SOFTWARE REQUIREMENTS SPECIFICATIONS

FOR

STUDENT DATA VISUALIZATION AND REPORT

VERSION 1.1

PREPARED BY

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1. Introduction

The **Student Details Visualisation and Report Project** is designed to serve as a centralized repository for tracking student participation in various academic and extracurricular activities. The system will facilitate efficient data storage, retrieval, and reporting, ensuring that institutions can streamline administrative processes and maintain comprehensive student records. This system is particularly useful for accreditation purposes, allowing institutions to present well-structured reports of student achievements and engagements.

By integrating user-friendly interfaces and advanced data management capabilities, the system will enable students, faculty, and administrators to access relevant information quickly. Key functionalities include event participation tracking, placement record management, faculty research integration, and automated reporting. Additionally, security measures such as role-based access and authentication will be implemented to protect sensitive data.

The system aims to improve data consistency and accessibility while reducing manual workload, making it an indispensable tool for educational institutions.

1.1 Purpose

This document defines the software requirements for a **Student Details Visualisation and Report**. The system aims to provide a **centralized database** for storing and managing student participation in curricular and co-curricular activities. It is designed to assist institutions in efficiently tracking student achievements for **accreditation and administrative purposes**. The document serves as a foundation for the development process, ensuring that all stakeholders have a shared understanding of the project scope and objectives.

1.2 Document Purpose and Scope

The **Student Details Visualisation and Report** will provide functionalities for:

- **Storing and retrieving** student records, including event participation, internships, placements, and memberships.
- **Importing data** from existing databases to ensure a smooth transition.
- **Tracking student involvement** in technical, cultural, and sports-related activities.
- **Generating reports** to assist in accreditation and institutional record-keeping.
- **Providing a user-friendly interface** for students, faculty, and administrators.

This document outlines the functional and non-functional requirements necessary for the development of the system, ensuring consistency in data storage, retrieval, and management.

1.3 Intended Audience

The intended users of this document include:

- **Developers and Engineers**: For implementing the required functionalities.
- **Institutional Administrators**: For understanding how the system will manage student records.
- **UI/UX Designers**: To create an intuitive interface based on the defined requirements.
- **Students and Faculty**: As primary users of the system for inputting and managing data.

1.4 Document Convention

This document follows the IEEE formatting requirements.

1.5 References and Acknowledgement

- https://medium.com/@growsolutions/functional-and-non-functional-requirements-the-ultimate-checklist-with-examples-cde16aba33d7
- **IEEE** – Referenced **IEEE Std 830-1998**, *IEEE Recommended Practice for Software Requirements Specifications*, IEEE Computer Society, 1998.

2. Functional Requirements

2.1 User Authentication & Access Control

1. Secure Login for Administrators, Faculty, and Students

- Users (administrators, faculty, and students) access the login page.
- They enter their **username/email and password** in the provided fields.
- The system validates input format and checks against stored credentials.
- If valid, authentication is granted, and the user is redirected to their respective dashboard.
- If invalid, the system displays an error message and logs failed attempts.

2. Password Recovery via Email Verification

- If a user forgets their password, they click the **"Forgot Password"** link on the login page.
- They enter their registered **email address** in the password recovery form.
- The system verifies if the email exists in the database.
- If valid, the system generates a **unique password reset token** and stores it temporarily.
- A **password reset link** containing the token is sent to the user's email.
- The user clicks the reset link, which redirects them to a secure password reset page.
- The user enters a **new password**, which is validated (e.g., minimum length, complexity rules).
- The new password is **hashed and stored**, and the old reset token is invalidated.
- The user can now log in using the new password.

4. Role-Based Access Control (RBAC)

- The system assigns roles (Admin, Faculty, Student) to users upon registration.
- Role-based access control (RBAC) ensures users can only access **features and data** based on their role.
    - **Administrators** can manage users, settings, and system-wide data.
    - **Faculty** can access and manage student-related academic data.
    - **Students** can access their personal records, submit requests, and view reports.
- Unauthorized access attempts are logged, and users see an appropriate access-denied message.

