SOFTWARE REQUIREMENT SPECIFICATION

Web-Based System for Nano Material Repository

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CHAPTER 1

INTRODUCTION

1.1 Purpose

The purpose of this Software Requirements Specifications (SRS) document is to delineate the functional and non-functional requirements of the proposed web-based system for a nano-material repository. It serves as a comprehensive guide for designers and developers, outlining precisely what the system must accomplish. The intended audience includes software developers, system architects, project managers, and stakeholders involved in the development and implementation of the nano-material repository system.

1.2 Scope

This section defines the scope of the software product, which is the web-based nano-material repository system. The system will enable users, including students and staff, to input data from journal articles or their own experiments related to morphology,X-Ray Diffraction (XRD), I-V Characteristic, and UV-Vis Spectra of nano-materials such as zinc oxide. The system's application encompasses streamlining data management, fostering collaboration, and advancing research in the field of nanomaterials. It will not include unrelated functionalities beyond the specified experiments and materials.

1.3 Definition, Acronyms and Abbreviations

1.3.1 Definition

- Nanomaterial - Materials that have at least one dimension in the 1-100 nm range.
- Morphology - Study of the shape and structure of nanomaterials using microscopy techniques.
- XRD - X-ray diffraction, a technique used to determine atomic arrangements and crystal structures of materials.
- I-V Characteristics - Current-voltage characteristics measured for nanostructured devices like solar cells, sensors, etc.
- UV-Vis Spectra - Absorption/reflectance spectra in the ultraviolet and visible wavelength range.

1.3.2 Acronyms

- SRS - Software Requirements Specification
- UI - User Interface
- API - Application Programming Interface
- SQL - Structured Query Language
- XRD - X-Ray Diffraction

1.3.3 Abbreviations

- mconc. - concentration
- temp. - temperature
- RT - room temperature
- subs. - substrate
- NM - nanomaterial

1.4 Overview

The SRS document for the nanomaterial repository system is organized into sections providing background information, high-level system overviews, detailed functional and non-functional requirements, system architecture and models, and supporting appendices. The Introduction outlines project goals, target users, definitions, acronyms, and the SRS structure. The Overall Description section provides a high-level perspective of product features, user classes, operating constraints, and implementation details. The System Features section documents detailed functional requirements through use cases, user stories, and system capabilities. The External Interface Requirements section depicts connections with external systems and devices. System Architecture and Models provide structural and behavioral representations of system components and workflows. Nonfunctional criteria like security, performance, and compliance are specified in the Nonfunctional Requirements section. Finally, the Appendices contain a project glossary, acronyms list, issues list, and supplementary SRS data. This comprehensive SRS facilitates the engineering team's design and development of the nanomaterial repository system aligned with the specified requirements Kitchenham and Brereton (2013).

CHAPTER 2

REQUIREMENT ELICITATION TECHNIQUES

2.1 Requirement Sources

2.1.1 Stakeholders

stakeholders for the web-based system for nano material repository include students, academic staff, and administrators. These stakeholders will be interviewed and surveyed to gather insights into functional and non-functional requirements.

2.1.2 Documents

Relevant documents will be analyzed including standards like ISO 9001, academic papers on nanomaterial databases, existing system requirement documents, and error logs. These will provide baseline and context-specific requirements.

2.1.3 Existing Systems

Legacy or predecessor systems, as well as competitor systems, serve as crucial sources of requirements. Analyzing these systems allows for the identification of functionalities, shortcomings, and potential improvements that can inform the development of the new nano-material repository system Tiwari et al. (2012).

2.2 Requirement Techniques

2.2.1 Conversational Techniques

Stakeholder interviews, focus group workshops, and brainstorming sessions will be conducted to facilitate two-way elicitation of requirements.

2.2.2 Creativity Techniques

Design thinking and ideation techniques will be used to generate innovative ideas for the system's capabilities.

2.2.3 Observational Techniques

Observation technique of nano material researchers may provide additional workflow insights if deemed beneficial.

2.2.4 Document-centric Techniques

Documentation will be thoroughly analyzed to extract relevant details using document-centric techniques.

2.2.5 Support techniques

Workshops, feedback sessions, and iterative discussions will facilitate collaboration between analysts and stakeholders for requirement verification Davis et al. (2006).

CHAPTER 3

SYSTEM REQUIREMENTS

3.1 Functional Requirement

3.1.1 Student

- **R1**: Student should be able to search for nano materials by such as properties, and composition.
- **R2**: Student should be able to view experimental results data including charts, graphs and tables.
- **R3**: Student should be able to filter and compare result data from multiple experiments.
- **R4**: Student should be able register a user account and log in.
- **R5**: Student should be able to input experimental data from published papers into the repository.

3.1.2 Academic Staff

- **R6**: Academic staff should be able to search repository based on advanced criteria.
- **R7**: Academic staff should be able to export analytics reports in PDF.

3.1.3 Administrator

- **R8**: The ability to create, update, and delete user accounts.
- **R9**: Should be able to manage database and queries. Glinz (2007)

3.2 Non-functional Requirement

- **Performance and Scalability:** The system must provide fast response times, and any performance degradation due to increased workload must be logged and corrected.
- **Portability and Maintainability, Availability:** The system must be compatible with Windows 11. The system must also be accessible through Google Chrome and Microsoft Edge browsers to ensure ensuring widespread availability and support.
- **Reliability, maintainability, availability:** How often does the system experience critical failures? How much time does it take to fix the issue when it arises? And how is user availability time compared to downtime?
- **Security:** Systems must implement strong security measures, including encryption protocols, secure user authentication, and protection against common cyber threats.
- **Localization:** The system must be adapted to local conditions, taking into account language support and possible regional customization requirements.
- **Usability:** The system must comply with usability principles, ensuring that users, including students, instructional staff, and administrators, find it intuitive intuitive and easy to use Kurtanović and Maalej (2017).

