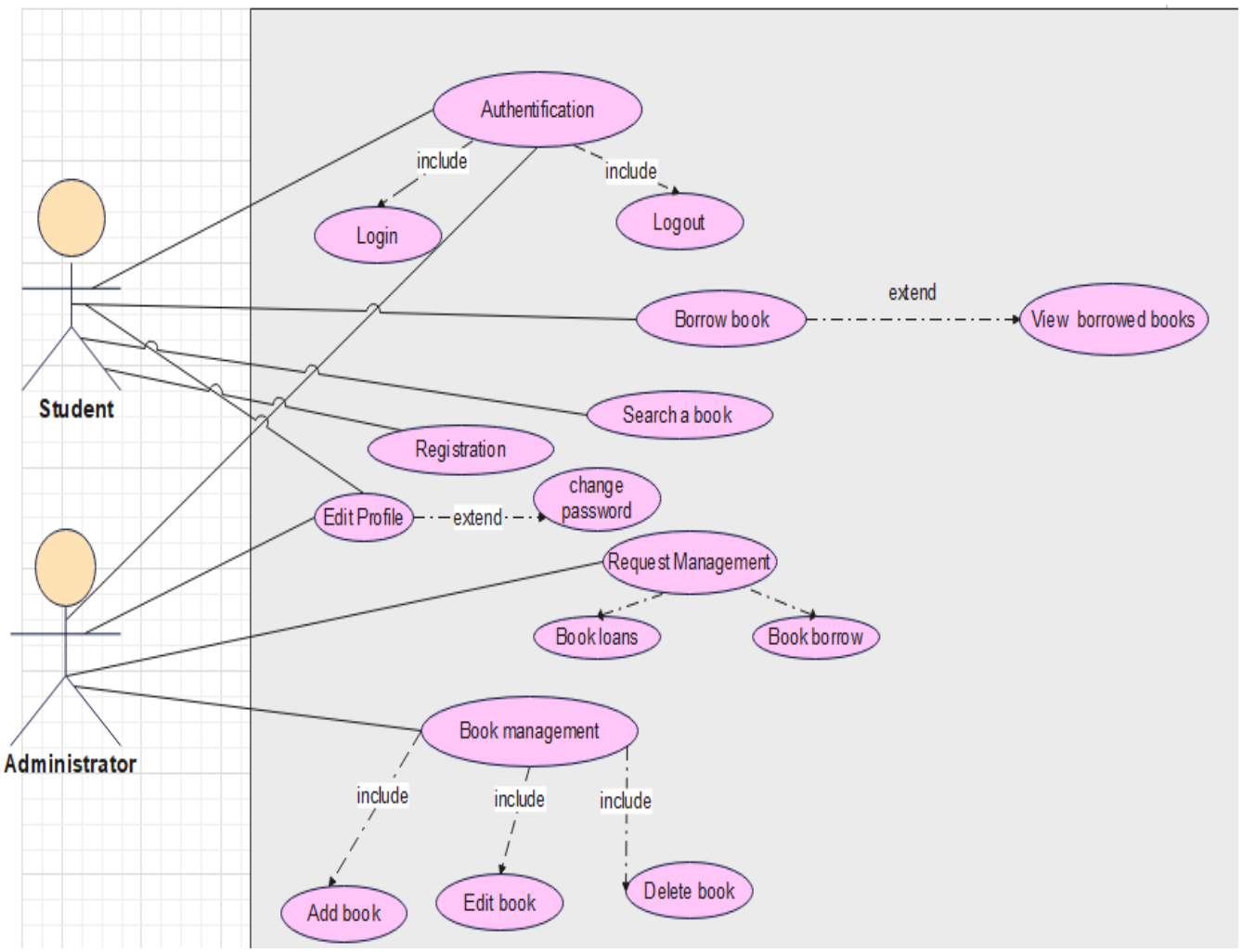
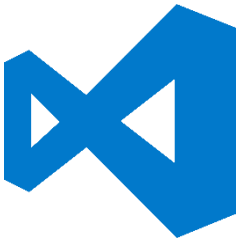


Figure 3: Use case diagram

These diagrams provide a simplified and visual representation of the Library Management System architecture, giving clarity for uniform implementation. Well, these two diagrams are just enough to keep the design simple and fit into the scope of the project that succeeds in fitting into the objective.

IV. Language and tools used



V. Justification of chosen technologies and languages

The selection of technologies for the Digital Library Management System at the FSR Department of Computer Science is based on a thorough analysis aimed at ensuring a robust, scalable implementation that aligns with the specific needs of the library. Each technology choice has been carefully evaluated for its advantages and relevance to the project's goals.

1. HTML, CSS and JavaScript :

- **Reason**: These fundamental technologies are crucial for creating an interactive and responsive user interface.
- **Advantages**: The combination of HTML for structure, CSS for presentation, and JavaScript for interactivity enables modern web design and a seamless user experience. They ensure that the system is accessible and intuitive for users.

2. PHP:

- **Reason:** PHP is a reliable and versatile choice for server-side development. It is compatible with various database management systems, making it a suitable option for dynamic web applications like the digital library.
- **Advantages:** PHP allows for the creation of dynamic web pages, user session management, and seamless integration with databases like MySQL through phpMyAdmin. It ensures an efficient way to manage data and perform backend operations.

3. phpMyAdmin:

- **Reason**: Managing data effectively is critical in a library management system. phpMyAdmin provides a user-friendly, graphical interface for managing MySQL databases.
- **Advantages**: phpMyAdmin simplifies database administration, enabling administrators to interact with the database intuitively. It allows for efficient database management tasks like creating tables, running queries, and handling user privileges without needing deep knowledge of SQL commands.

4. JavaScript (Client-Side):

- Reason: Beyond its use for the user interface, JavaScript on the client side enhances the user experience in real-time.
- Advantages: Adding interactive features, such as real-time search and form validation, contributes to a dynamic and engaging user experience. These features help users quickly find relevant resources and interact with the library system without unnecessary delays.

5. Security and Privacy:

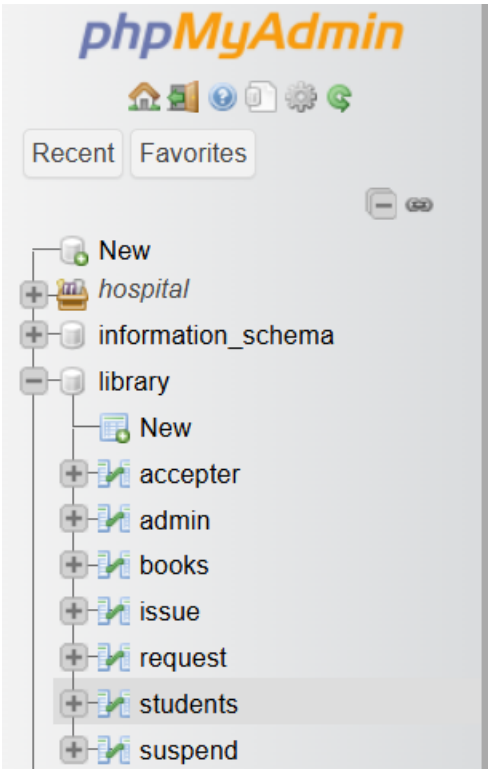
- Reason: Data security is a priority. The selected technologies enable the implementation of strong authentication mechanisms and protection of sensitive user data.
- Advantages: Secure authentication processes, coupled with encryption protocols, ensure the confidentiality of user information. These measures are vital to maintain trust in the system and protect users' personal data.

6. XAMPP:

- **Reason**: XAMPP is chosen as the local development environment to simplify the setup and management of the Apache server, MySQL, PHP, and other components required for the project.
- **Advantages**:
    - **Ease of Installation**: XAMPP offers a straightforward and fast installation, providing a ready-to-use local development environment.
    - **Compatibility**: It ensures tight compatibility with the selected technologies, allowing for an accurate simulation of the production environment.
    - **Centralized Management**: XAMPP simplifies the management of servers and services by offering a centralized dashboard with a user-friendly interface.
    - **Versatility**: It facilitates web application development, testing, and debugging, providing a complete environment to emulate the production server during the development phase.

VI. Data Base

Our database is named “Library”



It contains 7 tables

Table	Action	Rows	Type	Collation	Size	Overhead
accepter	Browse Structure Search Insert Empty Drop	1	InnoDB	latin1_swedish_ci	16.0 KiB	-
admin	Browse Structure Search Insert Empty Drop	1	InnoDB	latin1_swedish_ci	16.0 KiB	-
books	Browse Structure Search Insert Empty Drop	3	InnoDB	latin1_swedish_ci	16.0 KiB	-
issue	Browse Structure Search Insert Empty Drop	1	InnoDB	latin1_swedish_ci	16.0 KiB	-
request	Browse Structure Search Insert Empty Drop	4	InnoDB	latin1_swedish_ci	32.0 KiB	-
students	Browse Structure Search Insert Empty Drop	6	InnoDB	latin1_swedish_ci	48.0 KiB	-
suspend	Browse Structure Search Insert Empty Drop	0	InnoDB	utf8mb4_general_ci	16.0 KiB	-
7 tables	Sum	16	InnoDB	utf8mb4_general_ci	160.0 KiB	0 B

1. **Accept** table:

id_A	utilisateur	sid	isbn	name	author	date	rendu
0	H130106921	AYYADI Imane	0	The Signal and the Noise	nate silver	2025-01-03	2025-01-21

2. **Admin** table:

	aid	name	password
Edit Copy Delete	admin	Admin	21232f297a57a5a743894a0e4a801fc3

3. **Books** table:

isbn	name ▲ 1	author	genre	qte	image	id	Description
197531	countdown to zero day	kim zetter		12	0day.jpg	0	Countdown to Zero Day, written by Kim Zetter, is a...