5. Session Management & Security Measures

- After successful login, the system generates a **secure session token**.
- The system enforces **session expiration** after inactivity or logout.
- Users can log out securely, clearing the session data.

2.2 Search & Filtering Module

1. Advanced Search Options

The system shall allow users to perform an advanced search based on multiple criteria,enabling efficient retrieval of relevant student records.

Search Parameters:

- Batch: Users can search for students belonging to a specific graduation batch (e.g., 2020, 2021, 2022).
- Department: Allows filtering based on academic departments (e.g., CSE, ECE, ME, EE).
- Event Type: Enables searching for participation records in different event categories:
  - Technical Events (e.g., Hackathons, Coding Competitions, Tech Talks)
  - Cultural Events (e.g., Dance, Music, Drama, Fest Celebrations)
  - Sports Events (e.g., Football, Cricket, Athletics, Chess Tournaments)
- Internship/Placement Status:
  - Filter based on students who have secured internships (company name, duration).
  - Filter based on students who have received placements (company, package, offer type).

2. Data Filtering Options

The system shall provide dynamic filters to refine the search results in real time.

Filter Categories:

- **Multiple Selections**: Users can select one or more filter criteria simultaneously.
- **Date Range Selection**: Allows filtering based on event participation within a specific time frame.
- **Company-Specific Search**: Enables filtering students based on a particular company's placement offers.
- **Performance-Based Filtering**: Users can refine results based on participation frequency or performance in events

.

3. Interactive UI & Usability Enhancements

- **Live Search Results**: Display filtered results instantly without requiring a page reload.
- **Export Filtered Data**: Users can export refined search results as PDF or CSV reports.

4. Error Handling & User Experience

- **Invalid Selections**: Notify users if they select conflicting or incorrect filter combinations.
- **No Data Available**: Display a meaningful message when no matching records are found.

2.3 Dashboard & Reports

1. Displaying Dashboard with Key Admin Details

- When an **admin logs in**, they are directed to the dashboard.
- The dashboard retrieves and displays **key metrics** such as:
    - **Total student count** (fetched from the student database).
    - **Placement status** (number of students placed, placement percentage).
    - **Generated reports** (list of available accreditation or student reports).
    - **Event summaries** (recent faculty publications, student activities, etc.).
- The system refreshes **real-time data** or updates it periodically.
- The dashboard may include **interactive charts and graphs** for better visualization.

2. Automatic Report Generation for Accreditation (PDF Format)

- Admin selects **report type** (e.g., student participation, placement statistics, accreditation reports).
- The system fetches **relevant data** from the database.
- The system processes and formats the data into a structured report.
- A **PDF generation module** converts the data into a professional report format.
- The report is available for **download or email** to stakeholders.
- The system may also allow **scheduled report generation** (e.g., monthly, yearly reports).

2.4 Data Visualization & Analytics Module

The system shall provide an interactive dashboard with real-time analytics, visualizing key student engagement and performance metrics through various graphical representations.

1. Key Dashboard Features

The dashboard shall include multiple visual elements, providing insights into different aspects of student activities, placements, and memberships.

1.1 Student Participation Trends in Events

- Event Categories: The system shall display participation trends across different event types:
    - **Technical Events**: Hackathons, coding competitions, robotics, paper

presentations.
    - **Cultural Events**: Music, dance, drama, film screenings, celebrations.
    - **Sports Events**: Athletics, football, cricket, chess, e-sports.

- **Visualization Formats:**
    - Bar Charts: Event participation count per department.
    - Line Graphs: Trend analysis of participation over semesters.
    - Pie Charts: Percentage breakdown of students participating in various events.
    - Heatmaps: Display peak participation periods based on months or event types.

- **Additional Insights**:
    - Most popular events based on attendance.
    - Frequency of participation by individual students.