CHAPTER 4

REQUIREMENT ANALYSIS

4.1 Use Case Diagram

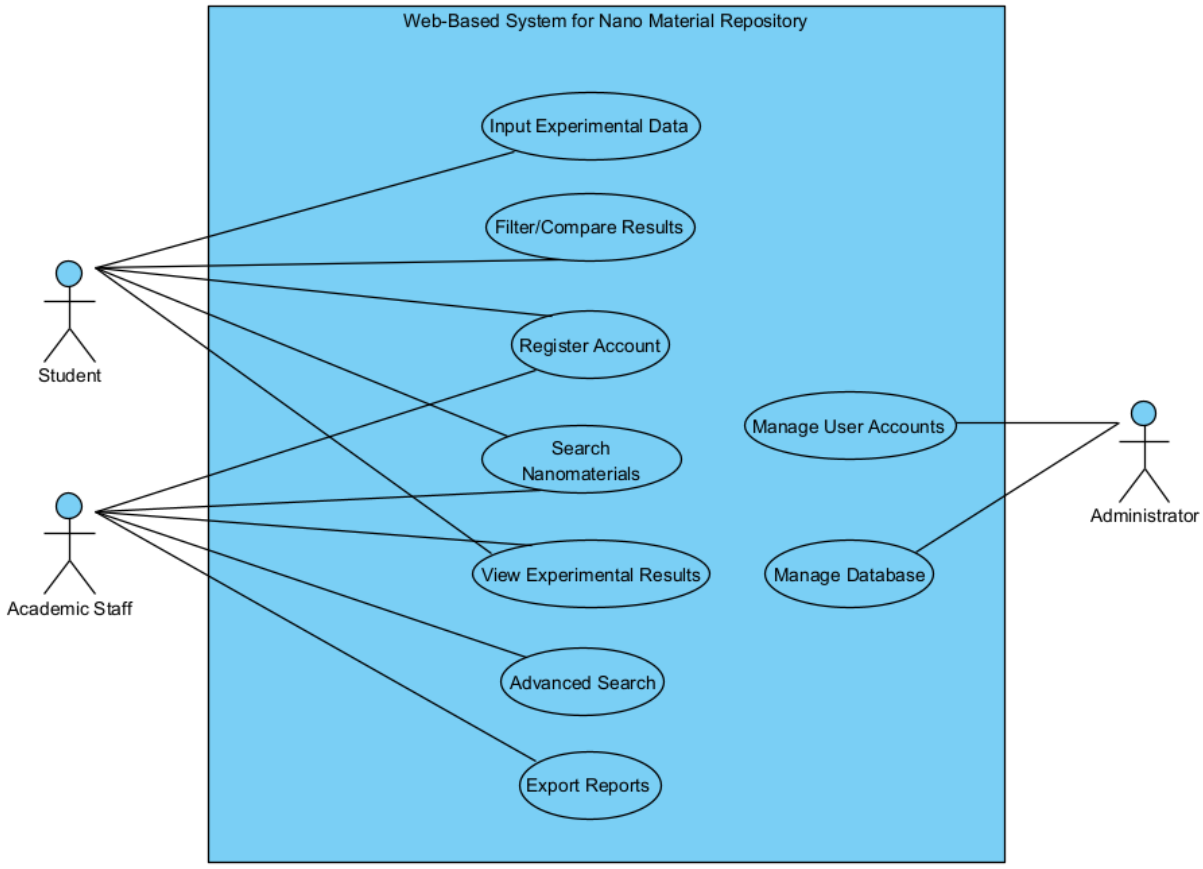

Figure 4.1: Web-Based System for Nano Material Repository use case diagram

4.2 Use Case Description

Table 4.1: Use Case 1

Use Case Name: Register Account **ID:** UC1 **Importance Level:** High

Primary Actor: Student, staff **Use Case Type:**Primary, Essential Academic
Stakeholder and Interests:
Student - wants to create account to access repository.
Academic Staff - wants to create account to access repository.
Brief Description: This use case describes how students and and academic staff register for account.
Trigger: Students and academic staff want to create an account.
Type: External
Relationship:
Normal Flow of Events:

1. Student and academic staff clicks register link and fills registration form.
2. Student and academic staff provides details like name, email, role.
3. Student and academic staff enters password and confirms.
4. System validates input.
5. Student and academic staff can now login with registered credentials.

Sub-Flows: None
Alternate/Exceptional Flows:
1a. Invalid input, user prompted to re-enter details

Table 4.2: Use Case 2

Use Case Name: Search Nanomaterials **ID:** UC2 **Importance Level:** High

Primary Actor: Student, staff **Use Case Type:**Primary, Essential Academic
Stakeholder and Interests:
Student - Wants to find nanomaterials for research
Academic Staff - Wants to search nanomaterials to analyze
Brief Description: Allows users to search for nanomaterials based on properties.
Trigger: User wants to find nanomaterials matching criteria
Type: External
Relationship:
Normal Flow of Events:

1. Student and academic staff logs into system with credentials.
2. Student and academic staff enters search parameters like composition, structure, properties.
3. Student and academic staff selects a material to view details.
4. Student and academic staff saves materials to favorites for future access.
5. Student and academic staff logs out after completing search.

Sub-Flows: None
Alternate/Exceptional Flows:
1a. Invalid login credentials prompts user to login again.

Table 4.3: Use Case 3

Use Case Name: View Experimental Results **ID:** UC3 **Importance Level:** High

Primary Actor: Student, staff **Use Case Type:**Primary, Essential Academic
Stakeholder and Interests:
Student - Wants to analyze experimental result data
Academic Staff - Wants to evaluate experimental results.
Brief Description: Allows users to view experimental data for nanomaterials.
Trigger: User wants to access experimental result data
Type: External
Relationship:
Normal Flow of Events:

1. Student and academic staff logs into system with credentials.
2. Student and academic staff finds nanomaterial to view results for.
3. System displays experimental results like charts, graphs, tables.
4. Student and academic staff can filter/sort the experimental data.
5. Student and academic staff can export the data for external analysis.
6. Student and academic staff logs out after viewing results.

Sub-Flows: None
Alternate/Exceptional Flows:
1a. Invalid login prompts user to login again.

Table 4.4: Use Case 4

Use Case Name: Input Experimental Data **ID:** UC4 **Importance Level:** High

Primary Actor: Student **Use Case Type:**Primary, Essential
Stakeholder and Interests:
Student - Wants to input experimental data into the system.
Brief Description: This use case describes how a student can input experimental data into the nano material repository system.
Trigger: Student has experimental data to input into the system.
Type: External
Relationship: Normal
Normal Flow of Events:

1. Student logs in by entering username and password.
2. Student navigates to the section for inputting experimental data.
3. Student inputs data from the experiments, which include Morphology, XRD (X-Ray Diffraction), I-V Characteristic, and UV-Vis Spectra.
4. Student inputs parameters such as concentration, length, diameter, and length, all in nano scale.
5. Student submits the data.
6. System validates and saves the data.
7. Student logs out of the system after completing the data input.

Sub-Flows: None
Alternate/Exceptional Flows:
1a. If username/password is invalid, student must login again.
2a. If data input is invalid or incomplete, the system prompts the student to correct it.

Table 4.5: Use Case 5

Use Case Name: Compare/Filter **ID:** UC5 **Importance Level:** High Experimental Data

Primary Actor: Student **Use Case Type:**Primary, Essential
Stakeholder and Interests:
Student - Wants to compare and filter experimental data in the system..
Brief Description: This use case describes how a student can compare and filter experimental data in the nano material repository system.
Trigger: Student wants to analyze experimental data.
Type: External
Relationship: Normal
Normal Flow of Events:

1. Student logs in by entering username and password.
2. Student navigates to the section for viewing experimental data.
3. Student applies filters or parameters such as concentration, length, diameter, and length, all in nano scale.
4. System displays the filtered data.
5. Student compares the filtered data with other data sets or benchmarks.
6. Student logs out of the system after completing the comparison/filtering.

Sub-Flows: None
Alternate/Exceptional Flows:
1a. If username/password is invalid, student must login again.
2a. If filter parameters are invalid or not applicable, the system prompts the student to correct it.