4. **Issue** table

	id	utilisateur	sid	isbn	name	author	date	rendu
Edit Copy Delete	1111139	H130106921	AYYADI Imane	197531	countdown to zero day	Claude Delannoy	2025-01-21 08:58:36	2025-01-31

5. **Request** table:

	id	name	author	sid
Edit Copy Delete	9	Statistic	David Freedman	F12131417
Edit Copy Delete	12	statistics	David Freedman	F12131417
Edit Copy Delete	14	Statistics Done	Alex Reinhart	F12131417
Edit Copy Delete	17	Statistics and Data Analyst	Alex Reinhart	H130106921

6. **Students** table:

	id	sid	name	branch	sem	password	email
Edit Copy Delete	1111133	51245	Hilmi Rajaa	IGOV	s1	827ccb0eea8a706c4c34a16891f84e7b	rajaahilmi6@gmail.com
Edit Copy Delete	1111134	F12131415	ELJABLI Saad	IGOV	s1	72429611eba4c13e6dce86c7f27fcb15	saad-eljabli@um5.ac.ma
Edit Copy Delete	1111136	F12131416	OUTIRSTE Mouad	IGOV	s1	de345b20a5d60ae93088b864977ea7cb	outirstemouad@um5.ac.ma
Edit Copy Delete	1111138	F12131417	Bassir Houssein	IGOV	s1	c5b2cebf15b205503560c4e8e6d1ea78	housseinbassir@um5.ac.ma
Edit Copy Delete	1111139	H130106921	AYYADI Imane	IGOV	s1	3b83277619e80de6a4a1b0da4e069b67	imaneayyadi@um5.ac.ma
Edit Copy Delete	1111140	G10111213	EL MAATAOUI Hamid	IGOV	s1	08f90c1a417155361a5c4b8d297e0d78	hamidelmaataoui@um5.ac.ma

7. **Suspend** table:

ids	sID	name	field	semester	email	password

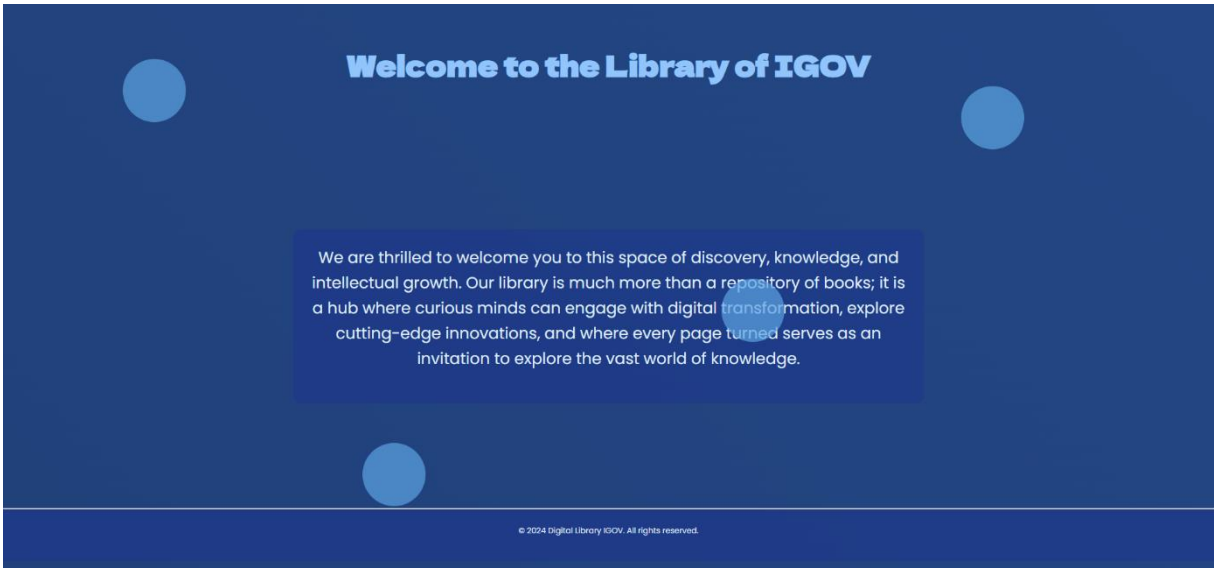
VII. Site Demonstration:

- **Home Page**

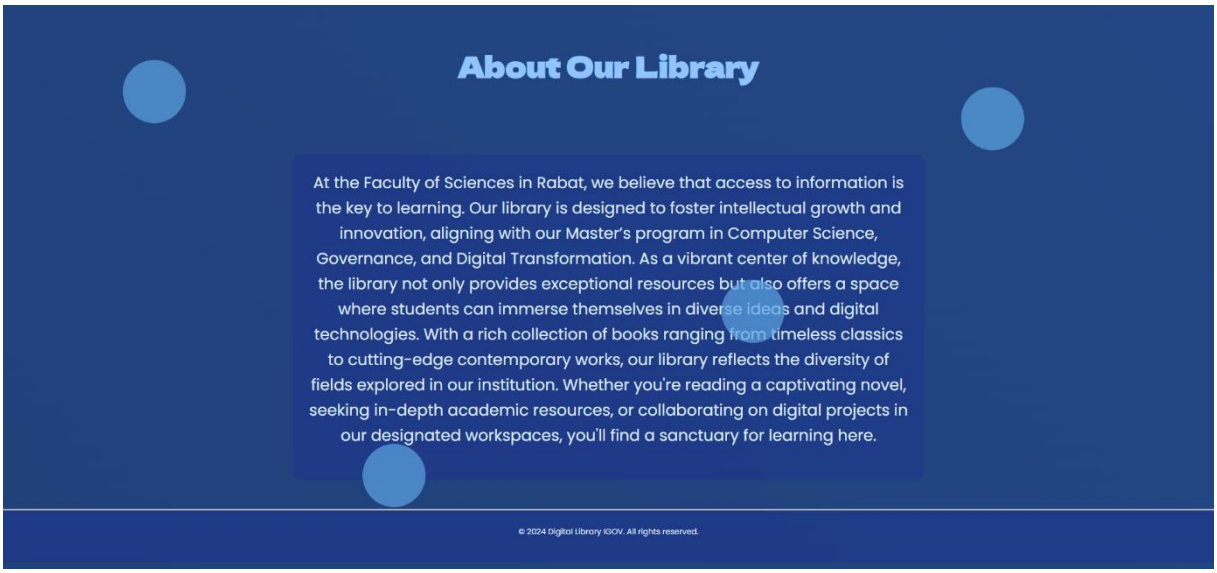
  On our homepage, there is a menu that contains three buttons providing access to our Home, About Us, and Our Services.

  It also features the school's logo with the text "ESEF-O Digital Library" followed by two buttons: one for Student Login and the other for Administrator Login.

- When you click the Home button, the following page will be displayed.

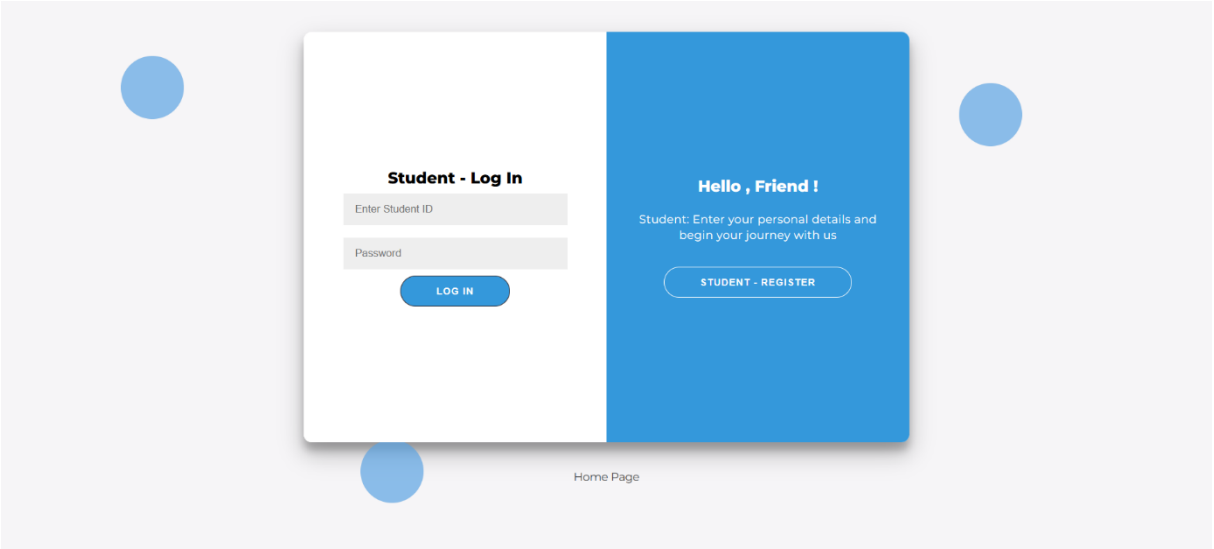


- When you click the About button, the following page will be displayed.

