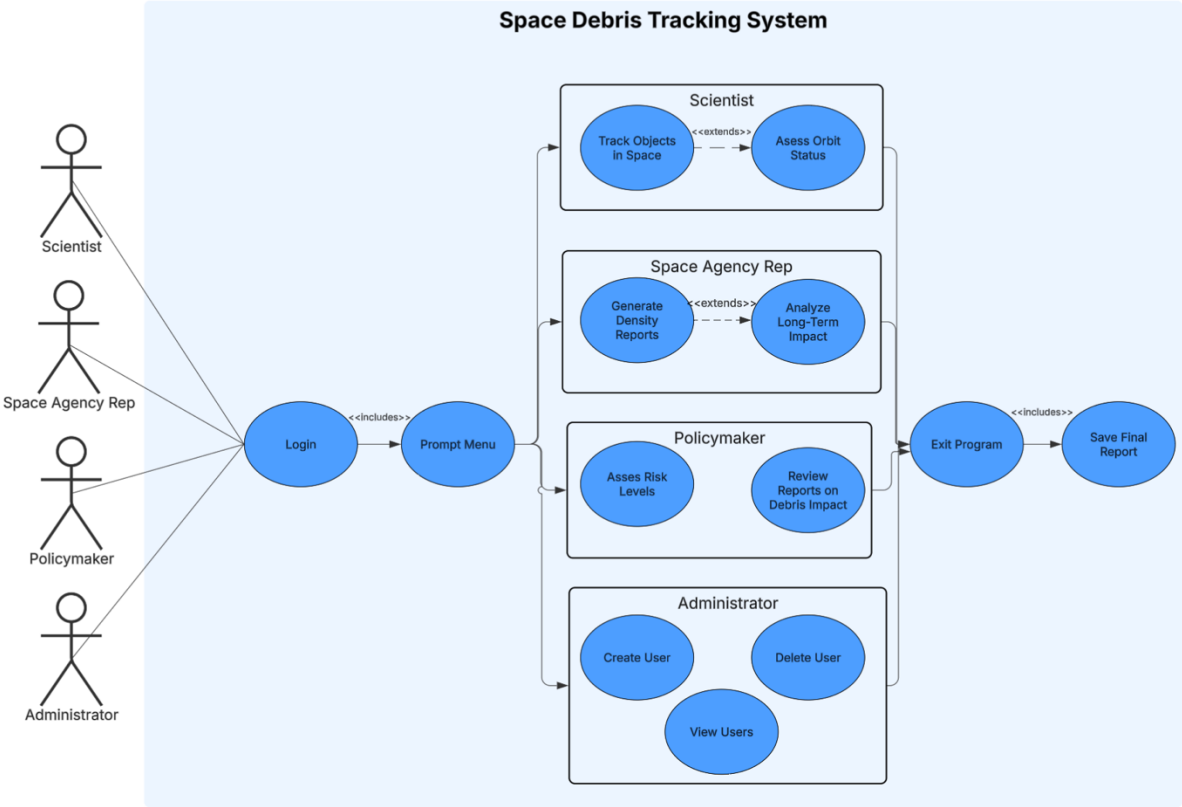


1. Use Case Diagram

2. Use Case Scenario 1

Scenario Name: Track Debris
• **Description:** The Scientist uses the system to view categorized debris objects in orbit, such as Rocket Bodies, Payloads, or Unknown objects.
• **Actors:** Scientist
• **Pre-condition:** The system is running and the Scientist has successfully logged in.
• **Trigger-condition:** The Scientist selects the "Track Objects in Space" option from the menu.
• **Flow of events:**

1. The system displays the main Scientist menu.

2. The Scientist selects "Track Objects in Space."
3. The system presents debris categories: Rocket Body, Payload, Debris, and Unknown.
4. The Scientist selects a category (e.g., Debris).
5. The system displays a list of matching space objects along with all relevant data fields.
6. The system logs the interaction with a timestamp.

• **Alt:**

- If the selected category has no matching records, the system informs the Scientist and still logs the action.