Table 4.6: Use Case 6

Use Case Name: Advanced Search **ID:** UC6 **Importance Level:** High

Primary Actor: Academic Staff **Use Case Type:**Primary, Essential
Stakeholder and Interests:
Academic Staff - Wants to perform an advanced search on the experimental data in the system.
Brief Description: This use case describes how an academic staff member can perform an advanced search on the experimental data in the nano material repository system.
Trigger: Academic staff wants to analyze specific experimental data.
Type: External
Relationship:
Normal Flow of Events:

1. Academic staff logs in by entering username and password.
2. Academic staff navigates to the advanced search section.
3. Academic staff inputs search parameters such as experiment type (Morphology, XRD, I-V Characteristic, UV-Vis Spectra), material type (e.g., platinum, zinc oxide), and experiment parameters (concentration, length, diameter, length - all in nano scale).
4. System performs an advanced search based on the input parameters.
5. System displays the search results.
6. Academic staff can save the search results for future reference.
7. Academic staff logs out of the system after completing the advanced search.

Sub-Flows: None
Alternate/Exceptional Flows:
1a. If username/password is invalid, academic staff must login again
2a. If search parameters are invalid or not applicable, the system prompts the academic staff to correct it.

Table 4.7: Use Case 7

Use Case Name: Export Report **ID:** UC7 **Importance Level:** High

Primary Actor: Academic staff **Use Case Type:**Primary, Essential
Stakeholder and Interests:
Academic Staff - Wants to export a report of experimental data from the system.
Brief Description: This use case describes how an academic staff member can export a report of experimental data from the nano material repository system.
Trigger: Academic staff needs to generate a report for analysis, presentation, or publication.
Type: External
Relationship: Normal
Normal Flow of Events:

1. Academic staff logs in by entering username and password.
2. Academic staff navigates to the section for exporting reports.
3. Academic staff selects the data and the format for the report.
4. System generates the report based on the selected data and format.
5. Academic staff downloads the generated report.
6. Academic staff logs out of the system after completing the report export.

Sub-Flows: None
Alternate/Exceptional Flows:
1a. If username/password is invalid, academic staff must login again.
2a. If selected data or format is invalid, the system prompts the academic staff to correct it.

Table 4.8: Use Case 8

Use Case Name: Manage User Accounts **ID:** UC8 **Importance Level:** High

Primary Actor: Administrator **Use Case Type:**Primary, Essential
Stakeholder and Interests:
Administrator - Wants to manage user accounts in the system.
Brief Description: This use case describes how an administrator can manage user accounts in the nano material repository system.
Trigger: Administrator needs to oversee the user accounts for system maintenance or user support.
Type: External
Relationship:
Normal Flow of Events:

1. Administrator logs in by entering username and password.
2. Administrator navigates to the section for managing user accounts.
3. Administrator can view all user accounts.
4. Administrator can add, modify, or delete user accounts.
5. Administrator can reset passwords for user accounts.
6. System updates the status of the user accounts based on the administrator's actions.
7. Administrator logs out of the system after completing the management of user accounts.

Sub-Flows: None
Alternate/Exceptional Flows:
1a. If username/password is invalid, administrator must login again.
2a. If an action on a user account is invalid or not applicable, the system prompts the administrator to correct it.

Table 4.9: Use Case 9

Use Case Name: Manage Database **ID:** UC9 **Importance Level:** High

Primary Actor: Administrator **Use Case Type:**Primary, Essential
Stakeholder and Interests:
Administrator - Wants to manage the database of the system.
Brief Description: This use case describes how an administrator can manage the database in the nano material repository system.
Trigger: Administrator needs to oversee the database for system maintenance or data integrity.
Type: External
Relationship: Normal
Normal Flow of Events:

1. Administrator logs in by entering username and password.
2. Administrator navigates to the section for managing the database.
3. Administrator can view all tables and records in the database.
4. Administrator can add, modify, or delete records in the database.
5. Administrator can perform database operations such as backup, restore, or optimize the database.
6. System updates the status of the database based on the administrator's actions.
7. Administrator logs out of the system after completing the database management.

Sub-Flows: None
Alternate/Exceptional Flows:
1a. If username/password is invalid, administrator must login again
2a. If an action on a database record is invalid or not applicable, the system prompts the administrator to correct it.