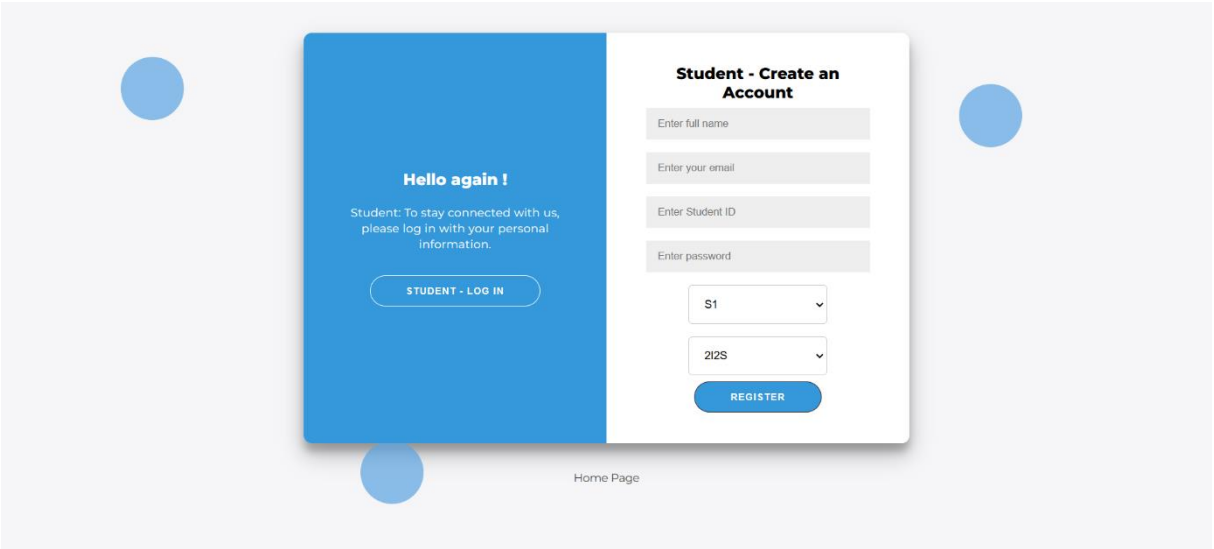


- When you click the Services button, the following page will be displayed.

- When you click the Student Login button, the following page will be displayed.

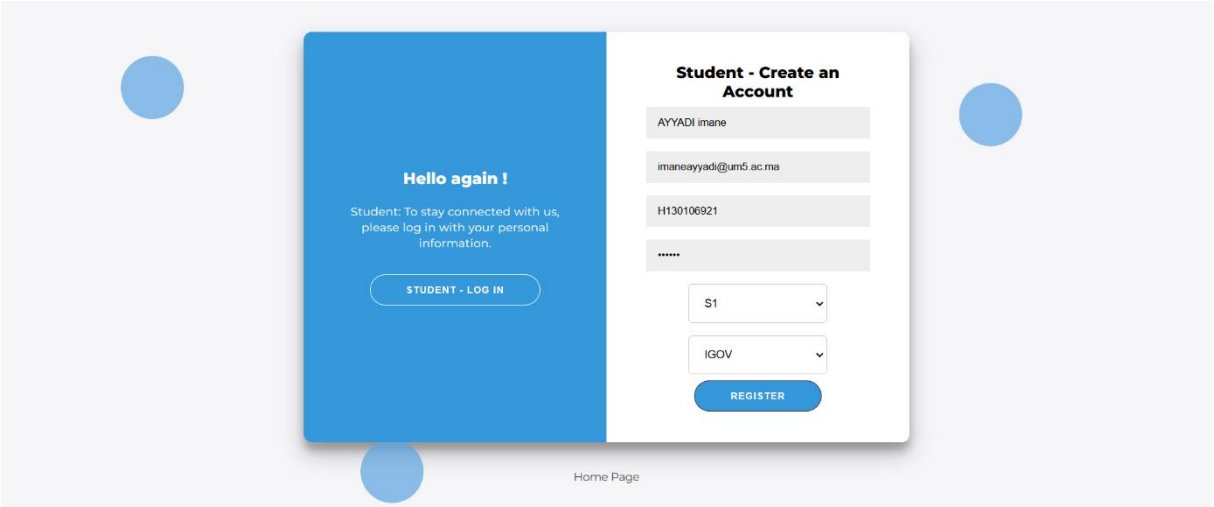


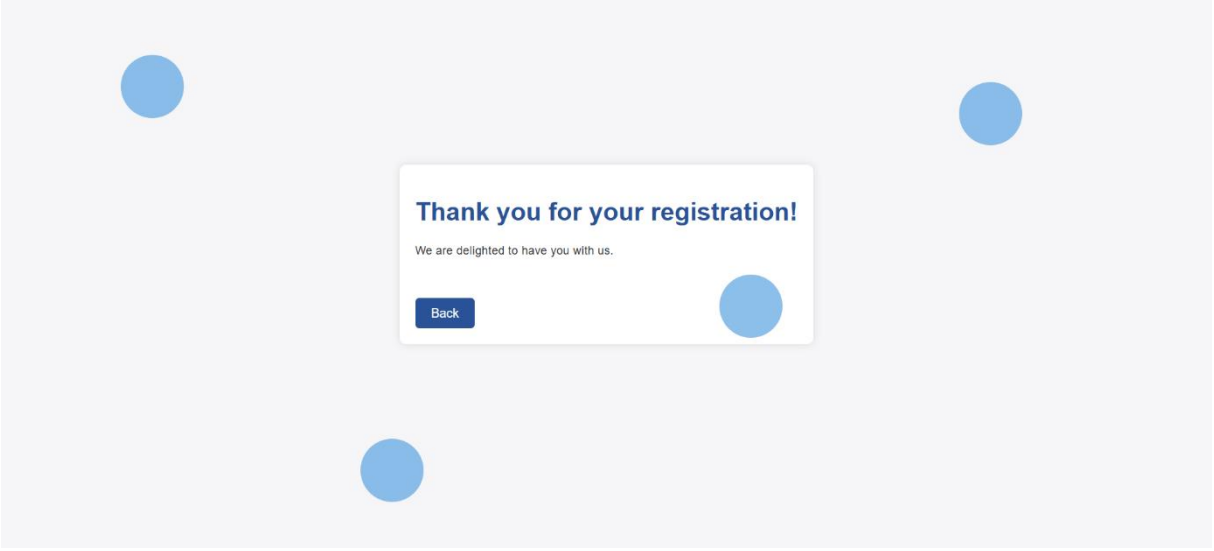
Home Page



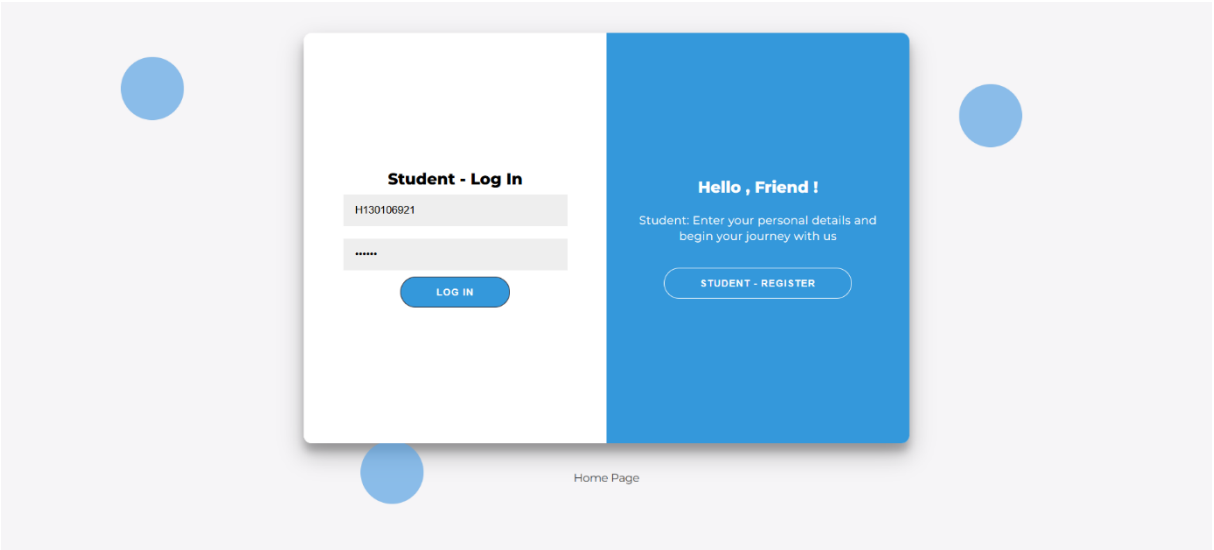
Home Page

- If the student is not yet registered, they must complete the form located at the top of the page. Once the form is filled out, the following page will be displayed.