1.2 Placement Statistics by Batch, Department, and Company

- **Batch-wise Placement Rates:**
    - Percentage of placed students vs. total students per batch.
    - Year-over-year placement trends.
- **Department-wise Placement Insights:**
    - Comparison of placement rates across different departments.
    - Salary distribution analysis (minimum, maximum, average package).
- **Company-wise Placement Distribution:**
    - Top recruiters and the number of students placed in each company.
    - Placement offer types (internship offers, full-time offers, PPOs).
- **Visualization Formats:**
    - Stacked Bar Graphs: Placement percentage per batch and department.
    - Scatter Plots: Salary vs. number of placed students per company.
    - Tree Maps: Company-wise placement distribution.
    - Trend Lines: Placement rate progression over the years.
- **Additional Insights:**
    - Average salary trends per batch.
    - Percentage of students securing multiple offers.

1.3 Membership Distributions in Professional Societies

- **Society Categories:**
    - IEEE, ACM, IET, ASME, SAE, and other student organizations.
- **Membership Trends:**
    - Membership growth over time (monthly, yearly).
    - Department-wise and batch-wise membership statistics.
- **Visualization Formats:**
    - Donut Charts: Membership distribution across different societies.
    - Bar Charts: Membership count per department.
    - Time-Series Graphs: Growth in memberships over semesters.
- **Additional Insights:**
    - Active vs. inactive members (participation in society events).

○ Top societies with the highest student engagement.

2. Custom Data Reports & User Interactivity

The system shall allow users to generate customized reports based on selected filters and Preferences.

2.1 Report Customization Options:

- **Filter Selection:**
  - ○ Event type, department, batch, placement status, membership type.
  - ○ Time range (semester-wise, yearly, custom date range).
- **Exportable Formats:**
  - ○ PDF Reports: Well-structured reports with graphical insights.
  - ○ CSV/Excel Files: For detailed raw data analysis.
  - ○ Interactive Dashboards: Users can toggle filters and adjust chart views dynamically.
- **Comparison Reports:**
  - ○ Compare placement statistics between different batches.
  - ○ Compare student engagement in events over multiple semesters.
  - ○ Analyze growth in professional society memberships.

3. Real-Time Analytics & Dynamic Updates

● Live Data Updates: The dashboard shall reflect the latest data without requiring manual refresh.
● Drill-Down Analysis: Users can click on data points to explore finer details (e.g., list of students placed in a specific company).
● Customizable Chart Views: Users can switch between different chart types (bar, line, pie, scatter) for better insights.

4. Error Handling & User Experience Enhancements

● No Data Available: Show a meaningful placeholder message when data is missing.
● Smooth Animations & Transitions: Ensure interactive and visually appealing charts.
● User-Friendly Navigation: Simple UI allowing quick access to relevant analytics.

2.5 Notifications & Alerts

1. Notifications for New Features & System Updates

- When a new feature is introduced, the **admin panel updates the feature list**.

- The system **generates a notification** for all users.
- Users receive a **dashboard pop-up, email, or SMS** (depending on system settings).
- Users can click the notification to **view details** about the update.

2. Notifications for New Graphs & Reports

- When a **new report or graphical analysis** is generated, the system logs the update.
- The system automatically **sends an alert** to relevant users (e.g., admin, faculty).
- The notification includes a **link to the new report/graph** for quick access.

3. Notifications for New Data Availability

- When **faculty publications, placement statistics, or event details** are updated:
    - The system identifies **affected users** (e.g., faculty, students, admin).
    - The system triggers a **notification event** and sends alerts via:
        - **Dashboard notifications** (for real-time updates).
        - **Email notifications** (for official communication).
- Users can click the notification to **view the updated data**.

2.6 System Integration & Data Export

The system shall provide a **comprehensive data export functionality**, allowing users to download and share analytical reports, student records, and insights in a structured format

1. Supported Export Formats

The system shall enable users to export data in the following formats:\

1.1 PDF Export (Primary Format)

● Generates well-structured, print-friendly reports containing graphical and tabular data.
● Includes charts, graphs, and key statistics relevant to the user's selected criteria.
● Ensures consistent formatting, making it suitable for official documentation, presentations, and administrative use.

1.2 Additional Formats (Optional for Future Expansion)

● CSV/Excel Export: Allows raw data export for further analysis.
● JSON/XML Export: Supports integration with external systems for automated data exchange.