4.3 Activity Diagrams

4.3.1 Use Case Diagram - Student

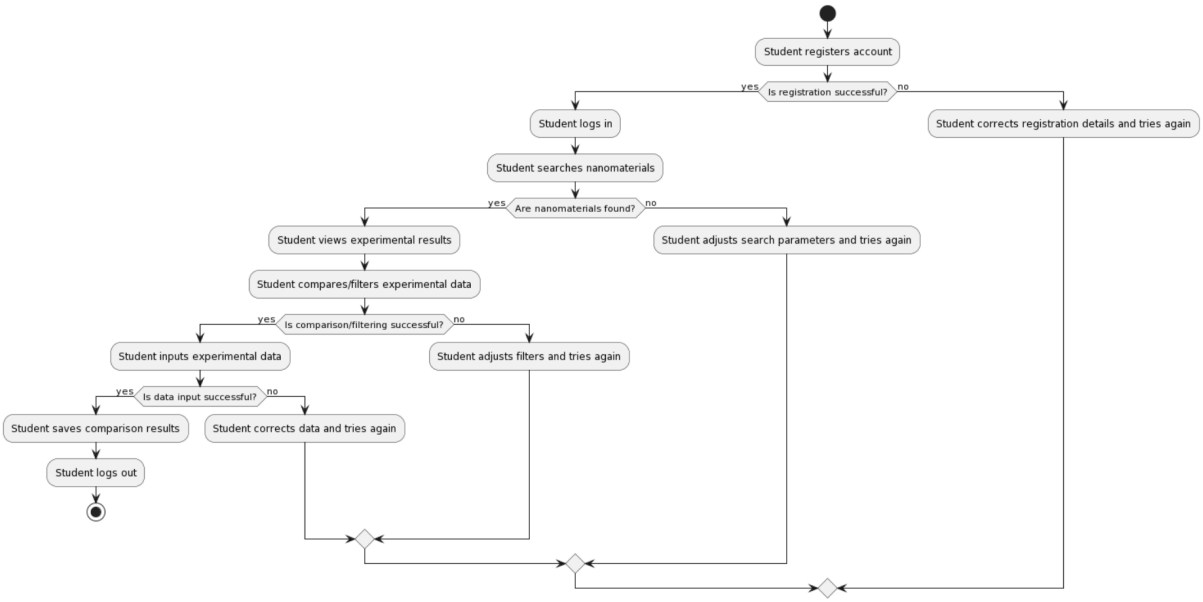

Figure 4.2: Web-Based System for Nano Material Repository Activity Diagram

4.3.2 Activity Diagram - Academic Staff

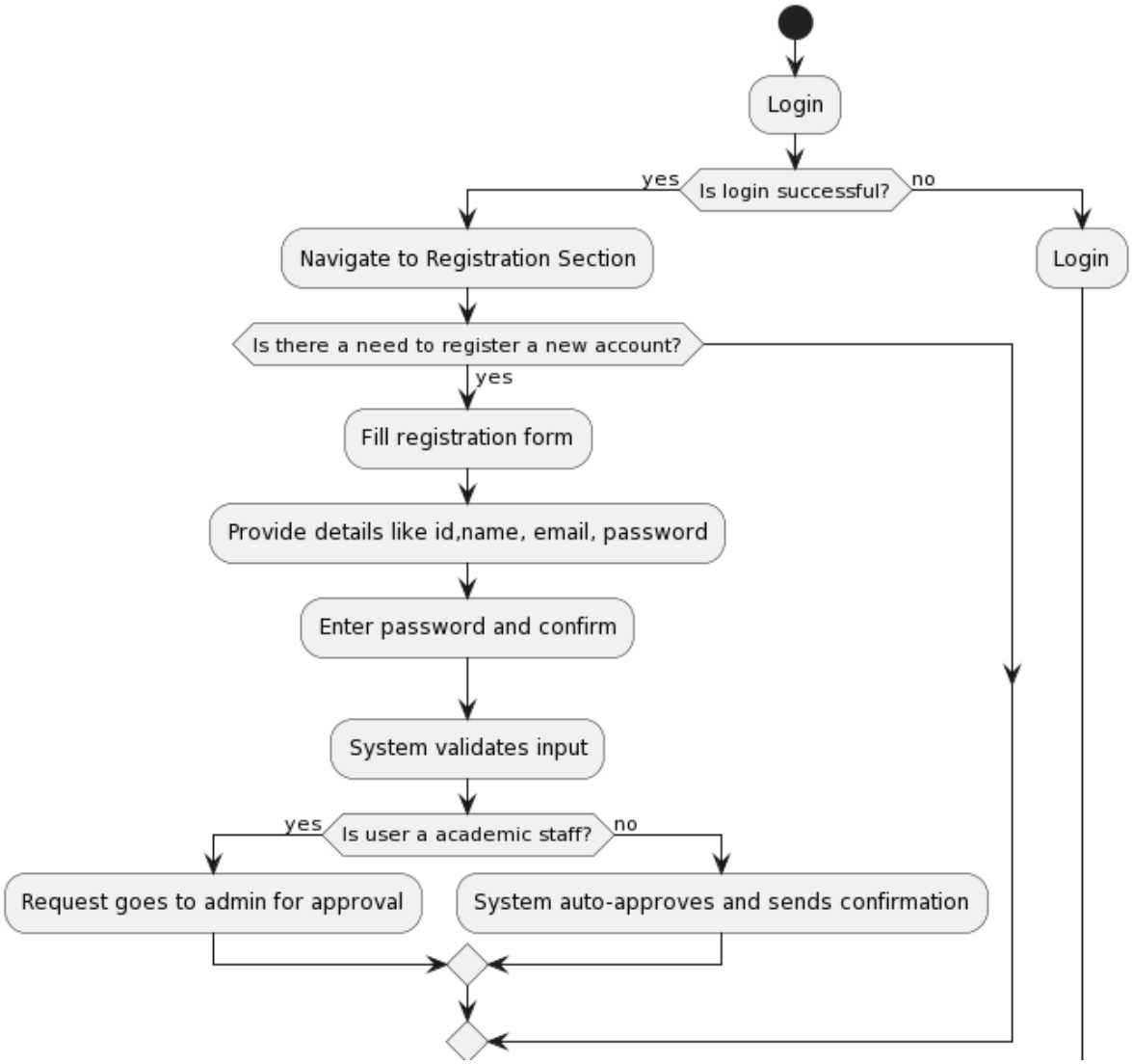

Figure 4.3: Web-Based System for Nano Material Repository Activity Diagram

4.3.3 Activity Diagram - Academic Staff

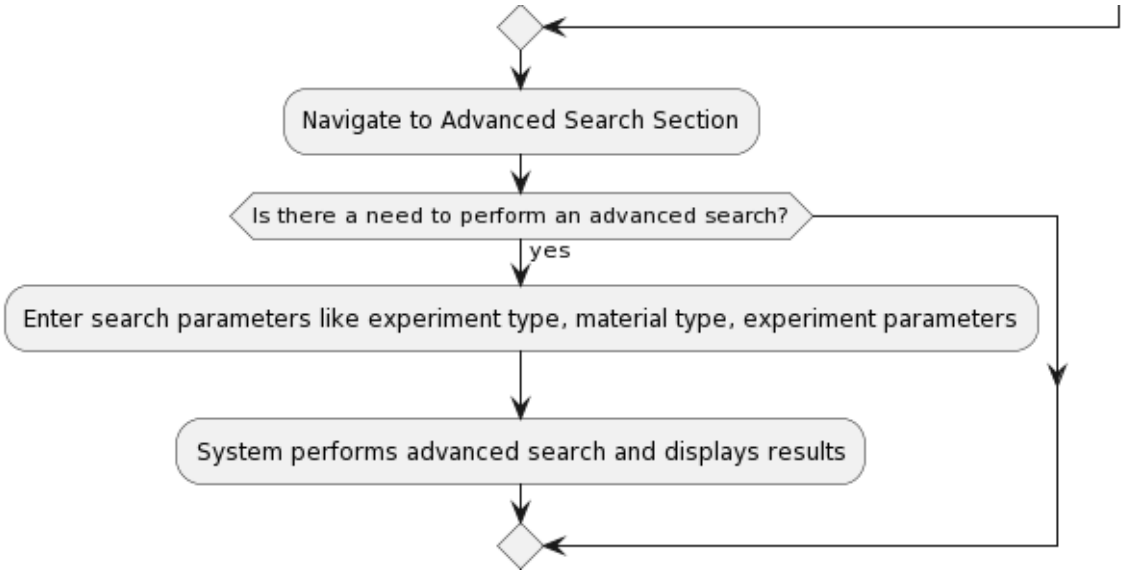

Figure 4.4: Web-Based System for Nano Material Repository Activity Diagram

4.3.4 Activity Diagram - Academic Staff

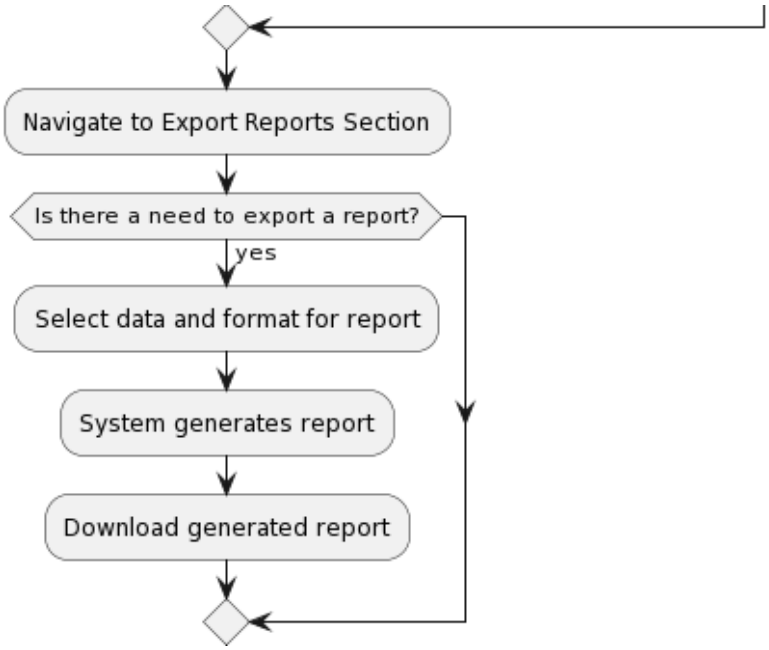

Figure 4.5: Web-Based System for Nano Material Repository Activity Diagram

4.3.5 Activity Diagram - Academic Staff

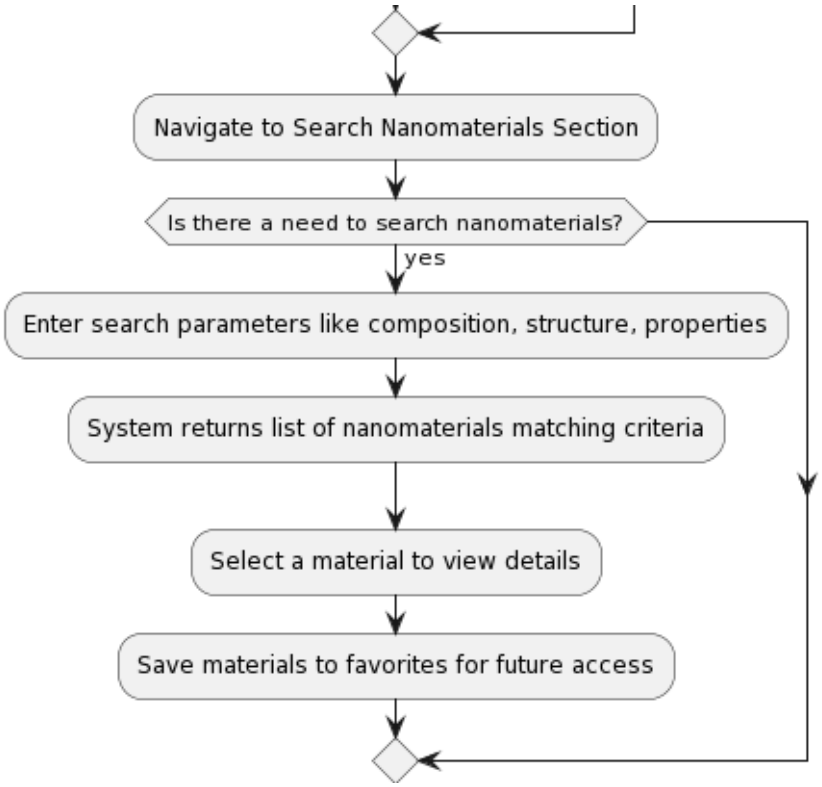

Figure 4.6: Web-Based System for Nano Material Repository Activity Diagram

4.3.6 Activity Diagram - Academic Staff

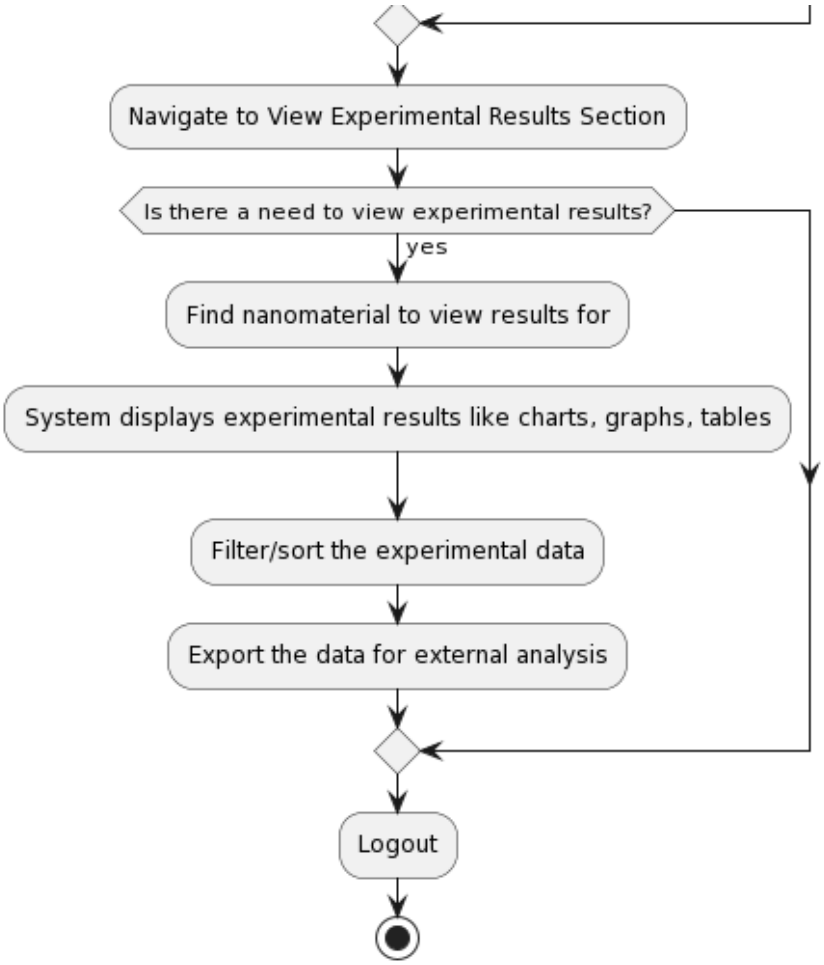

Figure 4.7: Web-Based System for Nano Material Repository Activity Diagram