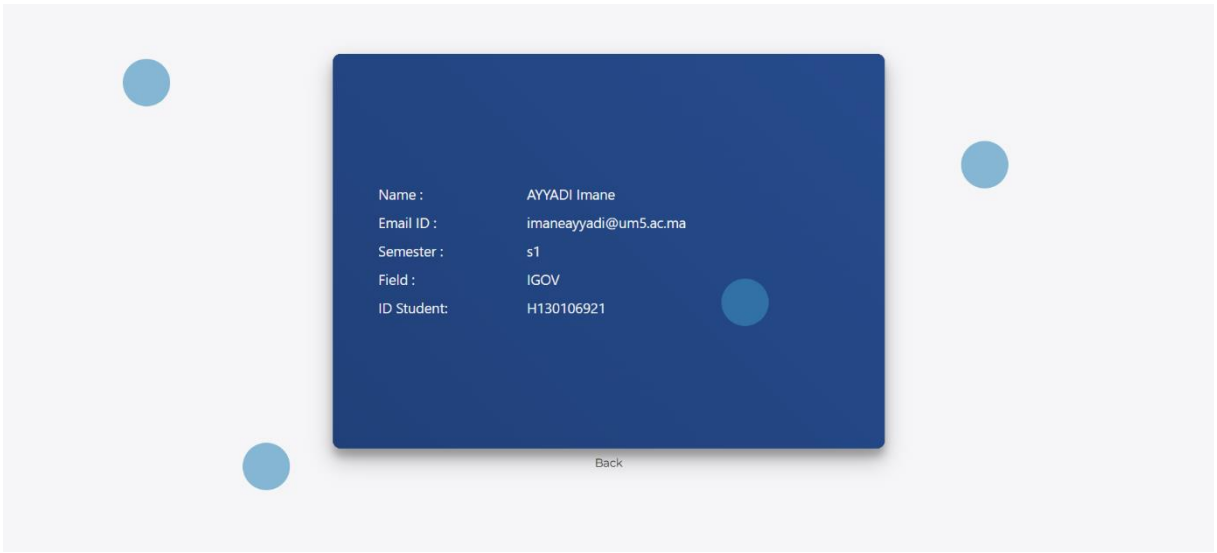




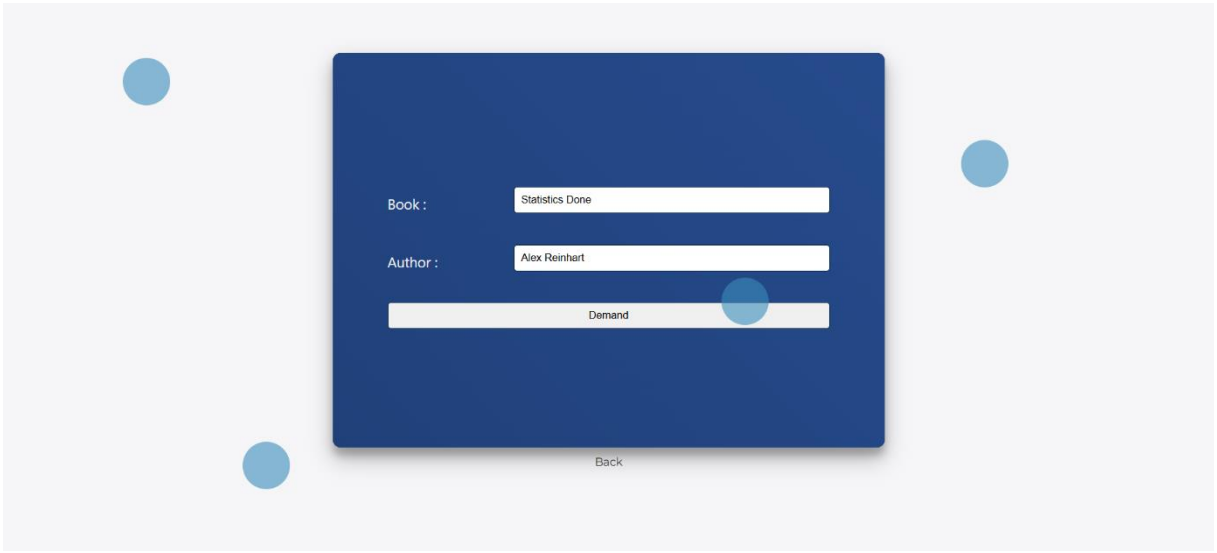
- If the student already has an account, they can log in, and then the following page will be displayed.

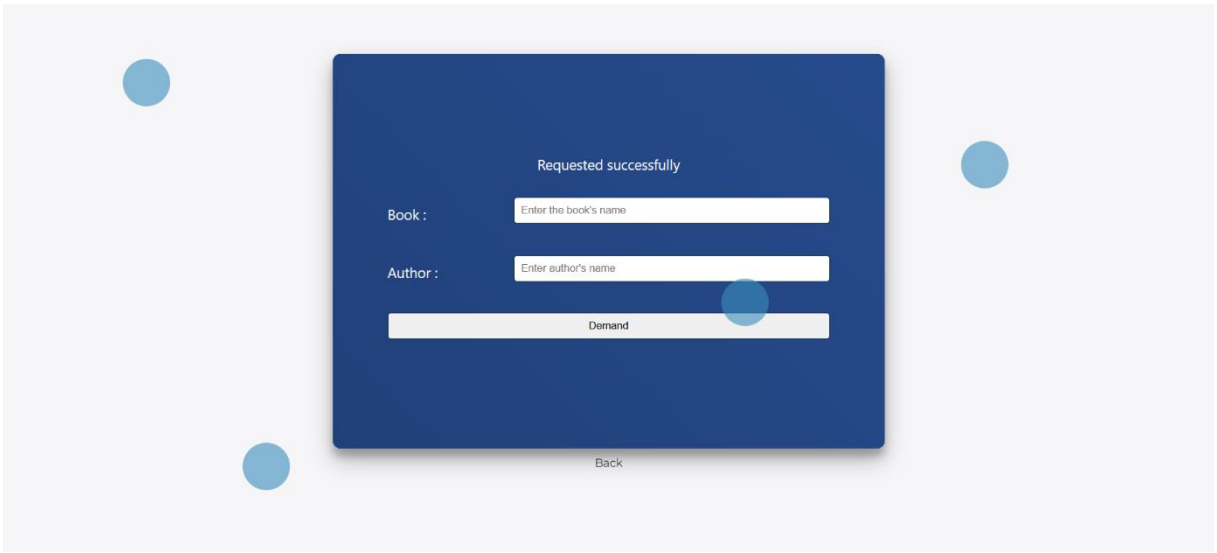


- The page contains a menu:
  Welcome (The name of the logged-in student). If clicked, the following page will be displayed.