Use Case Scenario 2

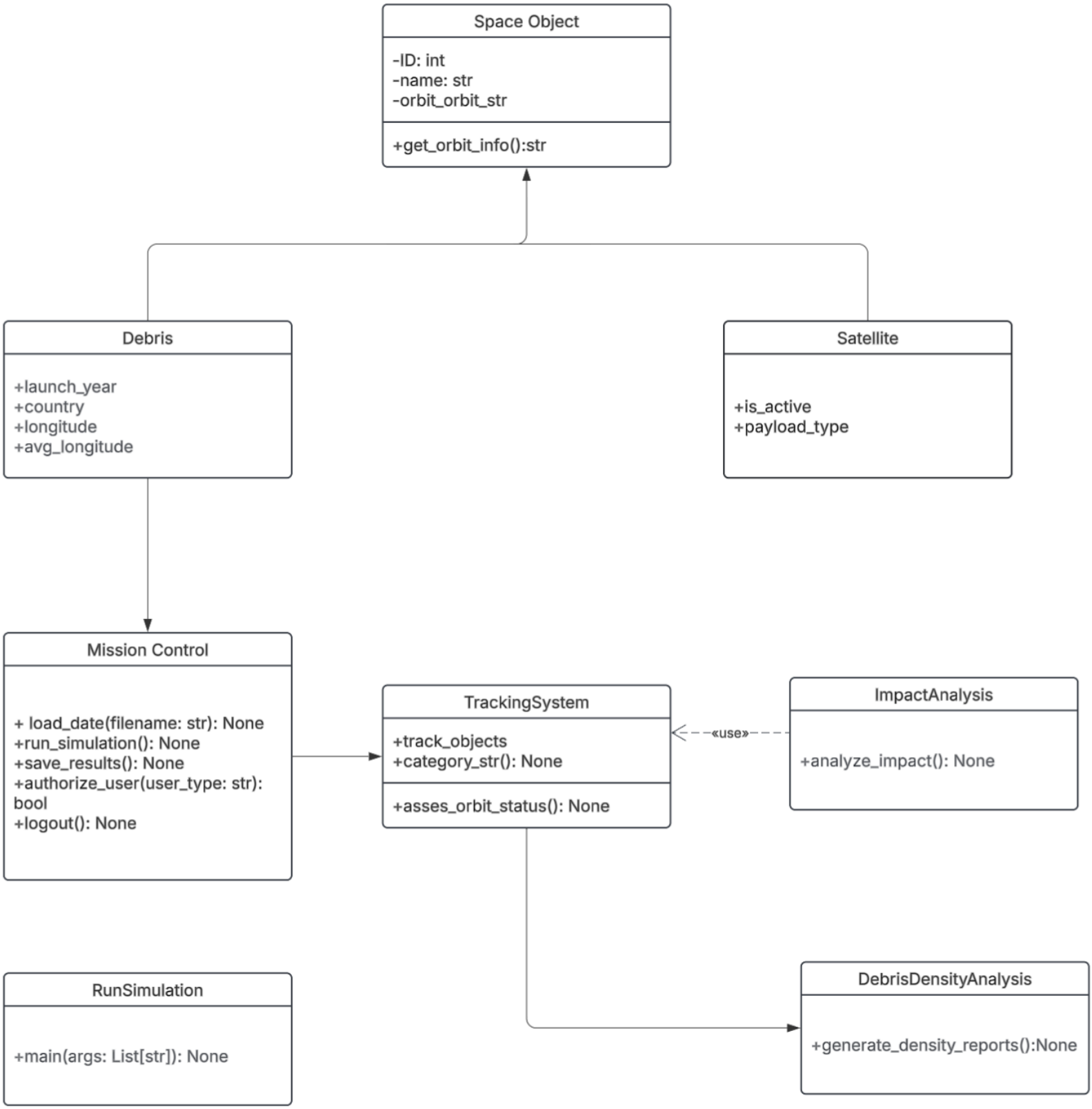
Scenario Name: Assess Orbit Status
• **Description:** The Scientist analyzes debris to determine whether it is still in orbit and evaluates the associated risk level.
• **Actors:** Scientist
• **Pre-condition:** The system is active and the Scientist is authenticated.
• **Trigger-condition:** The Scientist chooses the "Assess Orbit Status" option and then selects "Assess if debris is still in orbit."
• **Flow of events:**

1. The system shows the main Scientist menu.
2. The Scientist selects "Assess Orbit Status."
3. The system provides the option to assess if debris is still in orbit.
4. The Scientist selects the option.
5. The system applies conditions (orbit type, longitude, days_old, conjunction_count) to determine orbit status.
6. The system calculates orbital drift and classifies risk level (High, Moderate, Low).
7. A new CSV file is generated with added columns: still_in_orbit and risk_level.
8. A TXT summary file is generated with exited debris details and in-orbit/exited counts.
9. The system logs the activity with a timestamp.

• **Alt:**

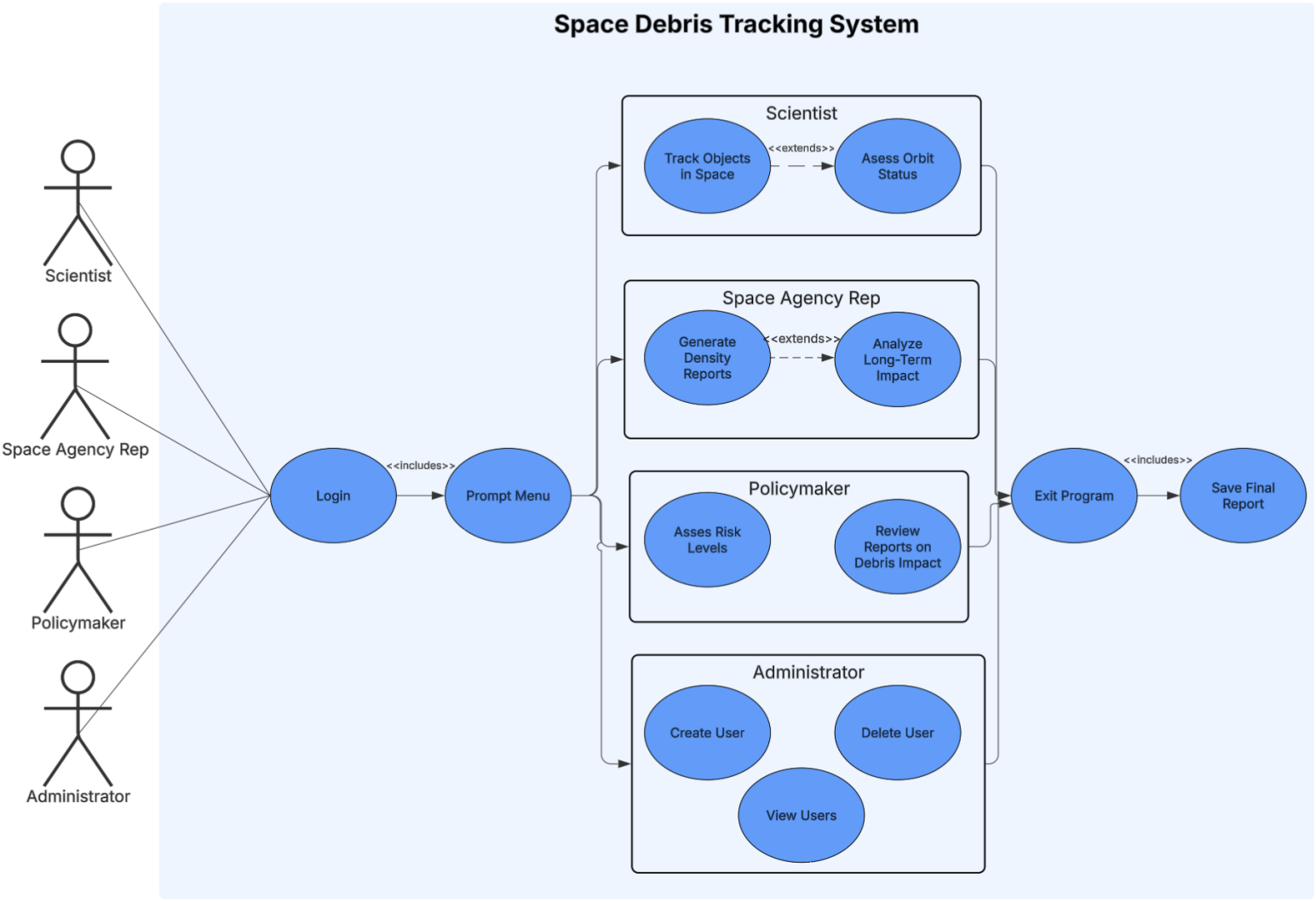
- If file writing fails due to permission or disk error, the system alerts the user and logs the failure.

3. UML Class Diagram



Part 2

1. Refactored UML Use Case Diagram



2. Use Case Scenario 3

- **Scenario Name:** Generate Density Reports
- **Description:** The Space Agency Representative requests a report of space objects within a specified longitude range.
- **Actors:** Space Agency Representative
- **Pre-condition:** The user is logged in as a Space Agency Representative.

- **Trigger-condition:** The user selects “Generate Density Reports” from the menu.
- **Flow of events:**
    - The system displays a prompt: “Please enter the minimum longitude.”
    - The user enters a numeric value (e.g., -100).
    - The system displays a prompt: “Please enter the maximum longitude.”
    - The user enters a second numeric value (e.g., 100).
    - The system filters all space objects within the range.
    - The system displays a report including:
        - Count of matching objects
        - Record ID, Satellite Name, Country, Orbit Type, Launch Year, and Object Type for each
    - The action is logged with a timestamp.
- **Alt:**
    - If inputs are invalid, the system displays an error and prompts again.

Use Case Scenario 4

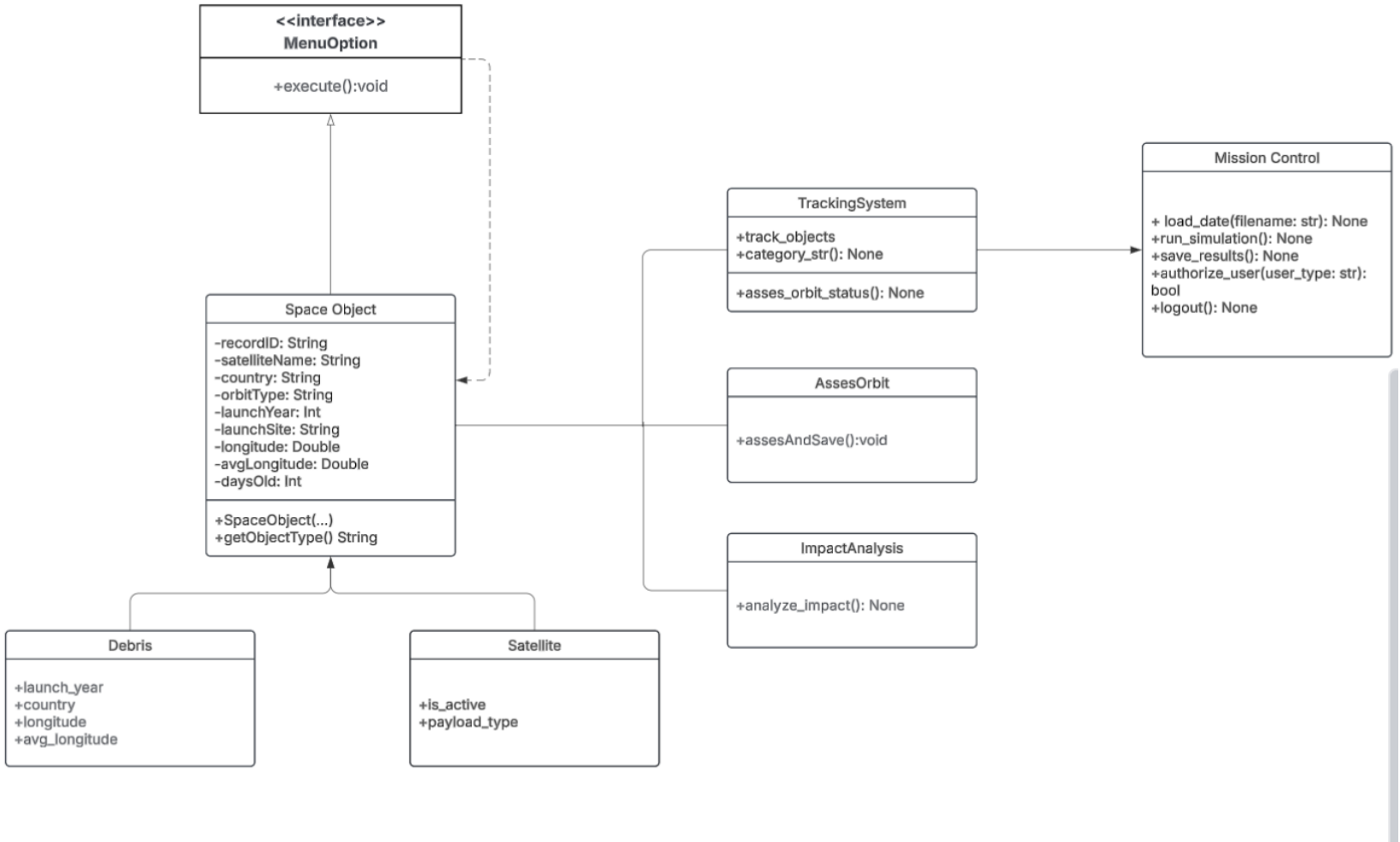
- **Scenario Name:** Manage User
- **Description:** The Administrator updates an existing user’s username or password.
- **Actors:** Administrator
- **Pre-condition:** The administrator is logged in successfully.
- **Trigger-condition:** The administrator selects “Manage User” from the menu.
- **Flow of events:**

- The system lists all existing users from the user database.
- The system prompts: “Enter the username of the user you want to manage.”
- The user enters a valid username.
- The system displays options:
  a. Change username
  b. Change password
- The admin selects an option.
- The system prompts for new input and applies the change.
- The update is saved to the user CSV file.
- A log entry is created.

- **Alt:**

- If the username is not found, the system returns an error and aborts the update.

3. Updated UML Class Diagram



4. UML State Diagrams