4.3.7 Activity Diagram - Administrator

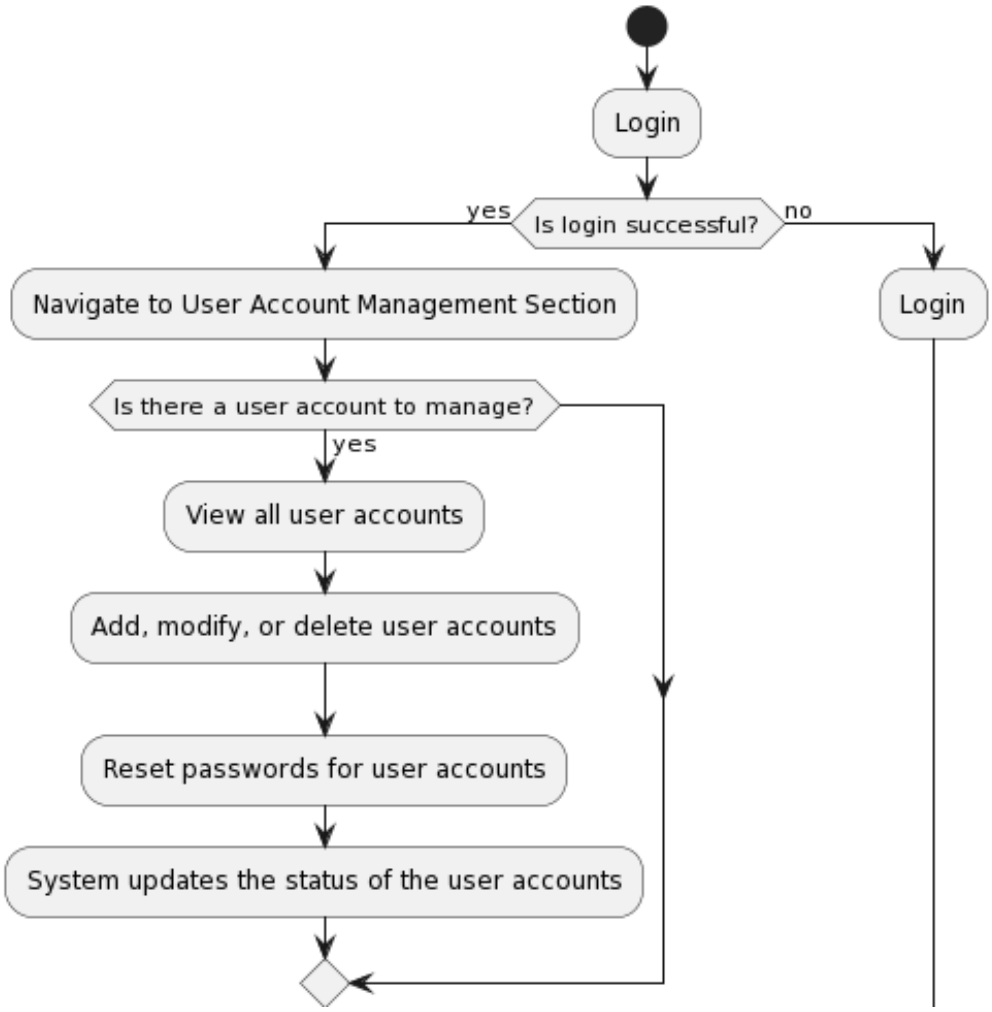

Figure 4.8: Web-Based System for Nano Material Repository Activity Diagram

4.3.8 Activity - Administrator

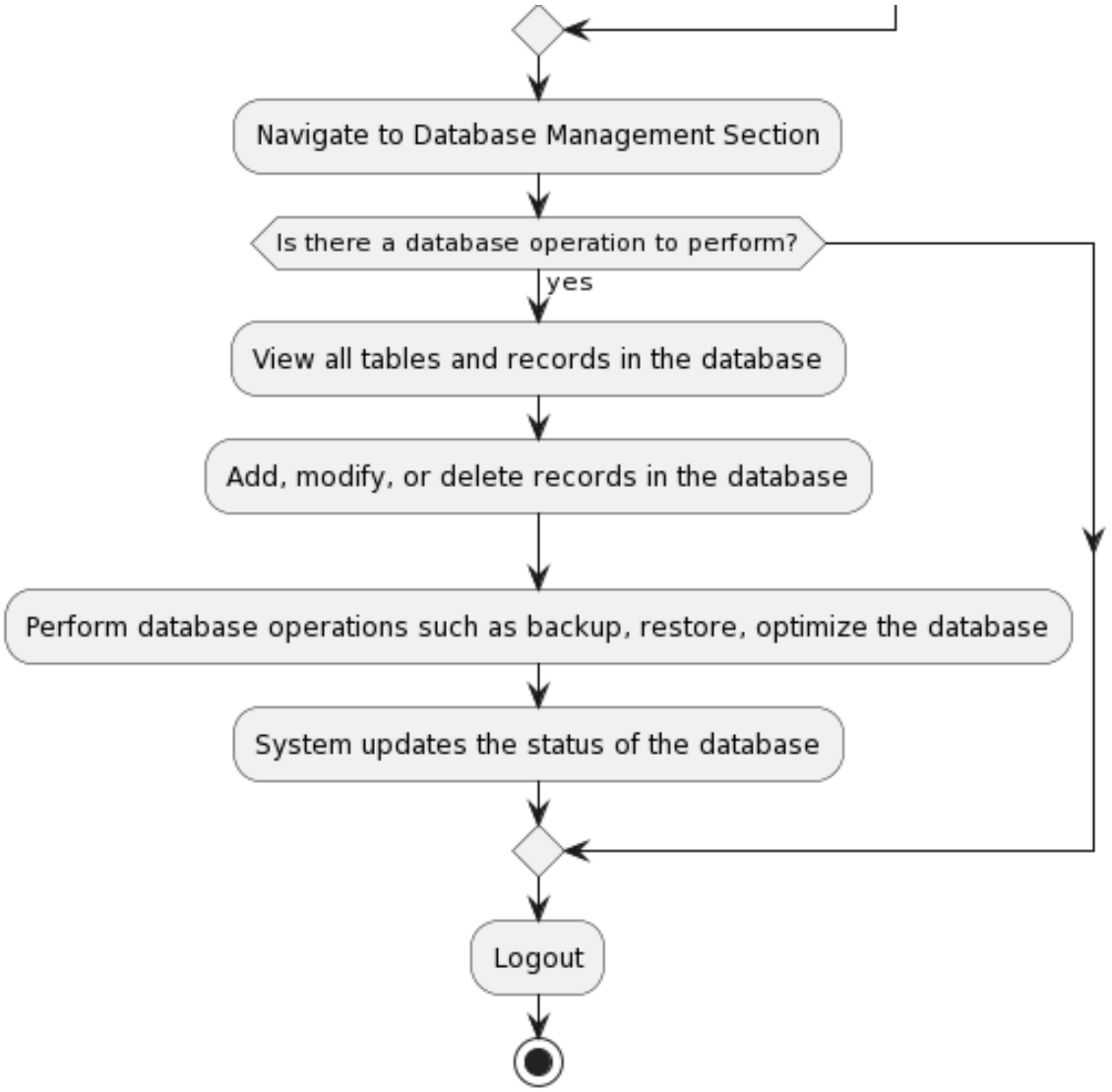

Figure 4.9: Web-Based System for Nano Material Repository Activity Diagram

4.4 Class Diagram

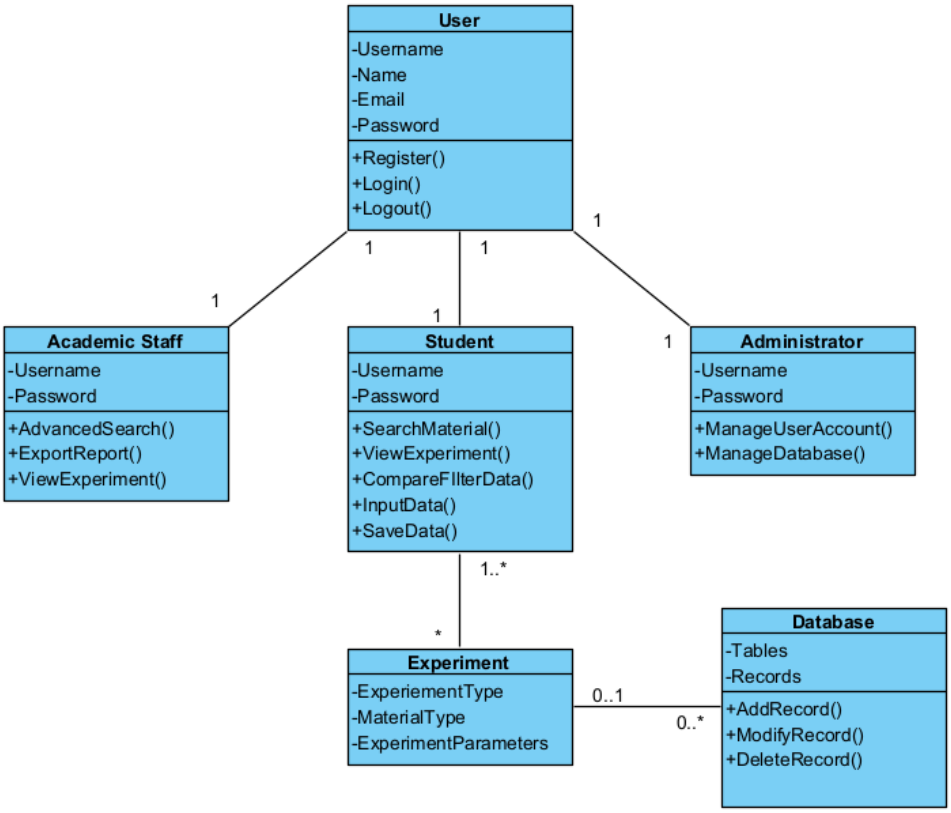

Figure 4.10: Web-Based System for Nano Material Repository Class Diagram

4.5 Sequence Diagrams

4.5.1 Use Case Diagram - Student

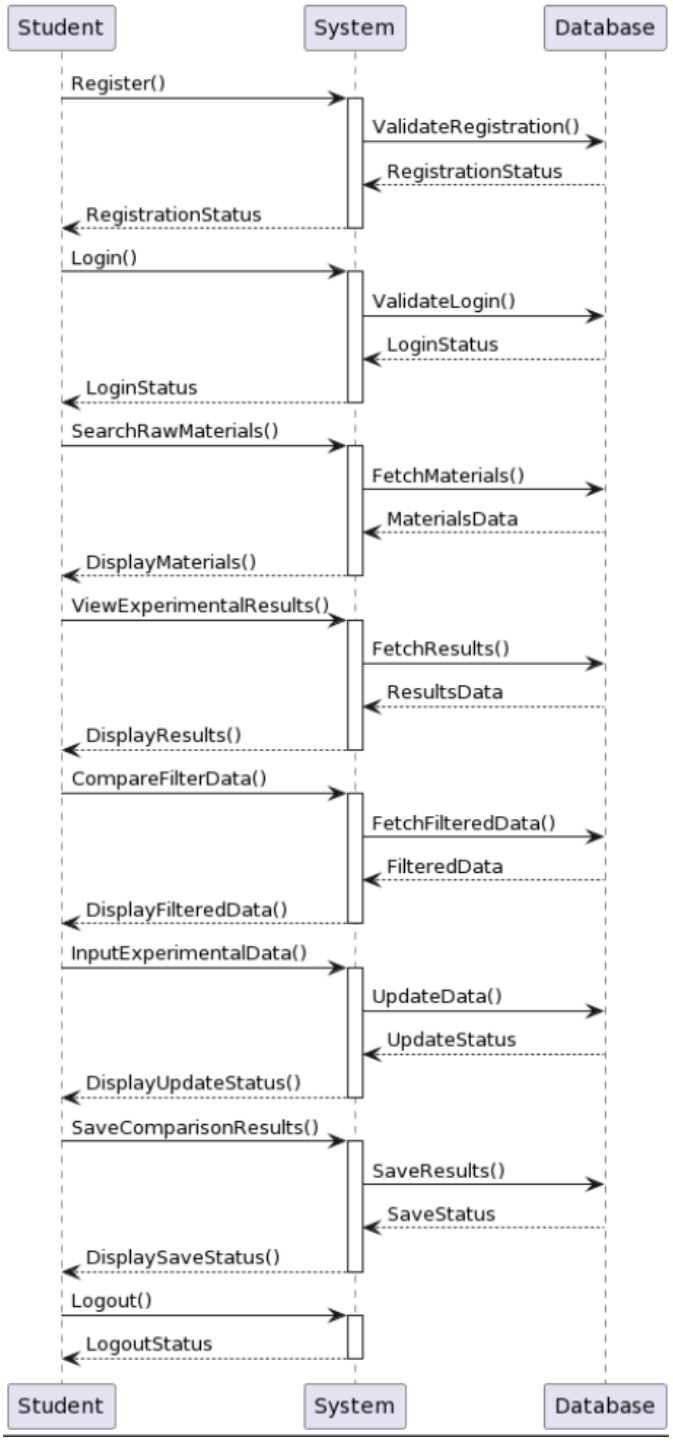

Figure 4.11: Web-Based System for Nano Material Repository Sequence Diagram

4.5.2 Sequence Diagram - Academic Staff

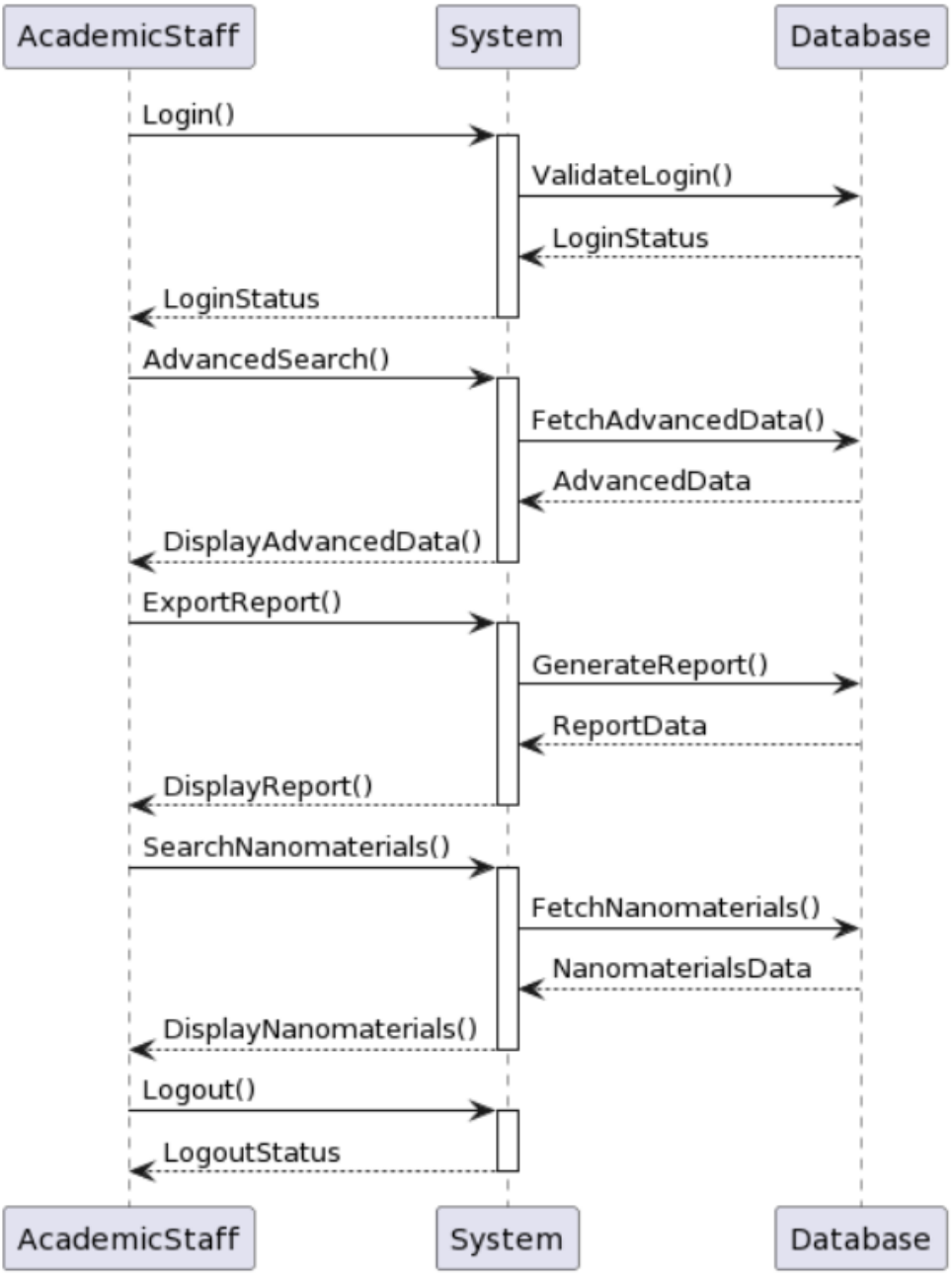

Figure 4.12: Web-Based System for Nano Material Repository Sequence Diagram

4.5.3 Sequence Diagram - Administrator

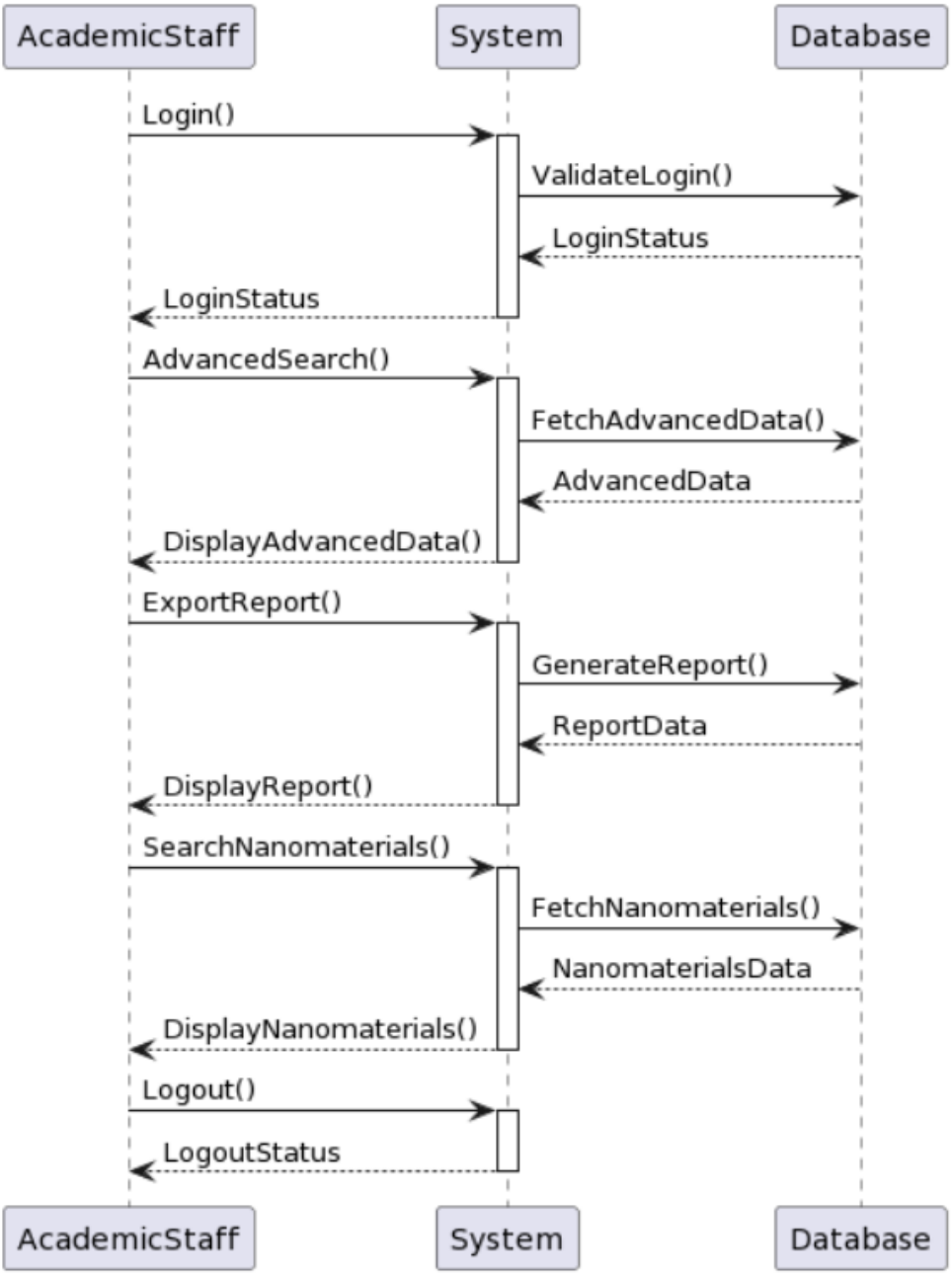

Figure 4.13: Web-Based System for Nano Material Repository Sequence Diagram

4.6 CRUD Matrix

Table 4.10: CRUD Matrix of Web-Based System for Nano Material Repository

Entities	Student	Academic Staff	Administrator
User Account	CU	CU	CRUD
Nanomaterials	R	R	CRUD
Experimental Results	R	R	R
Advanced Search Results	R	CRU	R
Reports	R	CRU	R
Experimental Data	CRU	R	R

CHAPTER 5

SUMMARY

The system is a comprehensive web-based platform designed specifically for the management and display of data related to nano materials. It serves a diverse user base, including students, academic staff, and administrators, each with distinct roles and permissions. Students have the ability to input experimental data derived from various experiments, filter and compare results to gain insights, and register an account for personalized access. They can search for nano materials, view experimental results, conduct advanced searches for more specific data, and export reports for offline analysis or sharing. Academic staff, in addition to having similar access as students, have the added capability of exporting comprehensive reports. This feature allows them to compile and present data in a structured format, facilitating knowledge transfer and collaborative research. Administrators play a crucial role in managing user accounts, ensuring the right access for the right user. They also manage the database, maintaining the integrity and reliability of the data stored in the system. The system is built with a strong emphasis on user-friendliness, making it accessible to users with varying levels of technical expertise. Security is paramount, with measures in place to protect sensitive data. Efficiency is key, with the system providing accurate and up-to-date information, ensuring users have the most relevant data at their fingertips.

REFERENCES

Davis, A., Dieste, O., Hickey, A., Juristo, N., and Moreno, A. M. (2006). Effectiveness of requirements elicitation techniques: Empirical results derived from a systematic review. In *14th IEEE International Requirements Engineering Conference (RE'06)*, pages 179–188. IEEE.

Glinz, M. (2007). On non-functional requirements. In *15th IEEE international requirements engineering conference (RE 2007)*, pages 21–26. IEEE.

Kitchenham, B. and Brereton, P. (2013). A systematic review of systematic review process research in software engineering. *Information and software technology*, 55(12):2049–2075.

Kurtanović, Z. and Maalej, W. (2017). Automatically classifying functional and non-functional requirements using supervised machine learning. In *2017 IEEE 25th International Requirements Engineering Conference (RE)*, pages 490–495. Ieee.

Tiwari, S., Rathore, S. S., and Gupta, A. (2012). Selecting requirement elicitation techniques for software projects. In *2012 CSI Sixth International Conference on Software Engineering (CONSEG)*, pages 1–10. IEEE.