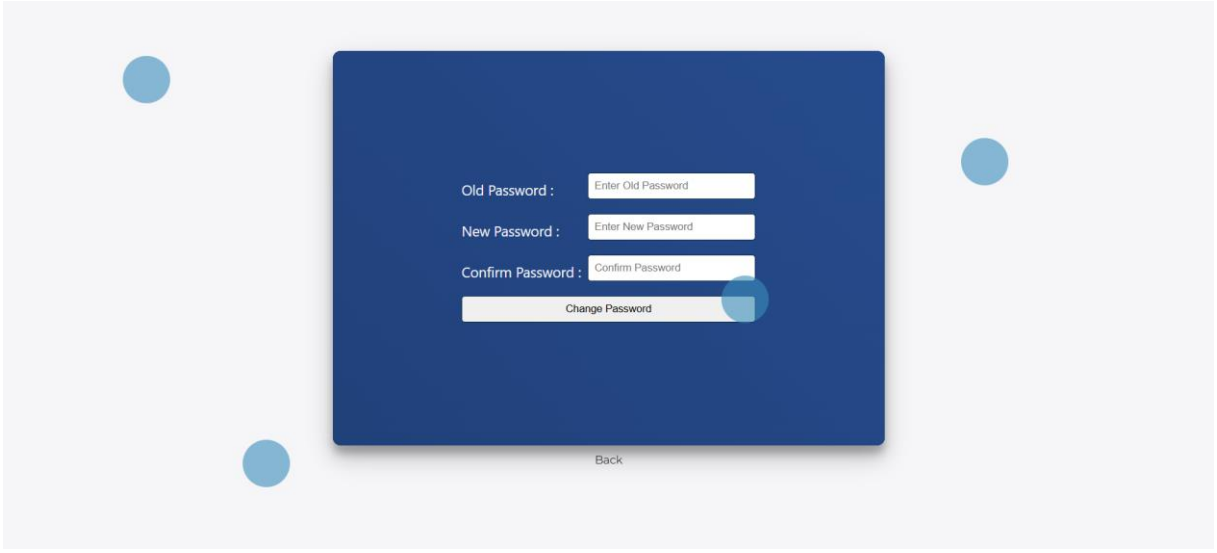


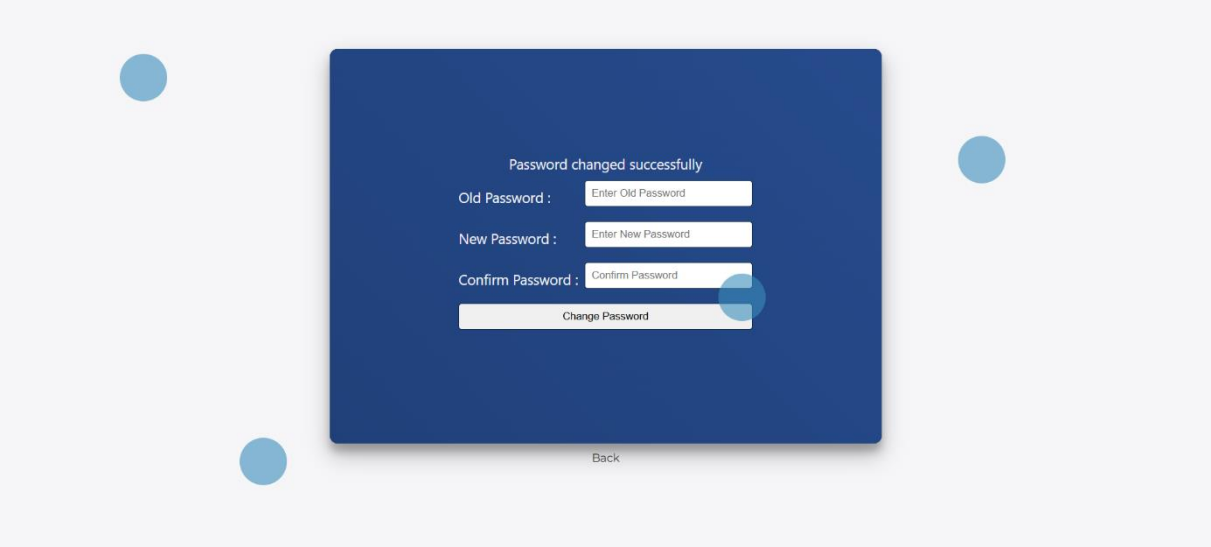
- Desired Book





- Change Password




Password changed successfully
Old Password :
Enter Old Password
New Password :
Enter New Password
Confirm Password :
Confirm Password
Change Password
Back

- Search Bar


Hello AYYADI Imane.
Desired Book
Modify Password
Log Out
Data
Category
EXAMS
Advanced Algorithms
Advanced Information Systems
Information Systems Security
Languages
Mobile Architectures
Soft Skills
Software Engineering
SQL/NoSQL Databases
Statistics and Data Analysis
Université Mohammed V
Faculté des Sciences
Rabat
Fundamentals of Information Systems Security
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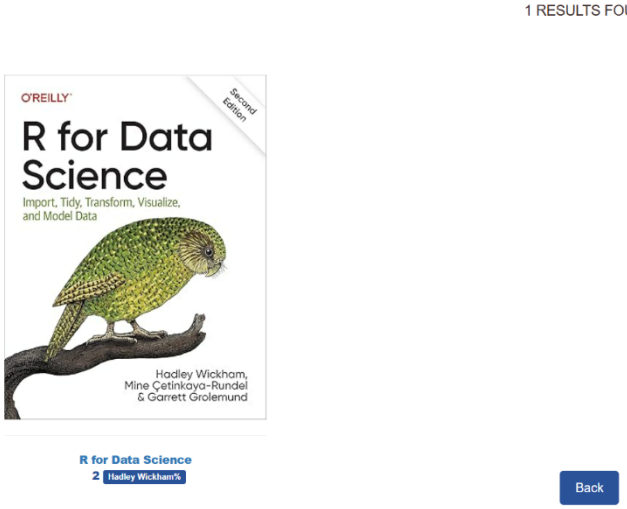
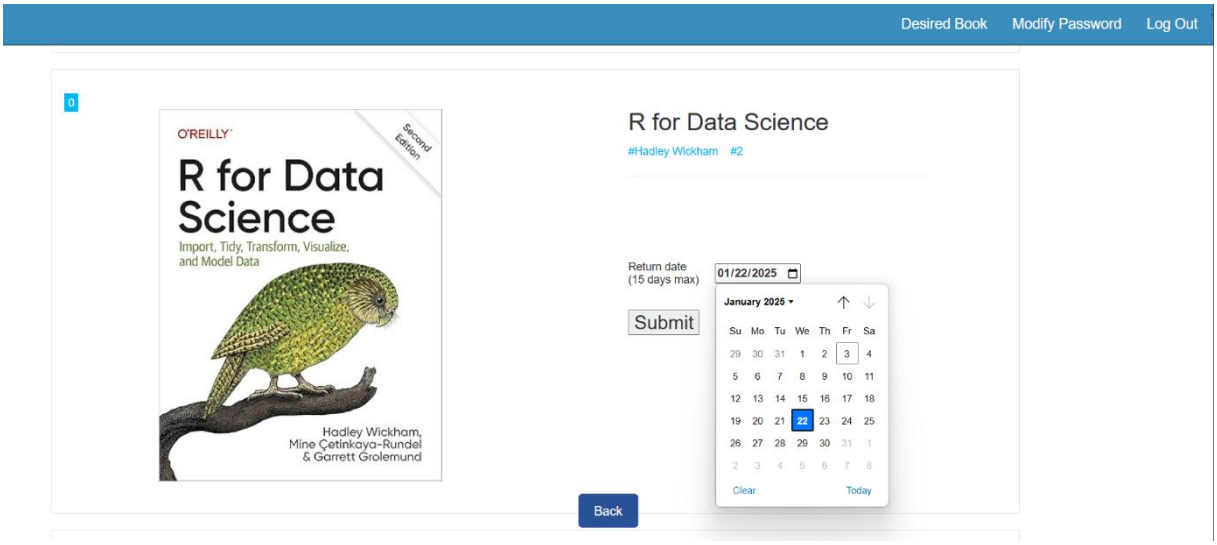
CONTACT US!

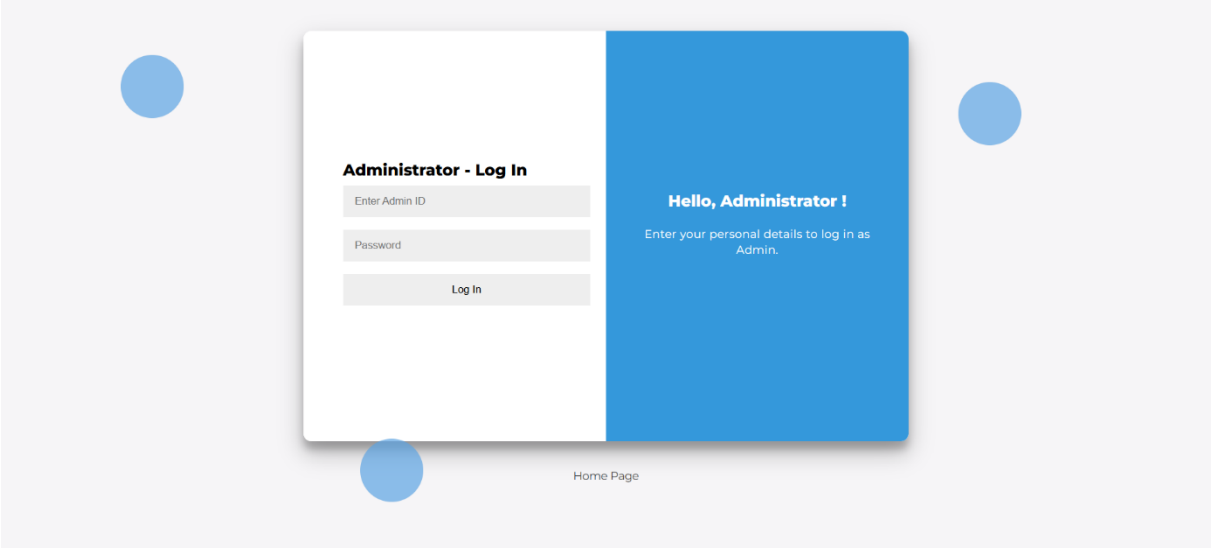

1 RESULTS FOUND
O'REILLY
Second Edition
R for Data Science
Import, Tidy, Transform, Visualize, and Model Data
Hadley Wickham, Mine Çetinkaya-Rundel & Garrett Grolemund
R for Data Science 2
Hadley Wickham's
Back