2.7 Security & Data Integrity

1. Admin Verification Before Allowing Students to Add Details

- A student attempts to **add or update their details** in the system.
- The system **flags the request** for admin verification before accepting the changes.
- The request is sent to an **admin panel**, where an admin:
    - **Reviews the request** (checks for accuracy and validity).
    - **Approves or rejects** the request.
    - If approved, the system updates the database with the new details.
    - If rejected, the student receives a **notification with the reason for rejection**.
- The system logs all **modifications and approvals** for audit purposes.

Optional: The system may allow **role-based delegation** where specific faculty members can verify details instead of the admin.

2.8 Future Scope Enhancements

AI-Powered Trend Prediction for Student Participation:

- The system shall use **machine learning (ML) models** to analyze student participation patterns in **technical, cultural, and placement activities**.
- It shall predict **which types of events will gain popularity** based on historical participation data.

Predictive Analytics for Placements & Internships:

- The system shall use **AI-based career trajectory analysis** to predict:
    - **Success rates** of students in placements based on skill sets and past performance.
    - **Companies likely to hire** students from specific departments.
    - **Internship conversion rates** into full-time offers.

AI-Driven Academic & Research Trends Prediction:

- The system shall analyze **faculty publications, student research interests, and global academic trends** to suggest emerging research areas.
- It shall provide **personalized research topic recommendations** based on a student's academic performance and interests

3. NON-FUNCTIONAL REQUIREMENTS

3.1 Performance Requirements

- The system shall efficiently handle a **large number of concurrent users** without performance degradation.
- The system shall ensure that **data retrieval operations**, such as searching student details and generating reports, are **fast and seamless** for users.
- The system shall allow **fast and flexible data export** in PDF format ensuring easy accessibility and sharing of reports.
- The system shall enable **customized exports**, allowing users to filter and extract specific student records, event details, or reports based on their needs.

3.2 Security Requirements

- **Data Encryption:** All sensitive information will be **encrypted both at rest and in transit** to prevent unauthorized access or breaches.
- **Authentication & Authorization:** The system will enforce **secure login mechanisms**

3.3 Software Quality Attributes

- **Reliability:** The system shall function **consistently** without failures, ensuring **high availability** and accurate data retrieval at all times.
- **Security:** The system shall implement **strong encryption, authentication mechanisms, and access controls** to protect user data from breaches.
- **Usability:** The system shall provide an **intuitive, user-friendly interface** that is easy to navigate for administrators.
- **Performance Efficiency:** The system shall execute all operations, such as **data retrieval,exports, and analytics, in a fast and responsive manner**.
- **Maintainability:** The system shall be **modular and well-documented**, allowing for easy updates, bug fixes, and enhancements in the future.

4. Use Case Scenarios for Student Visualization & Reporting System

Use Case 1: User Registration

Actors:Faculty, Administrator,Student

Description:

Allows new users to register and create an account before accessing the system.

Preconditions:

- The user must not already have an existing account.
- The user must have a valid **email ID** and required credentials.

Main Flow:

1. The user navigates to the **Registration Page**.
2. The user enters the required details:
    - Name
    - Email ID
    - Password
3. The system **validates the input fields**.
4. The system **activates the account** and redirects the user to the login page.

Postconditions:

- The user's account is successfully created and **ready for login**.

Exceptions:

- **Invalid or missing details** → Prompt user to correct errors.
- **Email already in use** → Display an error message.

Use Case 2: User Login & Authentication

Actors:Faculty, Administrator,Student

Description: Allows users to securely log into the system based on their roles.

Preconditions:

- The user must be **registered** in the system.
- The user must have valid **credentials (username/email and password)**.

Main Flow:

1. The user navigates to the **Login Page**.
2. The user enters their **email/username and password**.
3. The system **validates the credentials**:
    - If valid, the system grants access to the **respective dashboard** based on the user role.
    - If invalid, the system displays an **error message** and prompts the user to retry.

Postconditions:

- The user is **authenticated** and directed to the appropriate **dashboard**.

Exceptions:

- **Incorrect credentials** → Display an error message with a retry option.
- **Multiple failed attempts** → Temporarily lock the account and send a security alert.
- **Forgot password** → User can request a **password reset via email verification**.

Use Case 3: Viewing Student Analytics Dashboard

Actors : Faculty, Administrator

Description: Allows users to access an interactive dashboard displaying student reports.

Preconditions:

- **The user must be logged in.**

Main Flow:

1. **The user navigates to the dashboard.**
2. **The system fetches and displays key statistics (total students, placement rate, participation trends, publications).**
3. **The user can view charts and graphs representing student data visually.**
4. **The user can switch between different views (bar charts, pie charts, line graphs).**

Postconditions:

- **The dashboard displays real-time student statistics dynamically.**

Exceptions:

- **No data available → Display a placeholder message.**

Use Case 4: Applying Data Filters

Actors: Faculty, Administrator,Student

Description: Allows users to filter student data based on department, batch, event type, and date range.

Preconditions:

- The user must have access to the filters section.

Main Flow:

1. The user selects filters such as department, batch, date range, and event type.
2. The user clicks on "Apply Filters".
3. The system updates graphs and charts based on the selected criteria.
4. The system displays filtered statistics dynamically.

Postconditions:

- The user sees customized student analytics based on selected filters.

Exceptions:

- Invalid filter selection → Display a notification.

Use Case 5: Exporting Reports

Actors: Administrator, Faculty

Description: Allows users to export filtered student analytics into different formats.

Preconditions:

- The user must have access to the export function.

Main Flow:

1. The user selects a report format (PDF).
2. The user clicks on "Export".
3. The system generates and downloads the report.

Postconditions:

- **The user obtains a well-formatted report containing the requested data.**

Exceptions:

- **No data available → Display an error message.**

Use Case 6: Switching Between Chart Types

Actors: Faculty, Administrator,Student

Description: Allows users to change the visualization type for better insights.

Preconditions:

- **The user must be on a page with interactive charts.**

Main Flow:

1. **The user selects a chart type (bar, pie, line, or doughnut).**
2. **The system updates the chart dynamically.**
3. **The user views the new chart representation.**

Postconditions:

- **The chart updates to reflect the new visualization format.**

Exceptions:

- **Chart rendering error → Display a default view.**

Use Case 7: Tracking Placement Statistics

Actors: Faculty, Administrator,Student

Description: Allows users to track student placements by company and batch.

Preconditions:

- **Placement data must be available.**

Main Flow:

1. **The user selects a batch year or specific company.**
2. **The system updates the placement statistics graph.**
3. **The user views trends and patterns in recruitment.**

Postconditions:

- **The system provides placement insights for analysis.**

Exceptions:

- **No placement data available → Display a message.**

Use Case 8: Analyzing Event Participation Trends

Actors: Faculty, Administrator,Student

Description: Allows users to analyze student participation in co-curricular and technical events.

Preconditions:

- **Event participation data must be available.**

Main Flow:

1. **The user selects an event category (technical, cultural, sports).**
2. **The system updates the participation trend graph.**
3. **The user views statistics such as most popular events and attendance rates.**

Postconditions:

- **The user gains insights into student engagement in activities.**

Exceptions:

- **No participation data → Show an alternative message.**

Use Case 9: Monitoring Faculty Publications & Research Trends

Actors: Faculty, Administrator

Description: Allows faculty to track research publications and trends.

Preconditions:

- **Publication data must be available.**

Main Flow:

1. **The user selects a publication type (journal, conference).**
2. **The system updates the publication trend graph.**
3. **The user sees insights into faculty research output over time.**

Postconditions:

- **The system provides real-time research analytics.**

Exceptions:

- **No publication data → Show a placeholder message.**

Use Case 10: Professional Society Membership Analysis

Actors:Administrator, Faculty ,Student

Description: Allows users to analyze student memberships in professional societies (IEEE, ACM, etc.).