- Borrow the Book

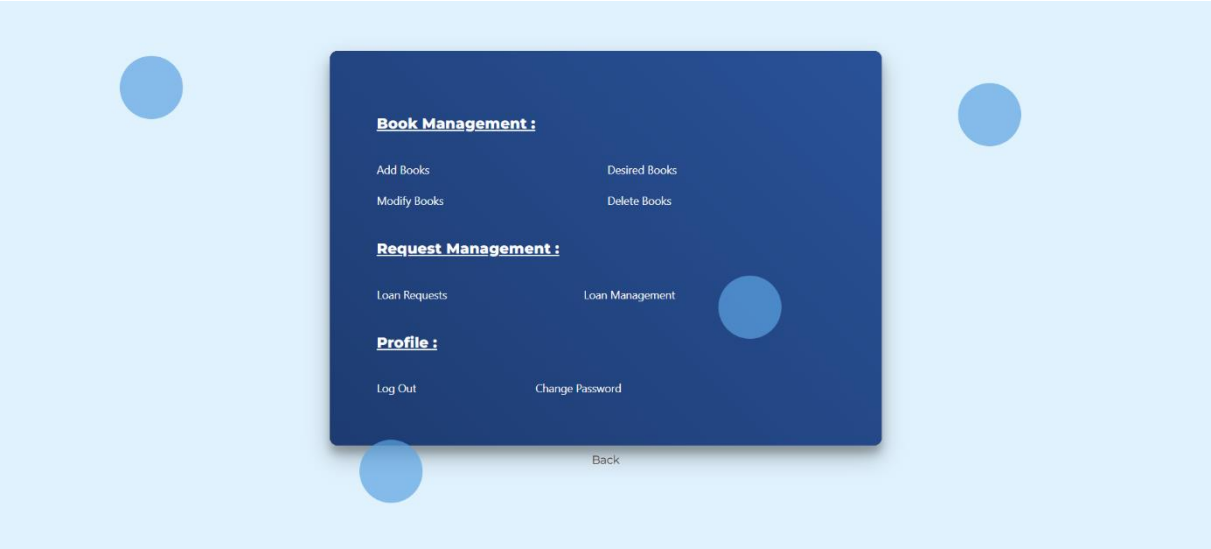


We log out and return to the Index.php page to access the administrator section.

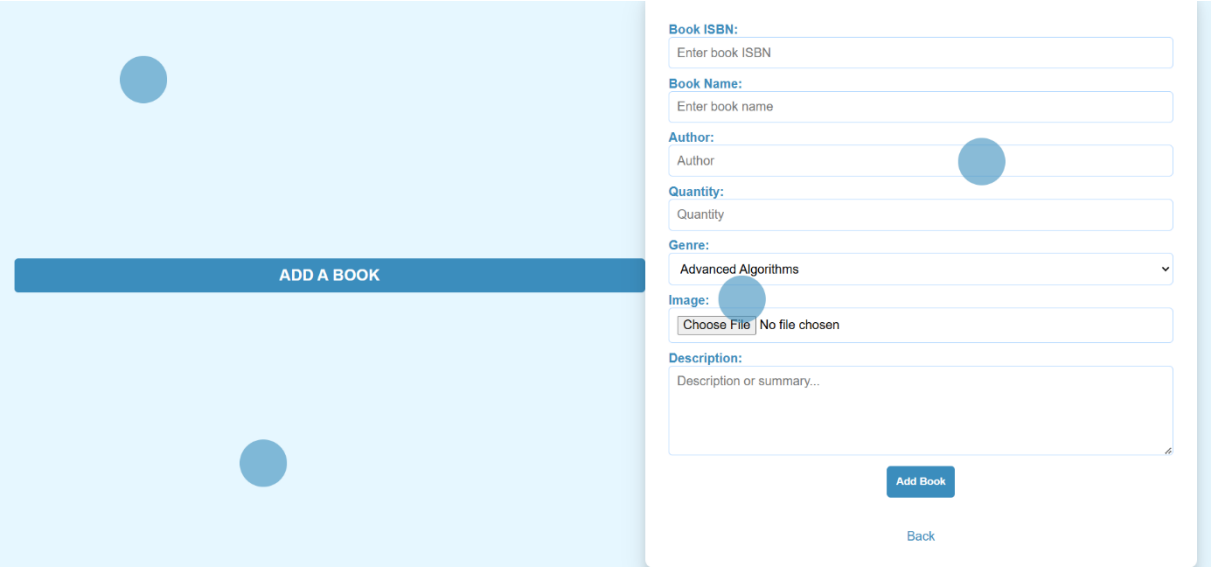
- Admin Connexion

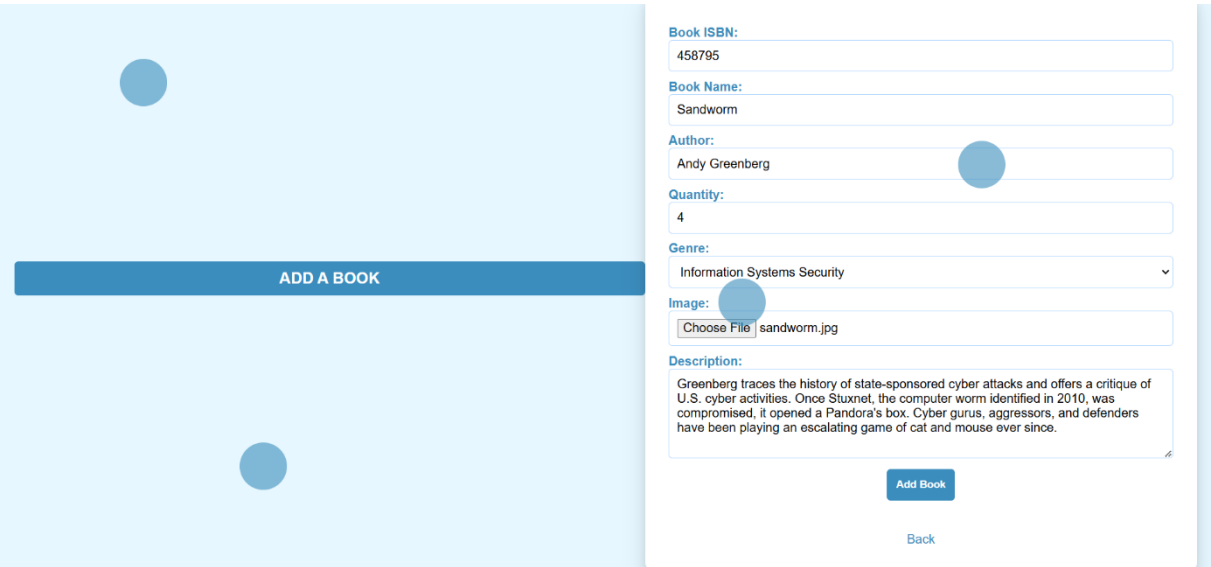


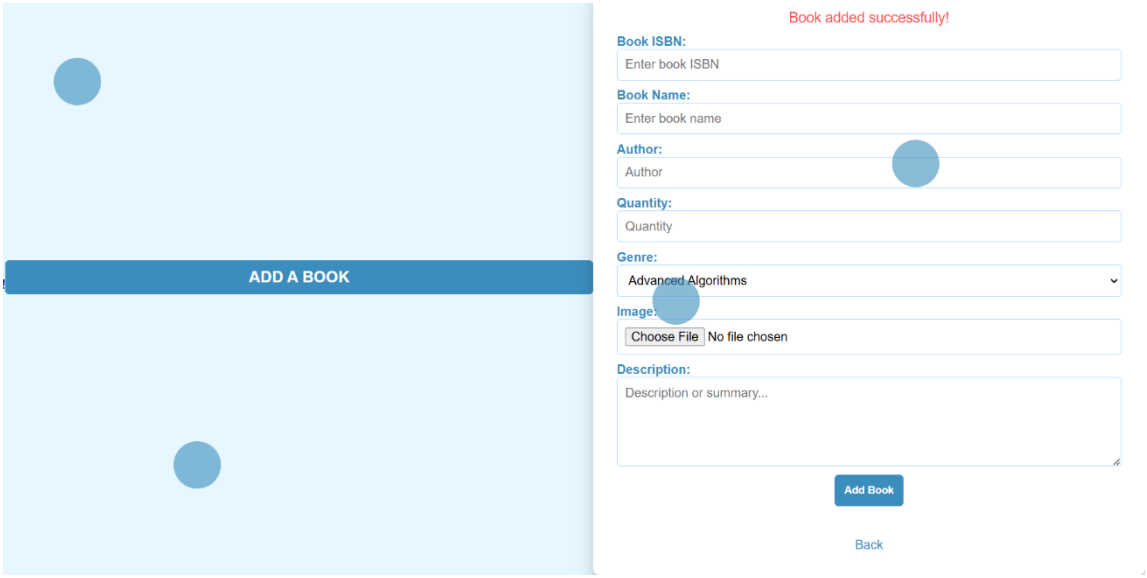
- Admin Menu


Book Management :
Add Books
Desired Books
Modify Books
Delete Books
Request Management :
Loan Requests
Loan Management
Profile :
Log Out
Change Password
Back

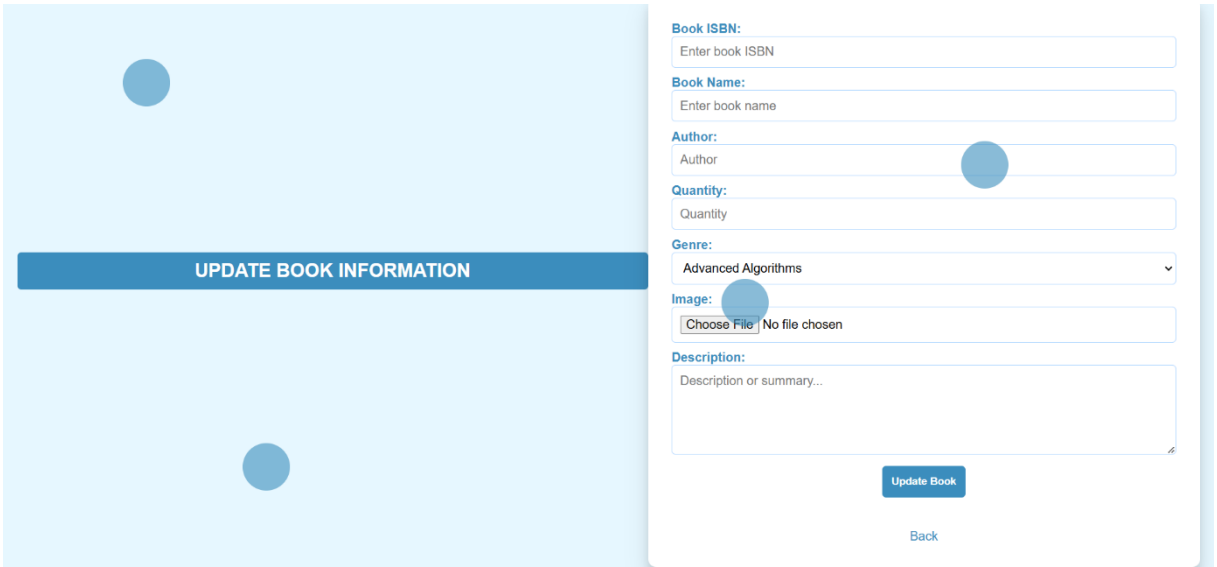
- Add book

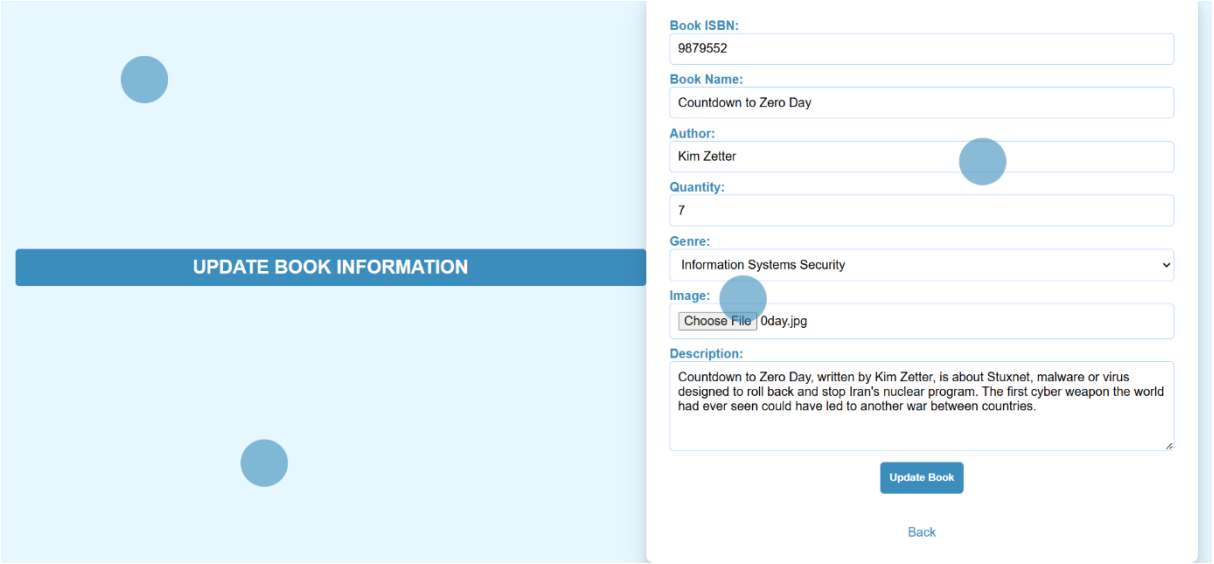

ADD A BOOK
Book ISBN:
Enter book ISBN
Book Name:
Enter book name
Author:
Author
Quantity:
Quantity
Genre:
Advanced Algorithms
Image:
Choose File No file chosen
Description:
Description or summary...
Add Book
Back


ADD A BOOK
Book ISBN:
458795
Book Name:
Sandworm
Author:
Andy Greenberg
Quantity:
4
Genre:
Information Systems Security
Image:
Choose File sandworm.jpg
Description:
Greenberg traces the history of state-sponsored cyber attacks and offers a critique of U.S. cyber activities. Once Stuxnet, the computer worm identified in 2010, was compromised, it opened a Pandora's box. Cyber gurus, aggressors, and defenders have been playing an escalating game of cat and mouse ever since.
Add Book
Back

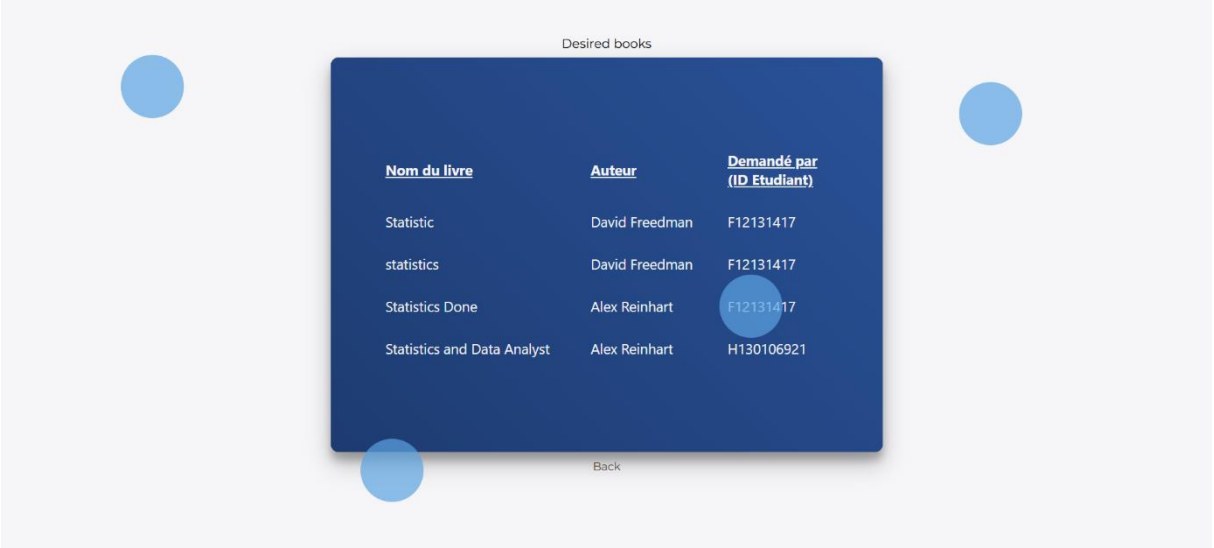


- Update a book

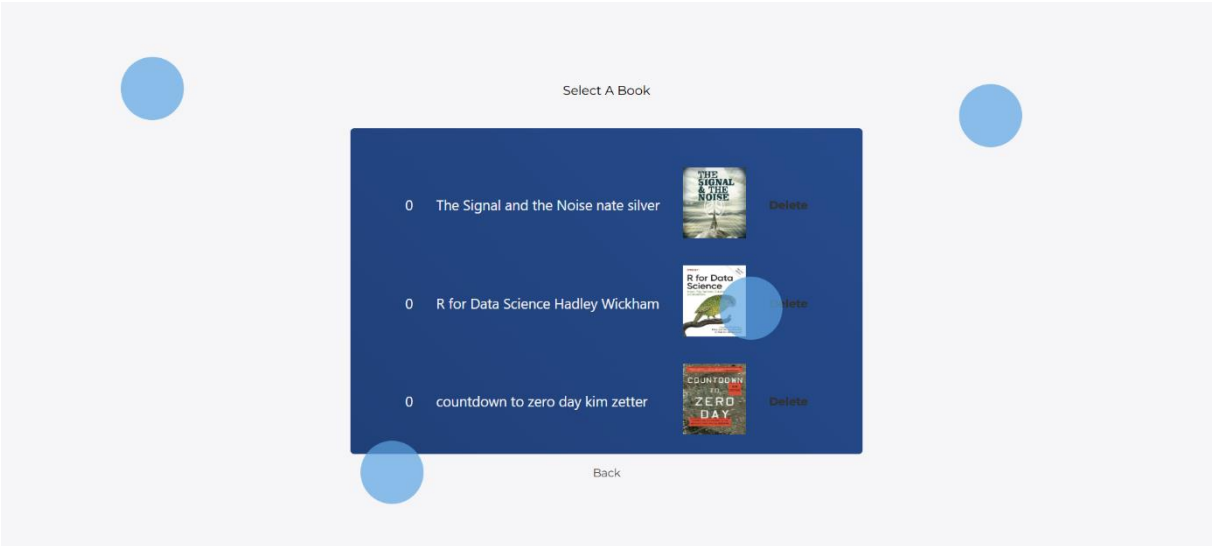




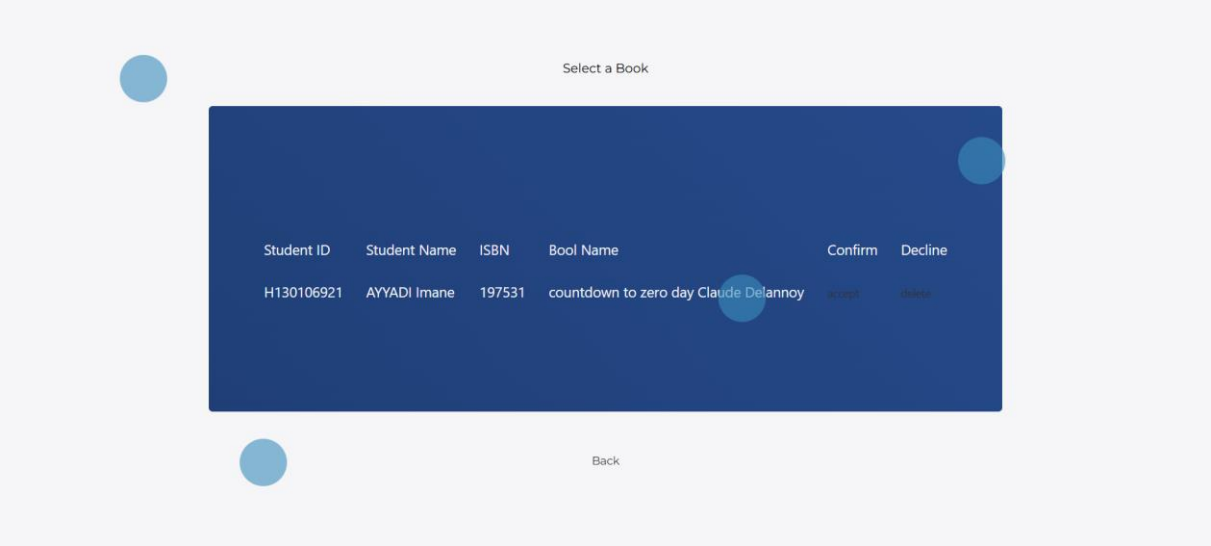
- Desired Books



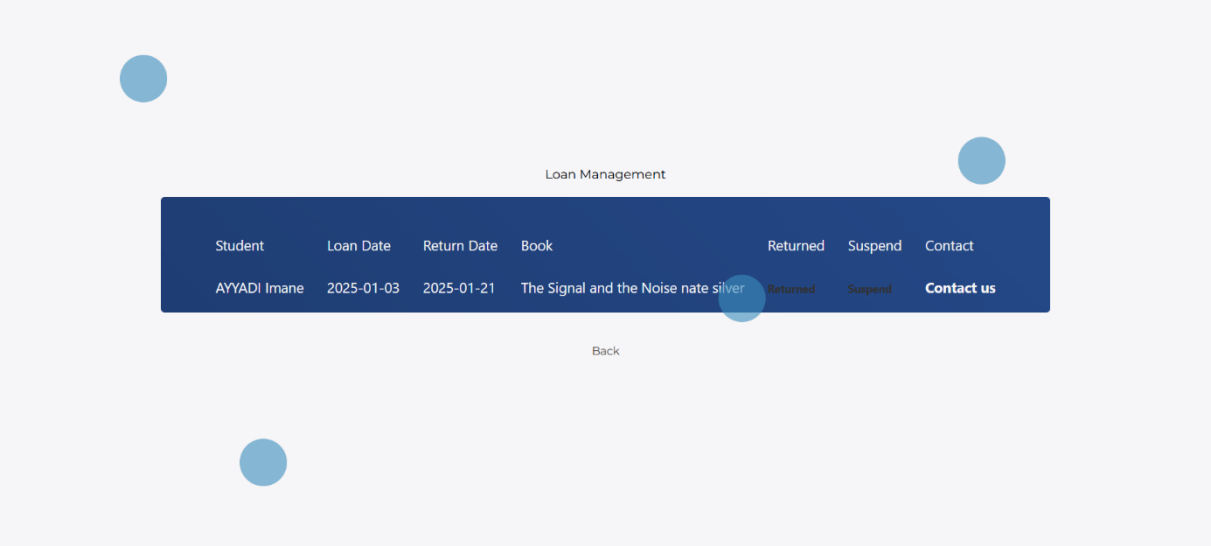
- Delete a book



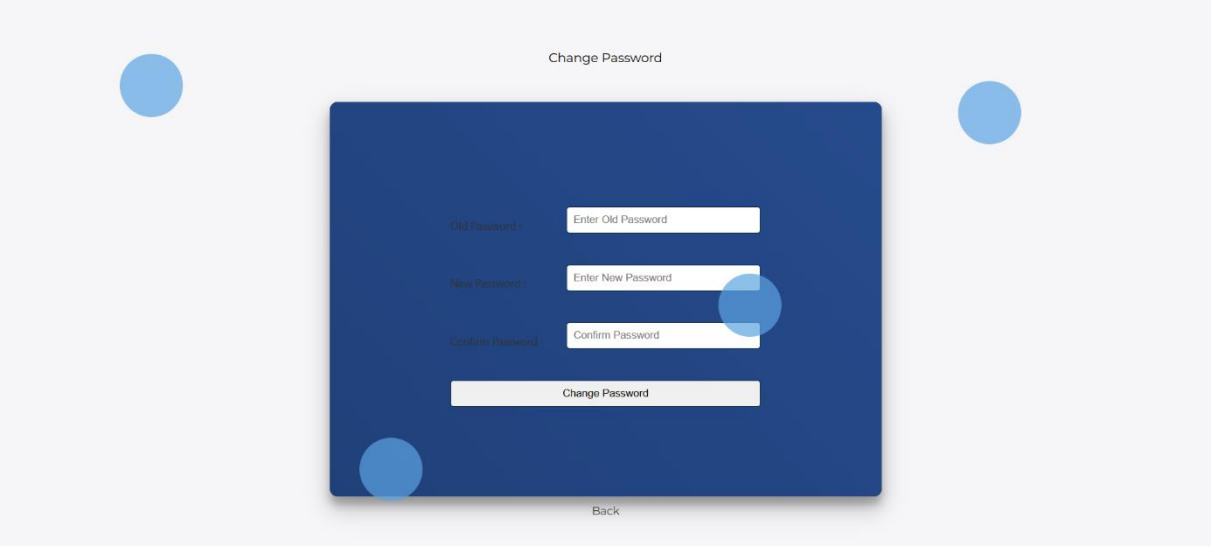
- Borrow Request



- Loan Management



- Change password



VIII. Conclusion

The development of the Library Management System for the Faculty of Sciences has been a comprehensive and structured process, guided primarily by the V-Model software development lifecycle. This methodology has enabled us to ensure rigorous verification and validation at each phase of the project, contributing significantly to the quality and reliability of the final product.

The project has successfully addressed the core challenges faced by traditional library systems by automating processes such as book loans, reservations, and catalog management. By focusing on user experience and operational efficiency, we have created an interactive platform tailored to the needs of students and administrators alike.

The specifications document has played a critical role in aligning the project's objectives with stakeholder expectations, ensuring that all functional and non-functional requirements are met. The project has leveraged proven technologies, such as PHP, MySQL, and JavaScript, to build a secure and scalable system that integrates seamlessly with existing university infrastructure.

Moreover, the system's architecture, which emphasizes user-centric design and robust security measures, ensures that the platform is not only efficient but also secure, safeguarding sensitive user information. The successful implementation of the system will lead to enhanced accessibility of library resources for students, particularly those in Computer Science and Software Engineering, while simplifying administrative tasks for library staff.

In summary, the Digital Library project stands as a testament to effective software engineering practices, demonstrating how structured methodologies like the V-Model can be employed to deliver high-quality, user-friendly solutions in educational contexts. The anticipated benefits of this system will contribute to the overall academic experience at the Faculty of Sciences, positioning it as a valuable resource for current and future students.