Preconditions:

- **Membership data must be available.**

Main Flow:

1. **The user selects a society (IEEE, ACM, IET, etc.).**
2. **The system updates the membership trend chart.**
3. **The user gains insights into student involvement in professional organizations.**

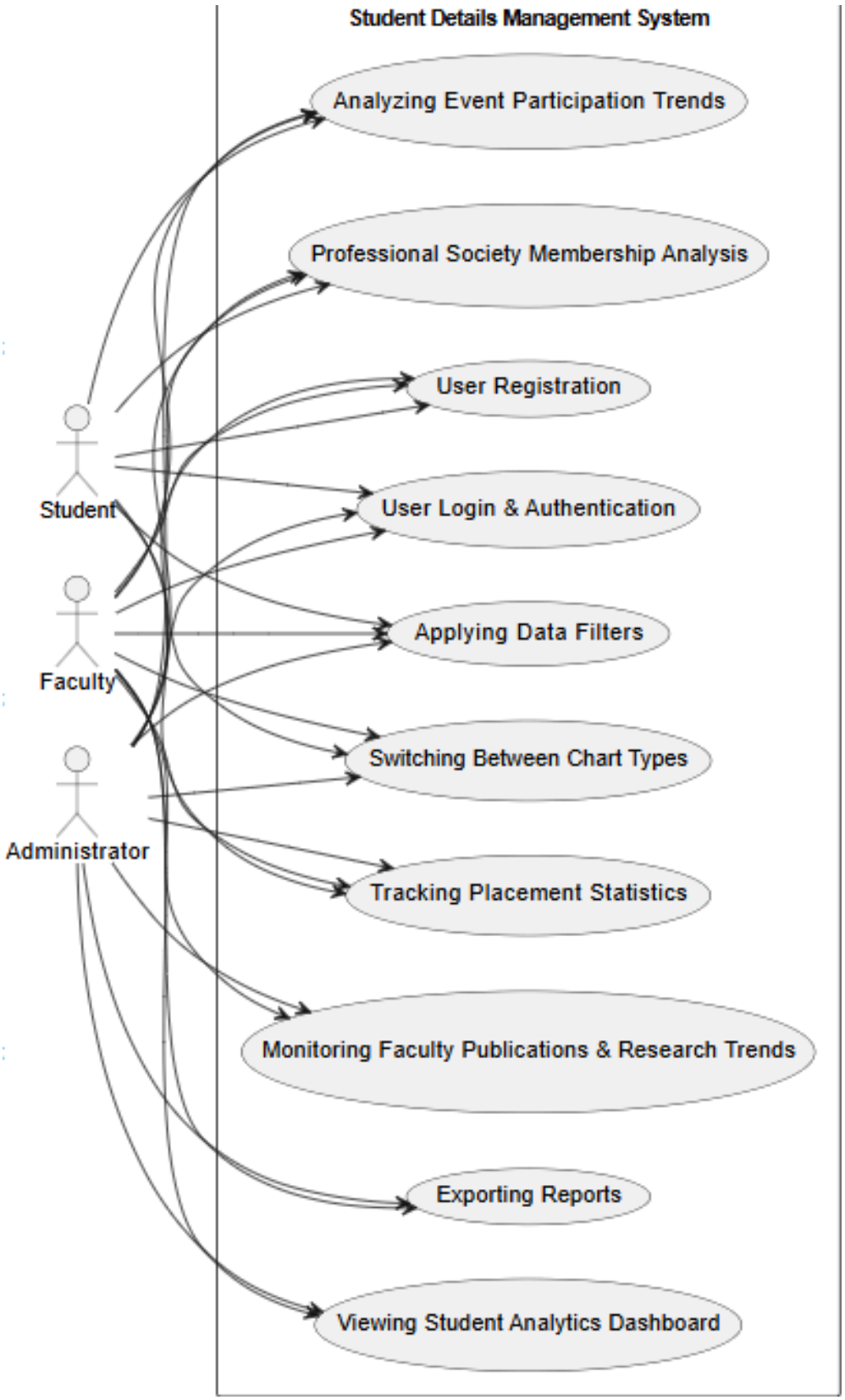
Postconditions:

- **The system provides membership distribution statistics.**

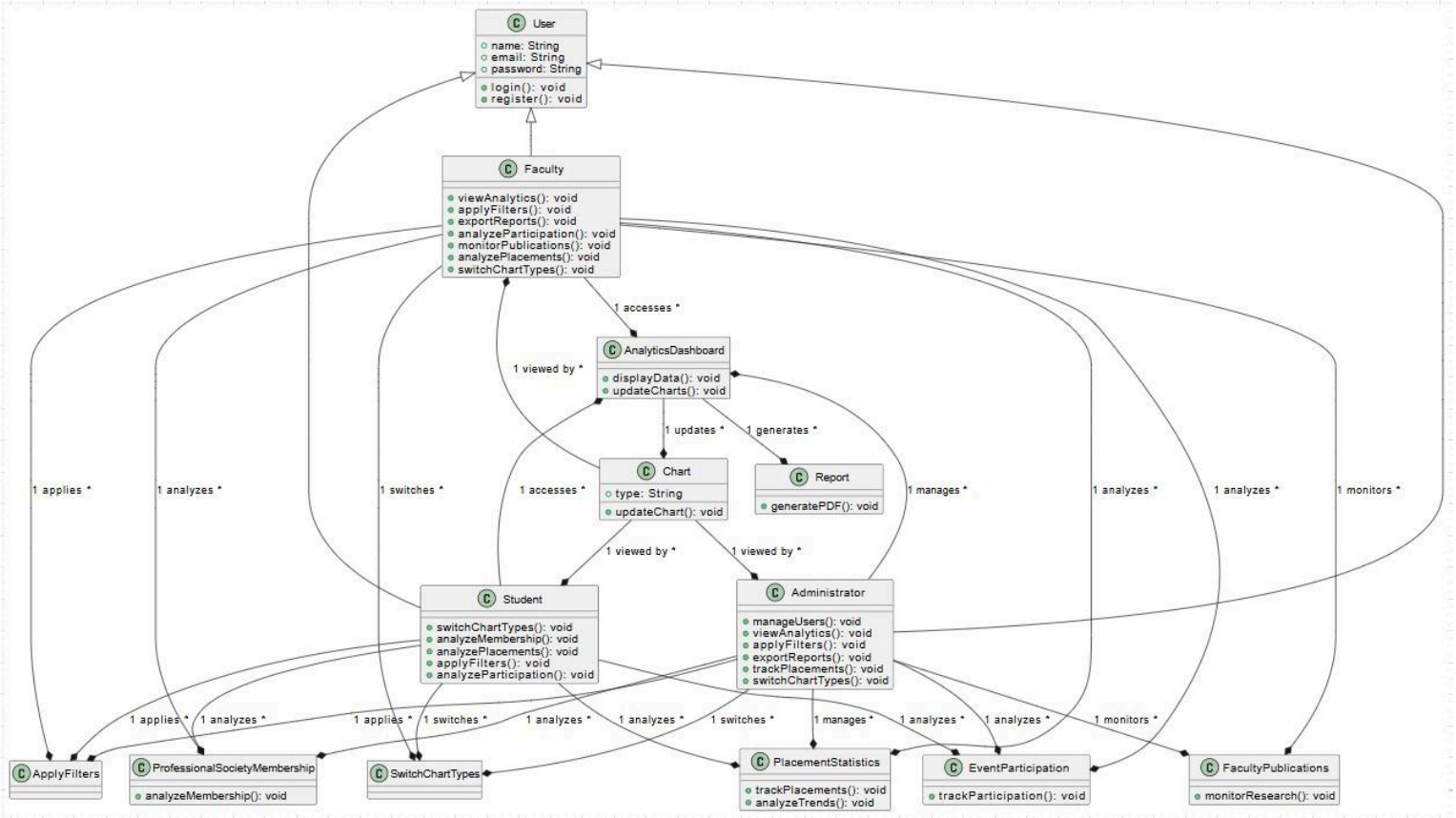
Exceptions:

- **No membership data available → Display a message.**

USE CASE DIAGRAM:



CLASS DIAGRAM



DATABASE DIAGRAM: