



**UTM**  
UNIVERSITI TEKNOLOGI MALAYSIA

SECJ2203: Software Engineering

## **System Documentation (SD)**

MyGreen UTM

Version 2.0

Date:

8/12/2024

Faculty of MJIT

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Prepared by: <Chinese Student>

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## Revision Page

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### Overview

This system documentation contains a system introduction, use case diagram, class diagram and description of use cases.

### Target Audience

Development Team

User : student and UTM Staff

### Project Team Members

Member Name	Role	Task	Status
Liu Ruoyang	Programmer	Develop and debug the system. Optimize system functionality.	Project Purpose Document completed. Currently working on system optimization and debugging.
Zhao Wei	System Analyst & Designer	Conduct system analysis. Design the system architecture and user interface.	System analysis and architecture design completed. Currently preparing detailed design documentation and supporting the development team.
Liu Wanpeng	Project Manager	Oversee project planning and execution. Allocate resources and monitor progress.	Project planning and team task allocation completed. Currently monitoring project progress and ensuring tasks align with timelines.
Bu Guoshun	Stakeholder Liaison & Validator	Communicate with stakeholders. Validate the system design.	Initial stakeholder communication completed. Currently validating design compliance with stakeholder requirements and providing feedback.

### Version Control History

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Version	Primary Author(s)	Description of Version	Date Completed
1.0	Liu Ruoyang	Project purpose	18/11/2024
2.0	Liu Ruoyang	System Documentation	8/12/2024

**Note:**

This System Documentation (SD) template is adapted from IEEE Recommended Practice for Software Requirements Specification (SRS) (IEEE Std. 830-1998), Software Design Descriptions (SDD) (IEEE Std. 1016-1998 1), and Software Test Documentation (IEEE Std. 829-2008) that are simplified and customized to meet the need of SECJ2203 course at Faculty of Computing, UTM. Examples of models are from Arlow and Neustadt (2002) and other sources stated accordingly.

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# 1. Introduction

The "My Green UTM" initiative is to raise environmental awareness and sustainable practices on university campuses. MYGreen UTM aims to use modern technology to promote more active participation of the campus community in environmental protection activities, increase students' environmental awareness and the sustainability of the campus.

## 1.1 Purpose

The purpose of the SD

1. Provide a detailed account of the system's objectives, and features.
2. Guide the development team and stakeholders in creating a user-centric, efficient, and innovative solution tailored to the needs of the campus community.
3. Ensure all stakeholders have a shared understanding of the system's design, functionalities, and implementation roadmap.

Audience for the SD.

1. UTM Staff: Staff will use the app to organize events, monitor participation, and check how green goals are being achieved.
2. Students: Students will use the app to learn about sustainability, join green events, and track their eco-friendly actions.
3. Development Team: To understand technical requirements, design specifications, and testing procedures for successful system implementation.

## 1.2 Scope

It is a mobile and stand-alone application designed to enhance environmental awareness and promote sustainability practices within the university campus.

UTM system will

1. Encourage participation: Through points and rankings, students and staff are promoted to participate in environmental activities.
2. Educate users: Provide interactive learning modules on sustainability topics.
3. Strengthening community participation: providing tools for organizing, participating and sharing activities related to sustainable development.

UTM system will NOT DO

Benefits:

1. To promote awareness and adoption of environmental protection measures

among students and staff.

2. Enhanced participation in the sustainable development of the campus environment.

Objectives:

1. Create a more sustainable campus environment by fostering a green culture.
2. Provide a platform that integrates education and activity participation.

Goals:

1. Increase the participation of staff and students in environmental activities.
2. To provide the university community with the knowledge and tools to contribute to protecting the environment.
3. Support the long-term sustainability goals of the campus through user-centric and data-driven solutions.

### 1.3 Definitions, Acronyms and Abbreviation

Term	Definition
Emotion Chatbot Analyzer	The software product being developed to analyze the user input in a chatbot conversation and determine the user's emotion based on the language and sentiment used in the conversation.
SRS	System Requirements Specification - a document that outlines the requirements and objectives of the software product being developed.
SDD	System Design Document - a document that describes the system architecture, components, and interfaces in detail.
STD	System Testing Document - a document that outlines the testing process and procedures for the software product being developed.
API	Application Programming Interface - a set of protocols and tools for building software applications.
UI	User Interface - the graphical layout of an application or website, including buttons, menus, and other visual elements.
UX	User Experience - the overall experience a user has while interacting with a product, including ease of use, efficiency, and satisfaction.
NLP	Natural Language Processing - a branch of artificial intelligence that deals with the interaction between computers and human language.
ML	Machine Learning - a type of artificial intelligence that allows software applications to learn and improve from experience without being explicitly programmed.

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## 1.5 Overview

Describe what the rest of the SD contains

1. System Requirements Specification (SRS):  
Define the functional and non-functional requirements of the system.
2. System Design Documentation (SDD):  
Describes the system architecture in detail, including back-end and front-end design.
3. System Test Documentation (STD):  
Describes the test strategies, tools, and methods used to validate the system.

Organization of the System Documentation

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## 2. Specific Requirements

### 2.1 User characteristics

The MyGreen UTM app is designed for two main user groups: UTM students and UTM staff. This section explains who these users are and how they will use the app, helping the development team make the app user-friendly and suitable for everyone.

#### 2.1.1 UTM Students

##### *Technical Skills:*

UTM students are expected to know how to use mobile apps and basic online tools.

##### *Knowledge and Needs:*

Students may have little experience with sustainability programs, so the app should be simple and easy to use.

They want to learn more about environmental practices and take part in activities like recycling or energy-saving projects.

##### *How They Use the App:*

Students will use the app to learn about sustainability, join green events, and track their eco-friendly actions.

They might also enjoy interactive features, like earning points or rewards for participating.

##### *Accessibility:*

The app should be easy to use for all students, including those with disabilities, so features like bigger text or screen reader compatibility might be needed.

#### 2.1.2 UTM Staff

##### *Technical Skills:*

UTM staff, including lecturers and office workers, may have moderate experience with apps and online systems. If needed, they can be trained to use the app.

##### *Knowledge and Needs:*

Staff members are already involved in sustainability projects, so they will need tools to manage activities, track progress, and help students get involved.

##### *How They Use the App:*

Staff will use the app to organize events, monitor participation, and check how green goals are being achieved.

They might also use it to generate reports or share updates about ongoing projects.

##### *Accessibility:*



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Like students, staff members with disabilities should also find the app easy to use.

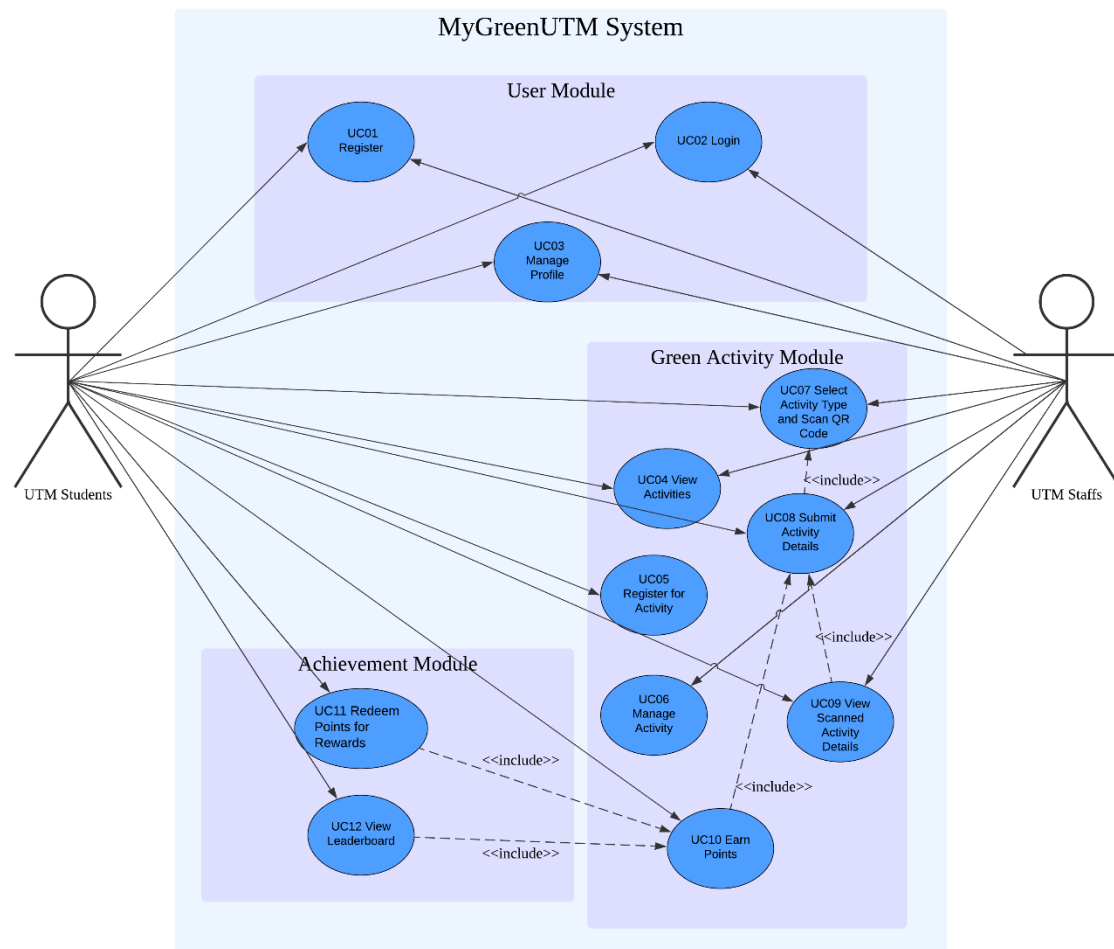
### **Privacy and Security**

To use the app, both students and staff will need to register their personal details, such as name and UTM email. The app will protect this information with strong security measures to ensure it stays private and safe.

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## 2.2 System Features

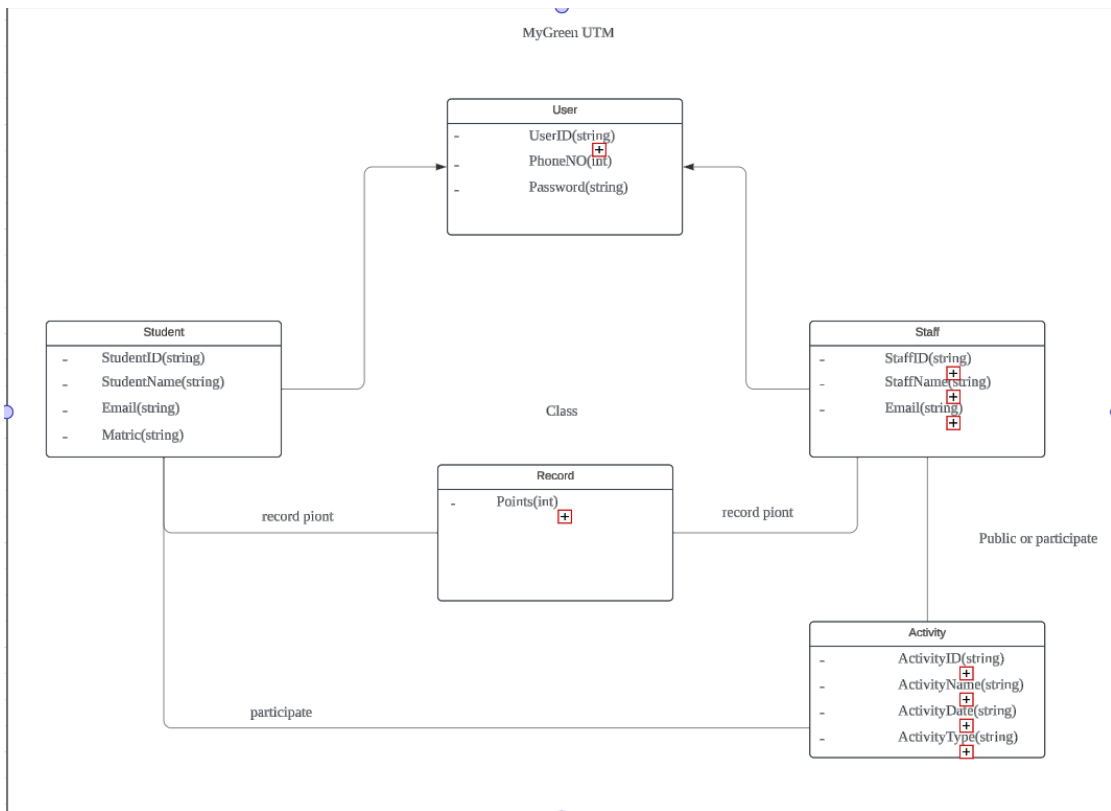
The MyGreen UTM is a software system designed to operate on mobile devices, including both Android and iOS operating systems. The system encourages sustainable practices among UTM students and staff by providing an interactive platform to participate in green activities, log their contributions, and earn points for rewards. The system simplifies event participation and tracking through QR code scanning and real-time data updates, supported by a cloud-based database to ensure a seamless user experience.



**Figure 1: Use Case Diagram for <MyGreen UTM of the System>**

**Table 1: Description of Module and Functions for <MyGreen UTM of the System>**

Module	Function	Description
User Module	UC01 Register	Users register an account using their UTM email address. They provide basic information such as name and email.
User Module	UC02 Login	Users log in using their registered email and password to access the app's features.
User Module	UC03 Manage Profile	Users can update their personal information, such as changing their email, password, or profile picture.
Green Activity Module	UC04 View Activities	Users can browse upcoming events and activities related to sustainability, such as recycling campaigns or workshops.
Green Activity Module	UC05 Register for Activity	Students can sign up for green events or programs directly through the app.
Green Activity Module	UC06 Manage Activity	Staff can create and manage green events, including updating event details and tracking participant lists.
Green Activity Module	UC07 Select Activity Type and Scan QR Code	Users can select an activity type (e.g., awareness, education, trash management), then open their camera to scan a QR code provided at the event.
Green Activity Module	UC08 Submit Activity Details	After scanning the QR code, users can input their user type (e.g., student, staff), choose the event type, and select the location. Once submitted, the app will confirm the submission with a success message.
Green Activity Module	UC09 View Scanned Activity Details	After submitting the details, users can view a summary screen showing the activity information, such as event name, type, location, date, and points earned. Users can also take a screenshot of the page for record-keeping.
Green Activity Module	UC10 Earn Points	Students earn points for every successful activity submission. Points are accumulated based on the type of activity and its contribution to sustainability goals (e.g., 300 points for attending a recycling event). Points contribute toward unlocking badges and rewards.
Achievement Module	UC11 Redeem Points for Rewards	Students can use their accumulated points to redeem various rewards offered within the app. Rewards can include items that align with sustainable practices, such as reusable products.
Achievement Module	UC12 View Leaderboard	Students can view a leaderboard ranking the most active participants in green activities, encouraging friendly competition.



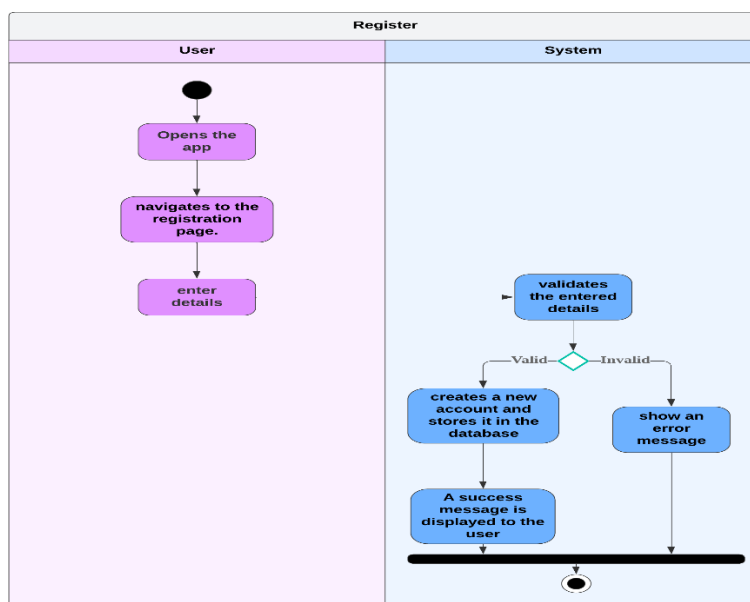
**Figure2: Domain Model for <MyGreen UTM of the System>**

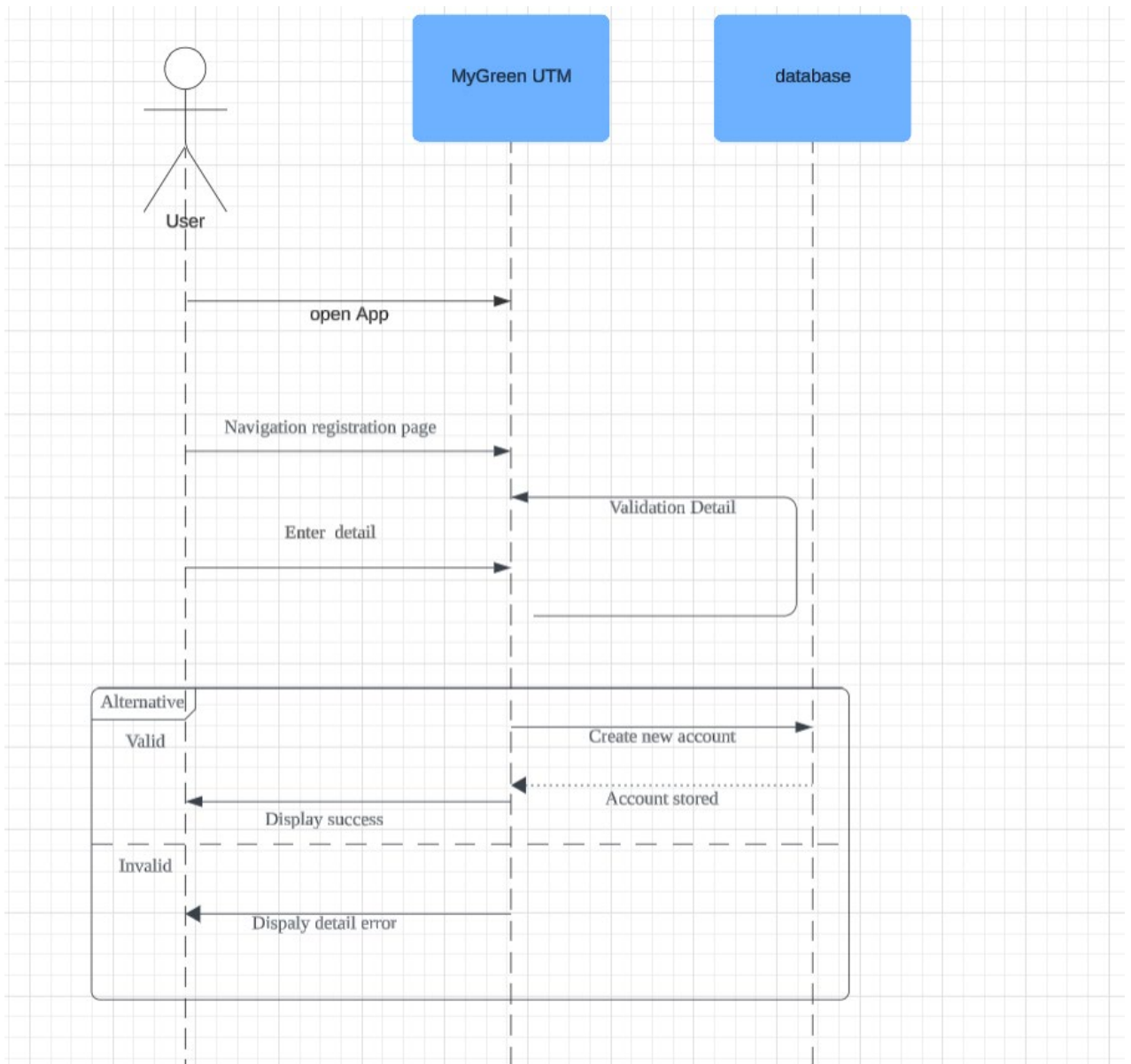
## 2.3 Use Case Detail

### 2.3.1 UC01: Use Case <Register>

#### 2.3.1 UC01: Use Case <Register>

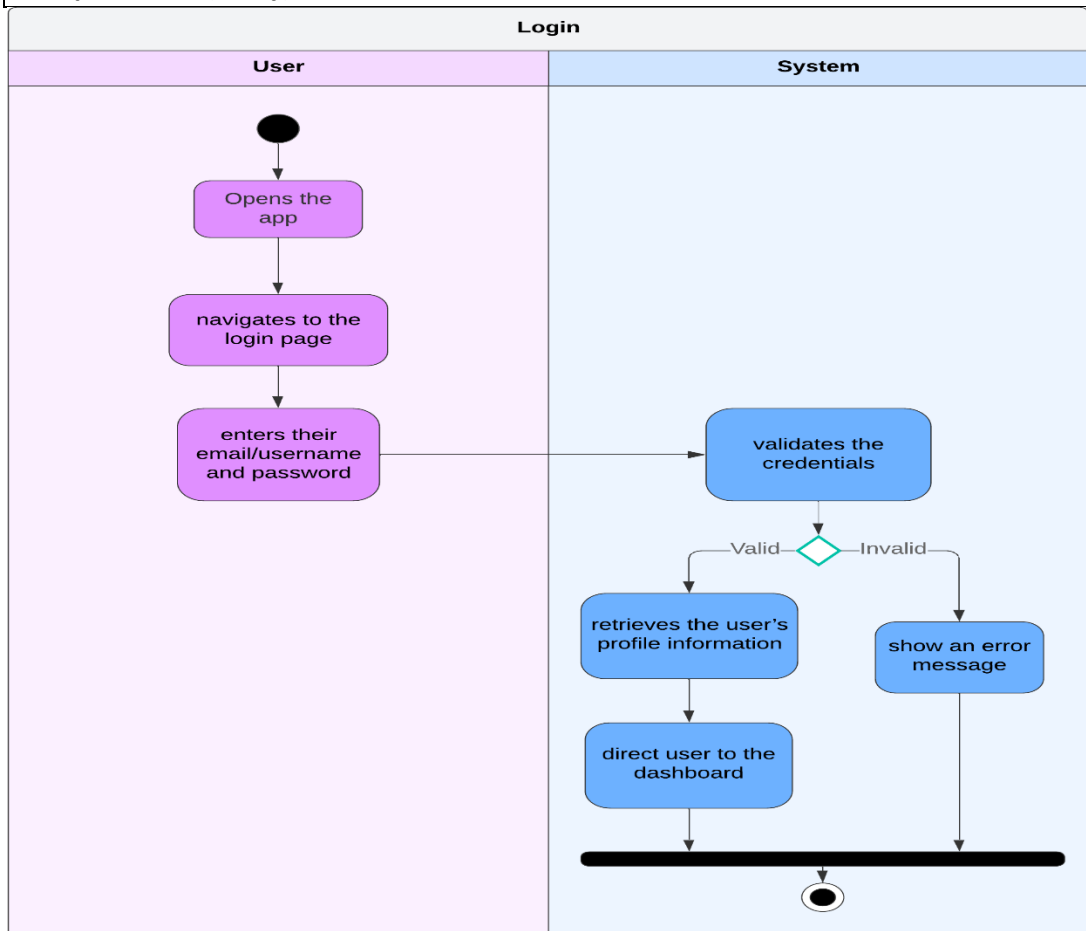
<b>Use case:</b> Register
<b>ID:</b> UC01
<b>Actors:</b> UTM Student, UTM Staff
<b>Extends:</b> <Register with UTM Student Account>
<b>Preconditions:</b>
<b>Flow of events:</b> <ol style="list-style-type: none"><li>1. The user opens the app.</li><li>2. The user navigates to the registration page.</li><li>3. The user enters their details (e.g., name, email, password).</li><li>4. The system validates the entered details:<ol style="list-style-type: none"><li>4.1 If valid, proceed to Step 6.</li><li>4.2 If invalid, show an error message. <b>(AF1)</b></li></ol></li><li>5. The system creates a new account and stores it in the database.</li><li>6. A success message is displayed to the user.</li></ol>
<b>Postconditions:</b> The user's account is successfully registered and saved in the system.
<b>Alternative flow 1:</b> If the entered details are invalid, the system displays an error message and prompts the user to correct them.

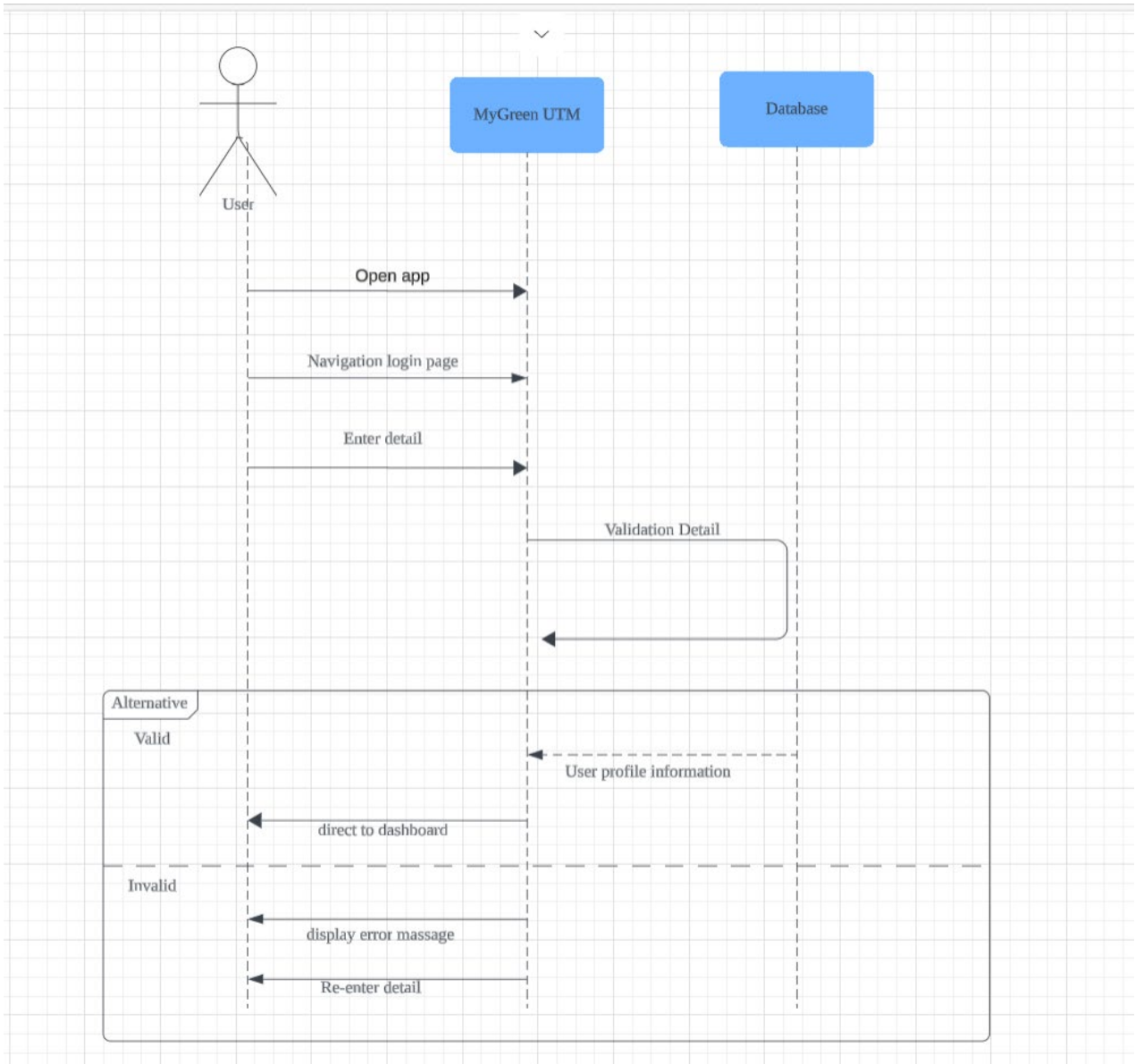




### 2.3.2 UC02: Use Case <Login>

<b>Use case:</b> Login
<b>ID:</b> UC02
<b>Actors:</b> UTM Student, UTM Staff
<b>Preconditions:</b> The user must have already registered an account in the system.
<b>Flow of events:</b> <ol style="list-style-type: none"><li>1. The user opens the app.</li><li>2. The user navigates to the login page.</li><li>3. The user enters their email/username and password.</li><li>4. The system validates the login credentials:<ol style="list-style-type: none"><li>4.1 If the credentials are valid, proceed to Step 5.</li><li>4.2 If the credentials are invalid, show an error message. (AF1)</li></ol></li><li>5. The system retrieves the user's profile information.</li><li>6. The user is directed to the dashboard.</li></ol>
<b>Postconditions:</b> The user is successfully logged into the system and can access the dashboard.
<b>Alternative flow 1:</b> If the login credentials are incorrect, the system displays an error message and prompts the user to re-enter them.
<b>Exception flow (if any):</b>

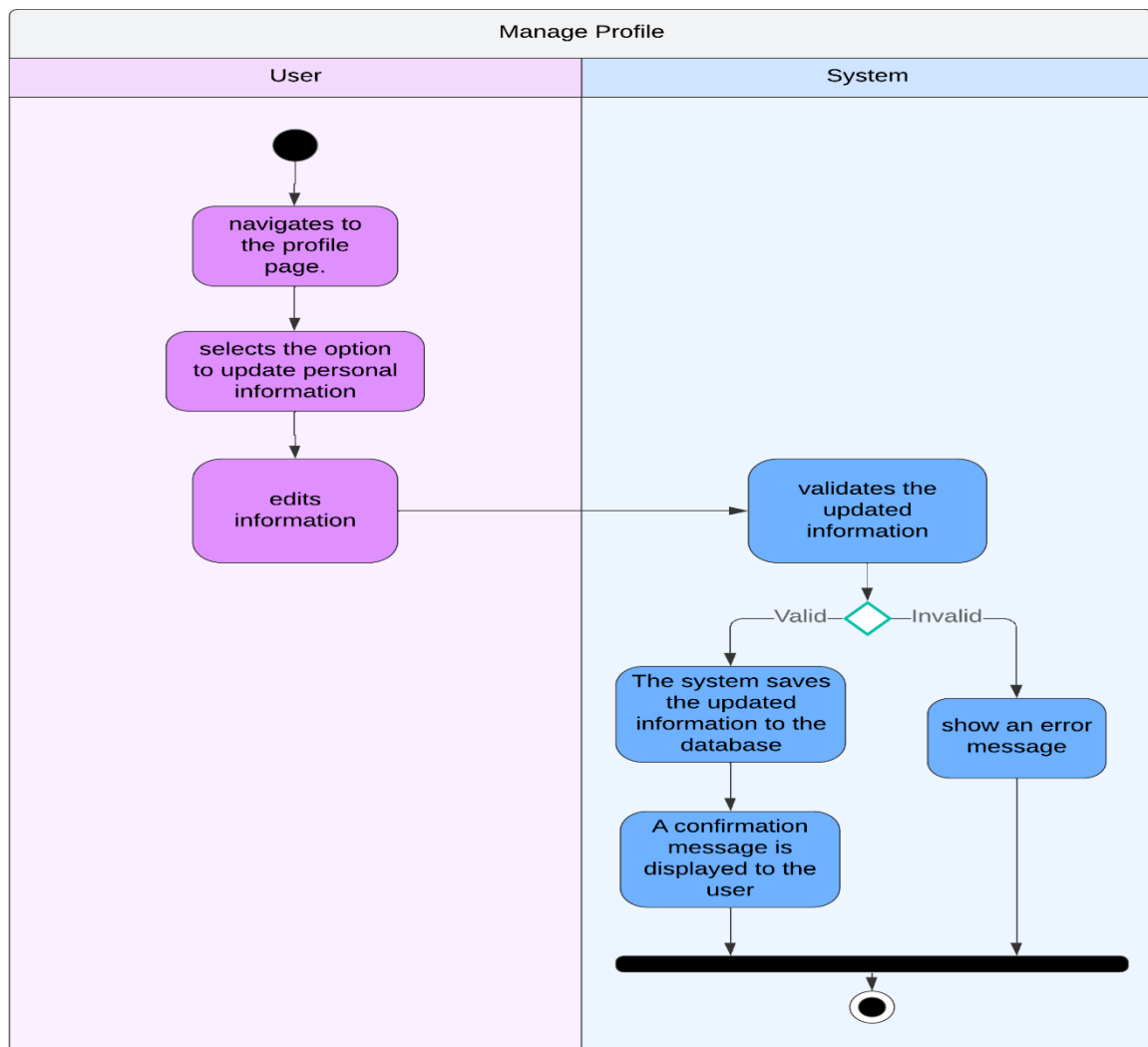


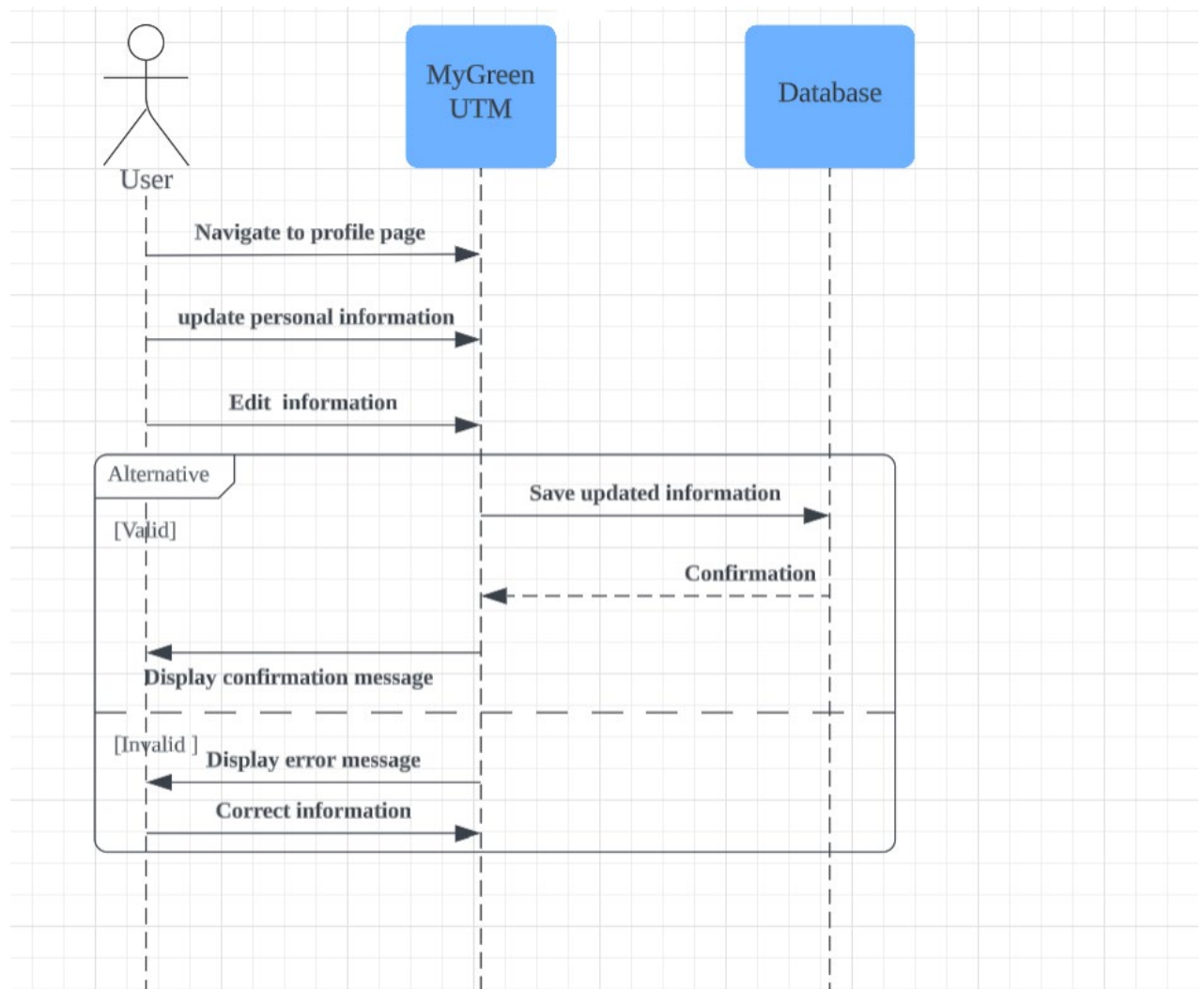




### 2.3.3 UC03: Use Case <Manage Profile>

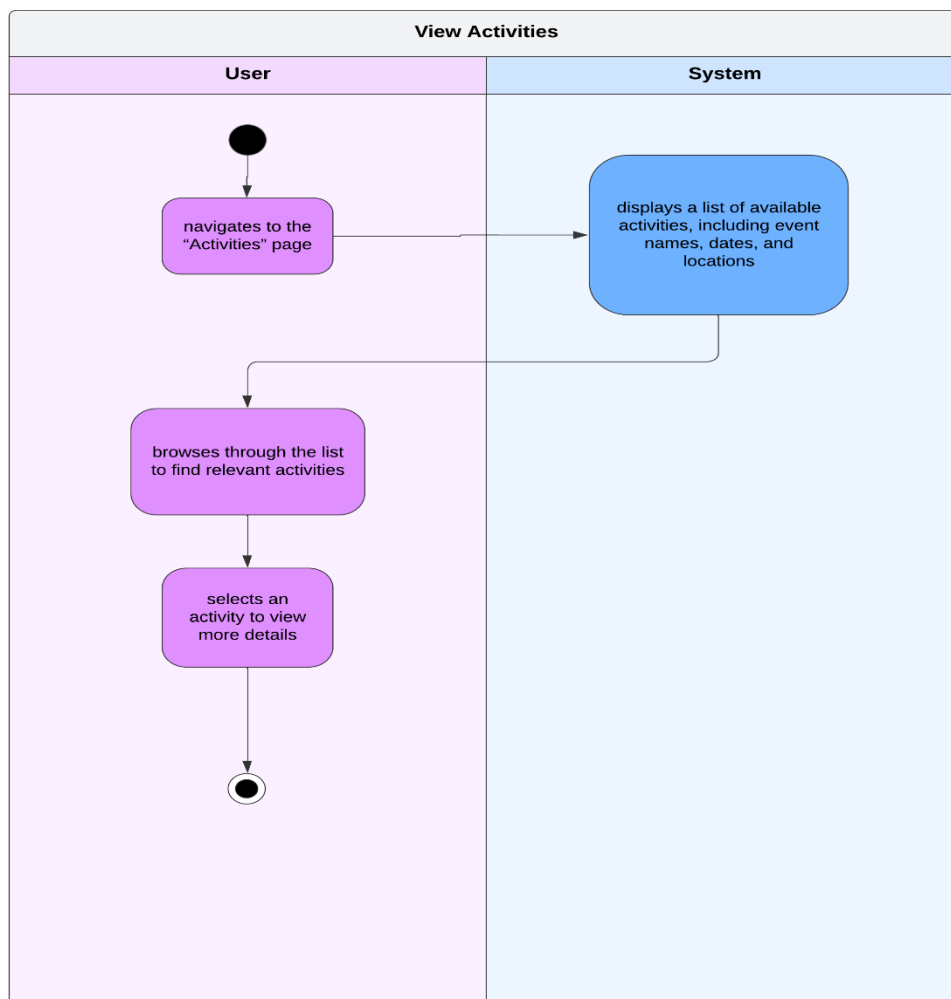
<b>Use Case:</b> Manage Profile
<b>ID:</b> UC03
<b>Actors:</b> UTM Students, UTM Staff
<b>Preconditions:</b> The user must be logged into the system.
<b>Flow of Events:</b> <ol style="list-style-type: none"><li>1. The user navigates to the profile page.</li><li>2. The user selects the option to update their personal information.</li><li>3. The user edits their information (e.g., name, email, password).</li><li>4. The system validates the updated information:<ol style="list-style-type: none"><li>4.1 If the information is valid, proceed to Step 5.</li><li>4.2 If the information is invalid, show an error message. (AF1)</li></ol></li><li>5. The system saves the updated information to the database.</li><li>6. A confirmation message is displayed to the user.</li></ol>
<b>Postconditions:</b> The user's profile is successfully updated and saved in the system.
<b>Alternative Flow 1:</b> If the updated information is invalid, the system displays an error message and prompts the user to correct it.
<b>Exception Flow:</b>

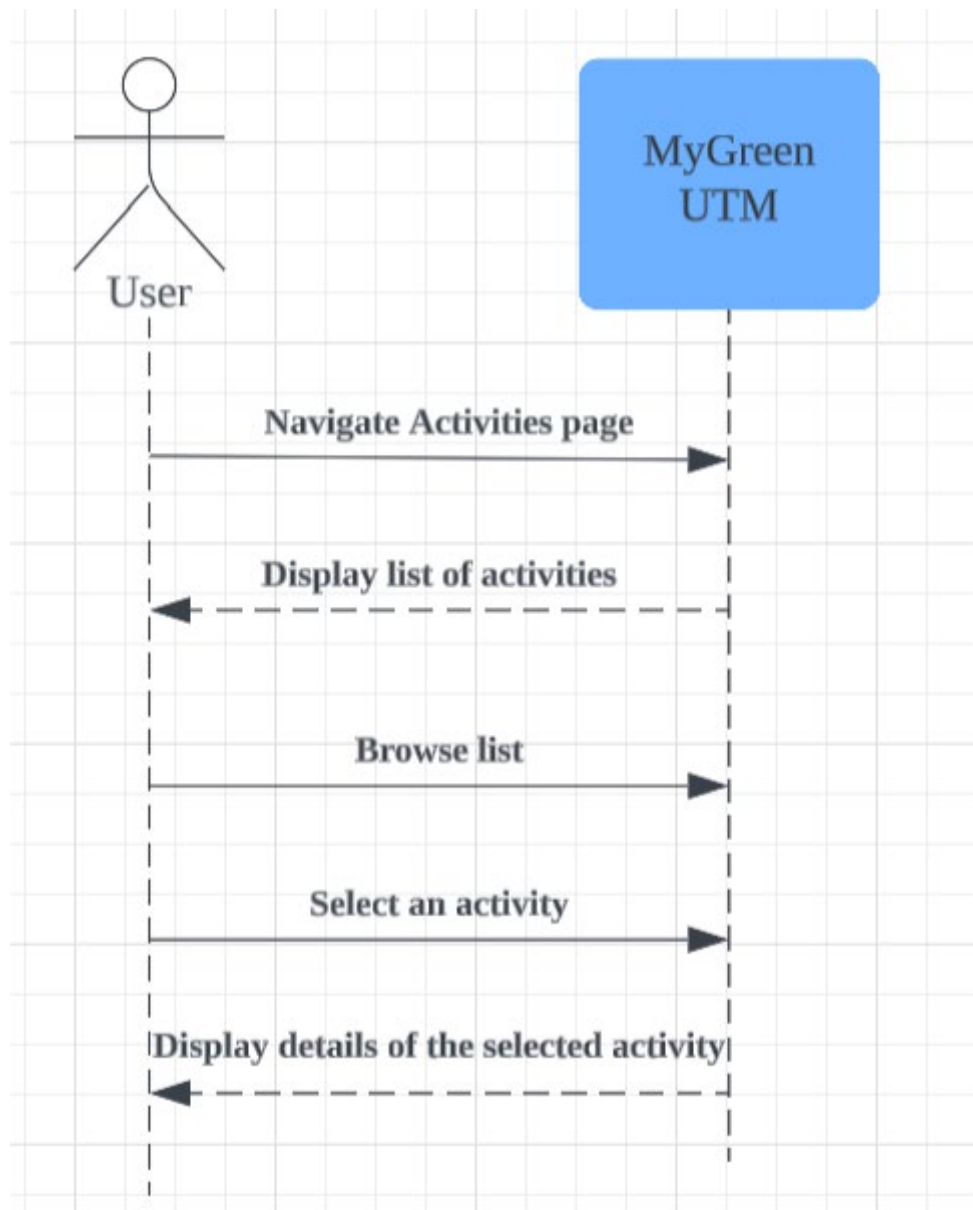




### 2.3.4 UC04: Use Case <View Activities>

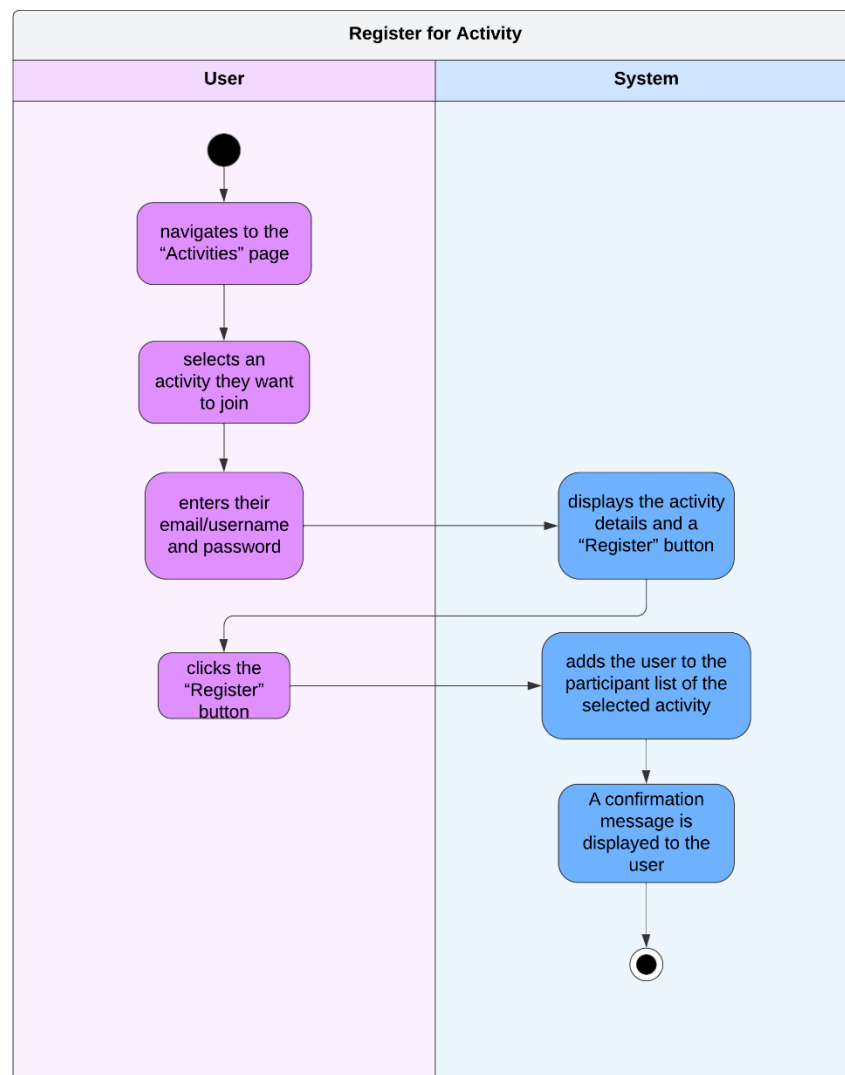
<b>Use Case:</b> View Activities
<b>ID:</b> UC04
<b>Actors:</b> UTM Students, UTM Staff
<b>Preconditions:</b> The user must be logged into the system.
<b>Flow of Events:</b> <ol style="list-style-type: none"><li>1. The user navigates to the “Activities” page.</li><li>2. The system displays a list of available activities, including event names, dates, and locations.</li><li>3. The user browses through the list to find relevant activities.</li><li>4. The user selects an activity to view more details.</li></ol>
<b>Postconditions:</b> The user can successfully view details of the selected activity.
<b>Alternative Flow:</b>
<b>Exception Flow:</b>

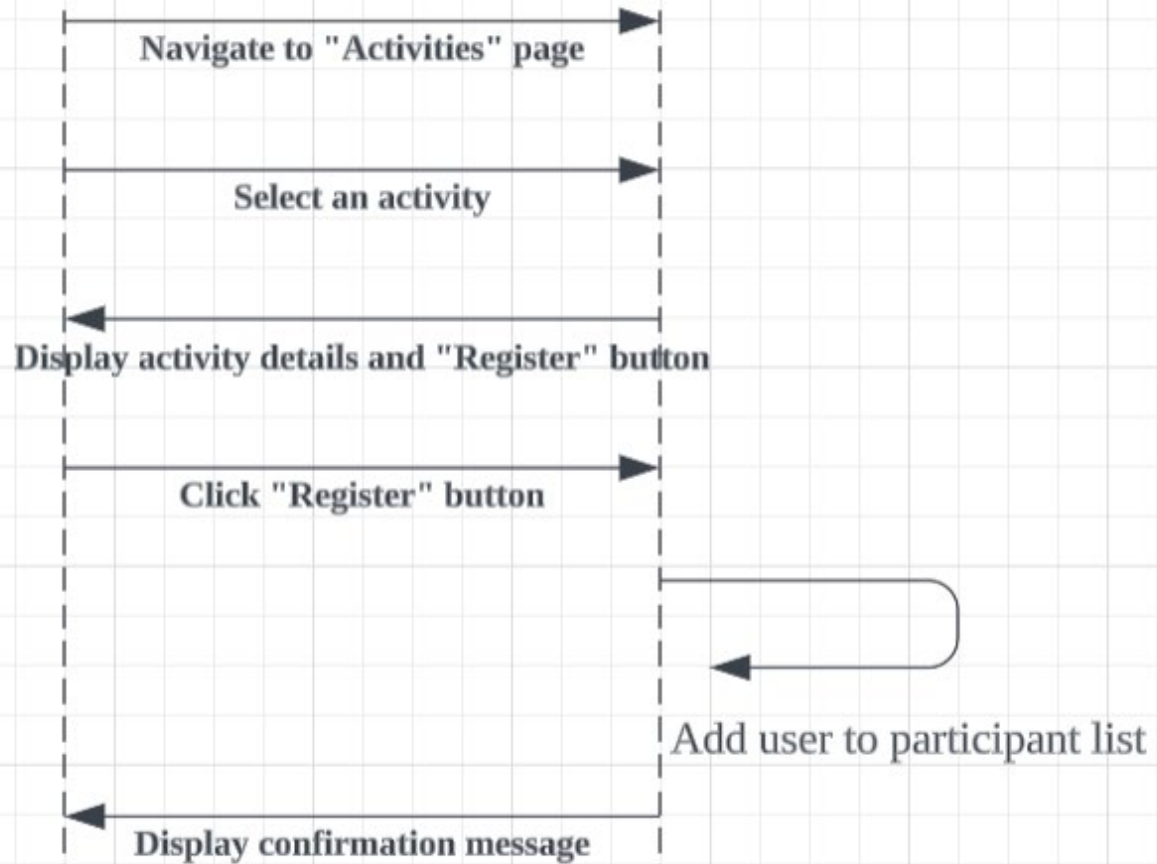




### 2.3.5 UC05: Use Case <Register for Activity>

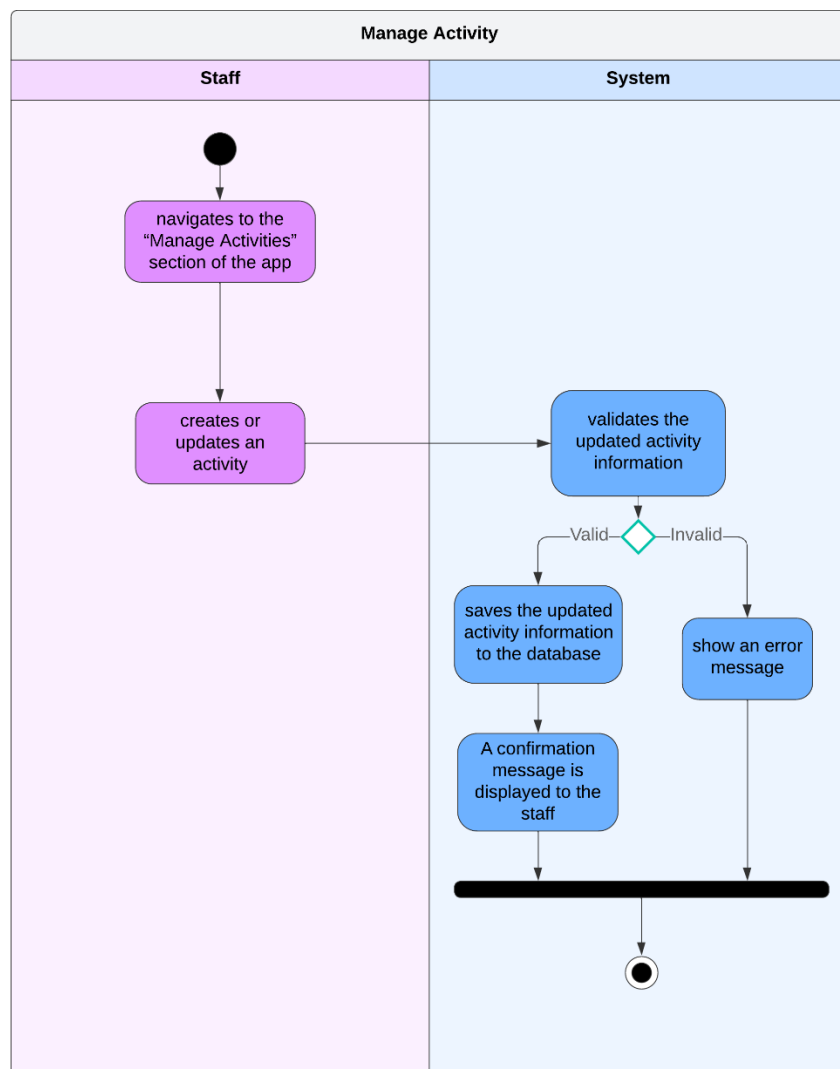
<b>Use Case:</b> Register for Activity
<b>ID:</b> UC05
<b>Actors:</b> UTM Students
<b>Preconditions:</b> The user must be logged into the system.
<b>Flow of Events:</b> <ol style="list-style-type: none"><li>1. The user navigates to the “Activities” page.</li><li>2. The user selects an activity they want to join.</li><li>3. The system displays the activity details and a “Register” button.</li><li>4. The user clicks the “Register” button.</li><li>5. The system adds the user to the participant list of the selected activity.</li><li>6. A confirmation message is displayed to the user.</li></ol>
<b>Postconditions:</b> The user is successfully registered for the selected activity.
<b>Alternative Flow:</b>
<b>Exception Flow:</b>

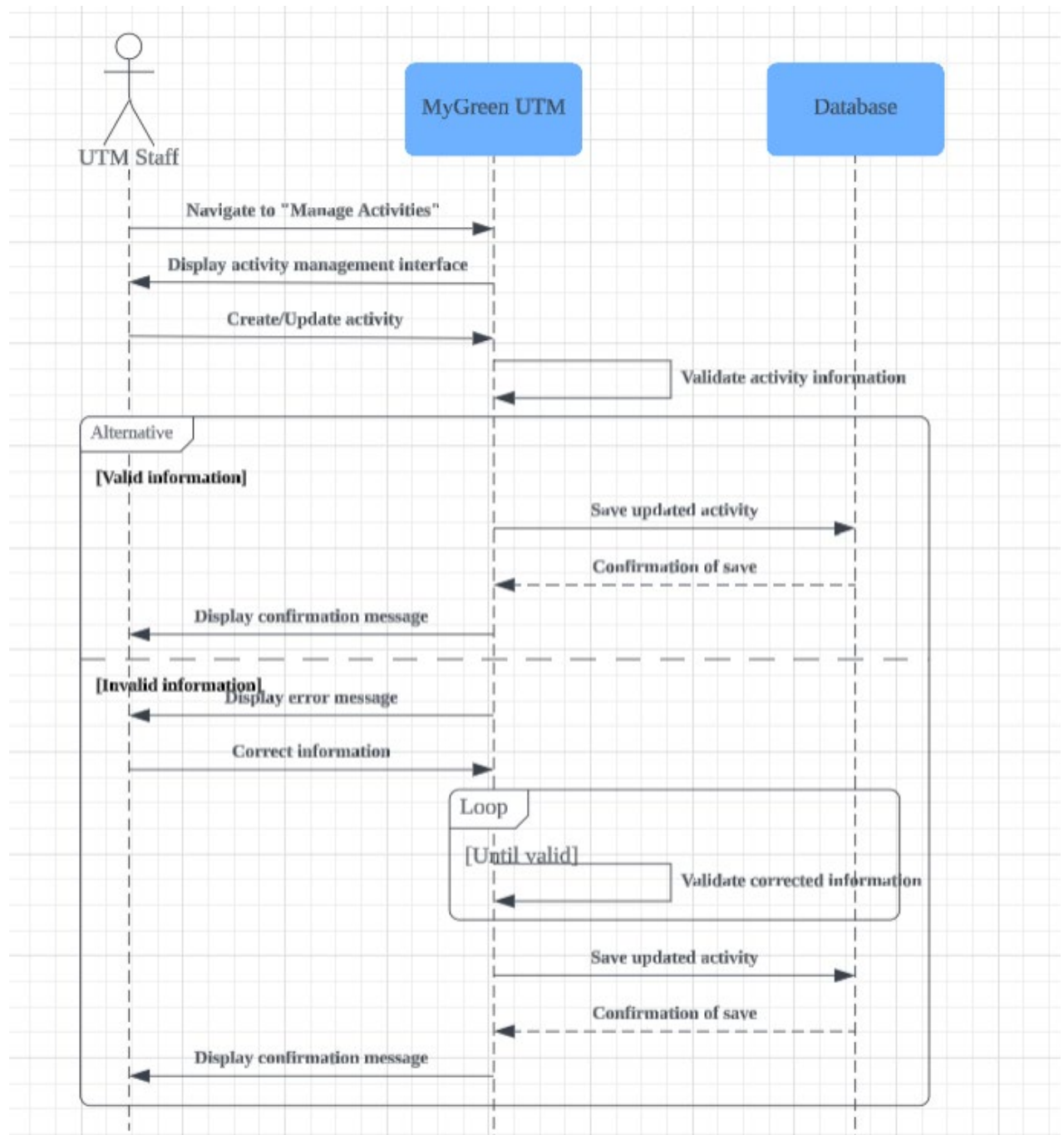




### 2.3.6 UC06: Use Case <Manage Activity>

<b>Use Case:</b> Manage Activity
<b>ID:</b> UC06
<b>Actors:</b> UTM Staff
<b>Preconditions:</b> The user must be logged in with staff privileges.
<b>Flow of Events:</b> <ol style="list-style-type: none"><li>1. The staff navigates to the “Manage Activities” section of the app.</li><li>2. The staff creates or updates an activity (e.g., event name, date, time, location).</li><li>3. The system validates the updated activity information:<ol style="list-style-type: none"><li>3.1 If valid, proceed to Step 4.</li><li>3.2 If invalid, show an error message. (AF1)</li></ol></li><li>4. The system saves the updated activity information to the database.</li><li>5. A confirmation message is displayed to the staff.</li></ol>
<b>Postconditions:</b> The activity information is successfully created or updated in the system.
<b>Alternative Flow 1:</b> If the input data is invalid, the system displays an error message and prompts the staff to correct it.
<b>Exception Flow:</b>

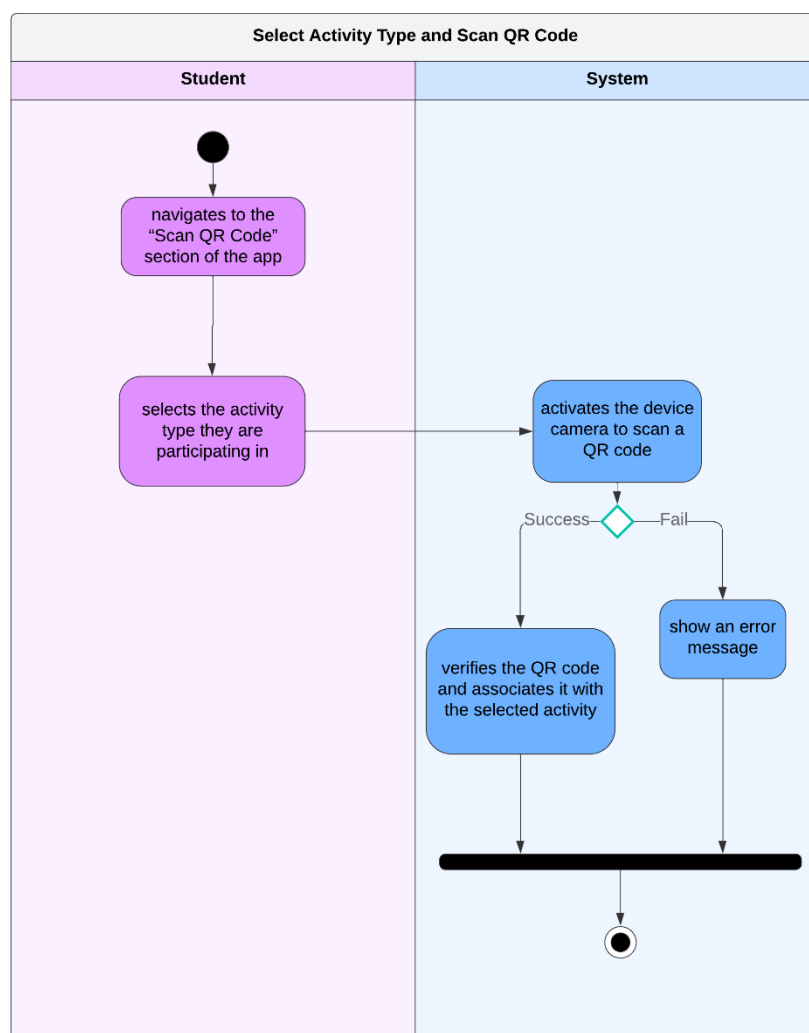


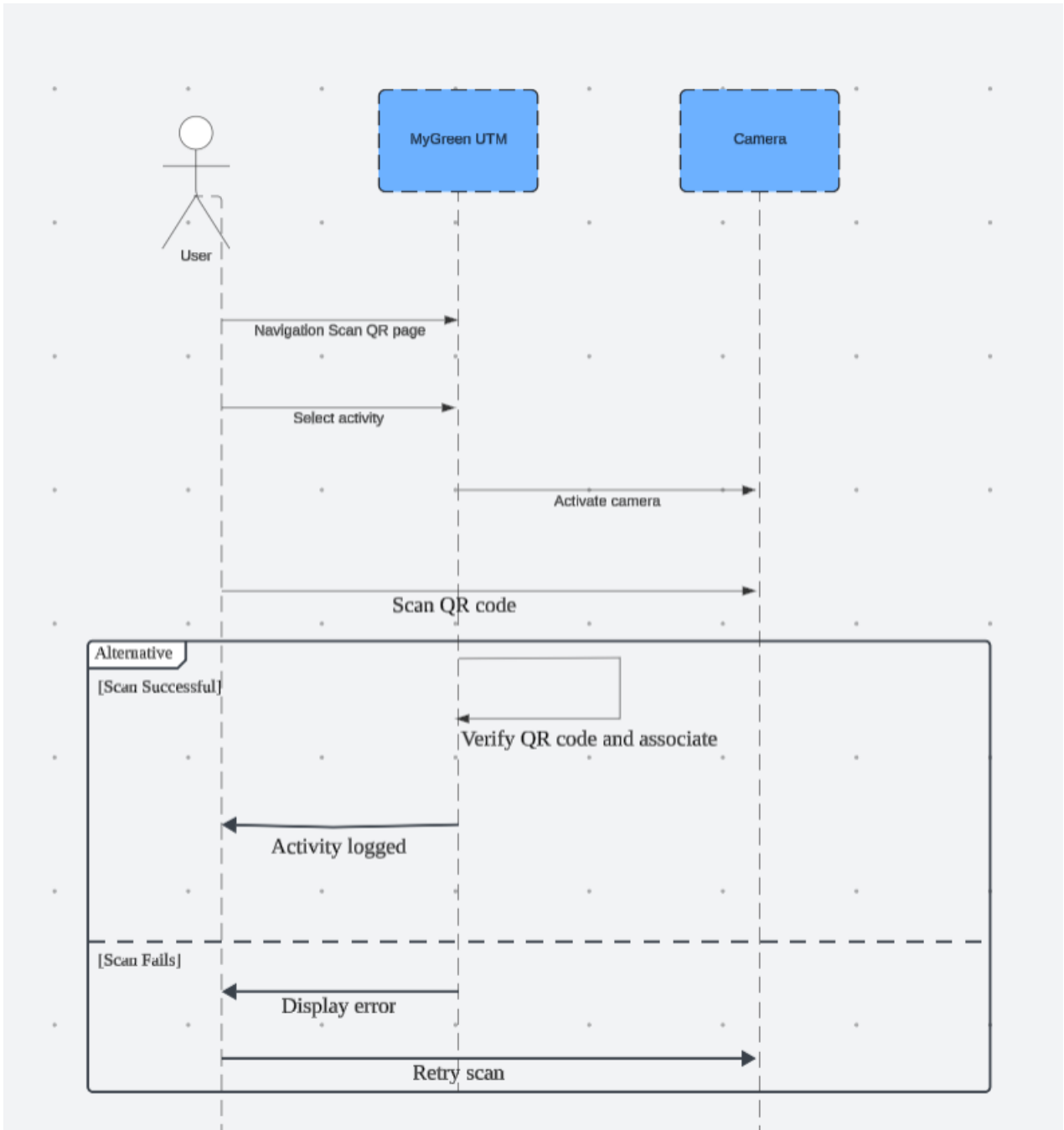




### 2.3.7 UC07: Use Case <Select Activity Type and Scan QR Code>

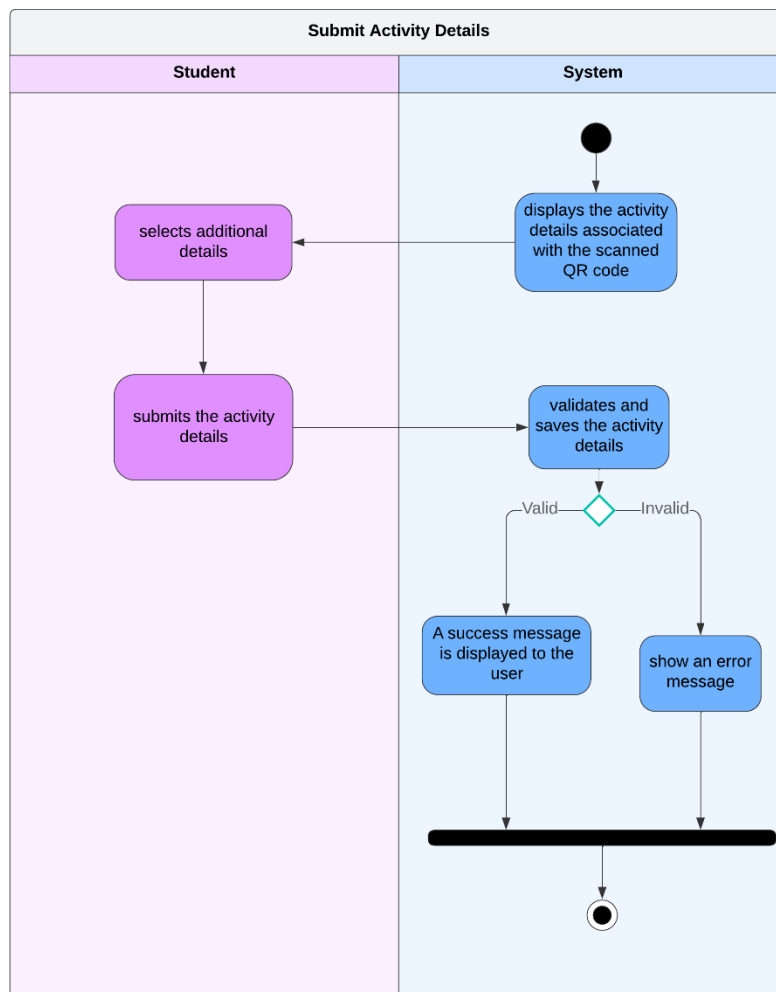
<b>Use Case:</b> Select Activity Type and Scan QR Code
<b>ID:</b> UC07
<b>Actors:</b> UTM Students, UTM Staff
<b>Preconditions:</b> The user must be logged in.
<b>Flow of Events:</b> <ol style="list-style-type: none"><li>1. The user navigates to the "Scan QR Code" section of the app.</li><li>2. The user selects the activity type they are participating in (e.g., awareness, recycling).</li><li>3. The system activates the device camera to scan a QR code.</li><li>4. The user scans the QR code provided at the event:<ol style="list-style-type: none"><li>4.1 If the scan is successful, proceed to Step 5.</li><li>4.2 If the scan fails, show an error message. (AF1)</li></ol></li><li>5. The system verifies the QR code and associates it with the selected activity.</li></ol>
<b>Postconditions:</b> The QR code is successfully scanned, and the activity is logged in to the system.
<b>Alternative Flow 1:</b> If the QR code scan fails, the system displays an error message and prompts the user to retry.
<b>Exception Flow:</b>

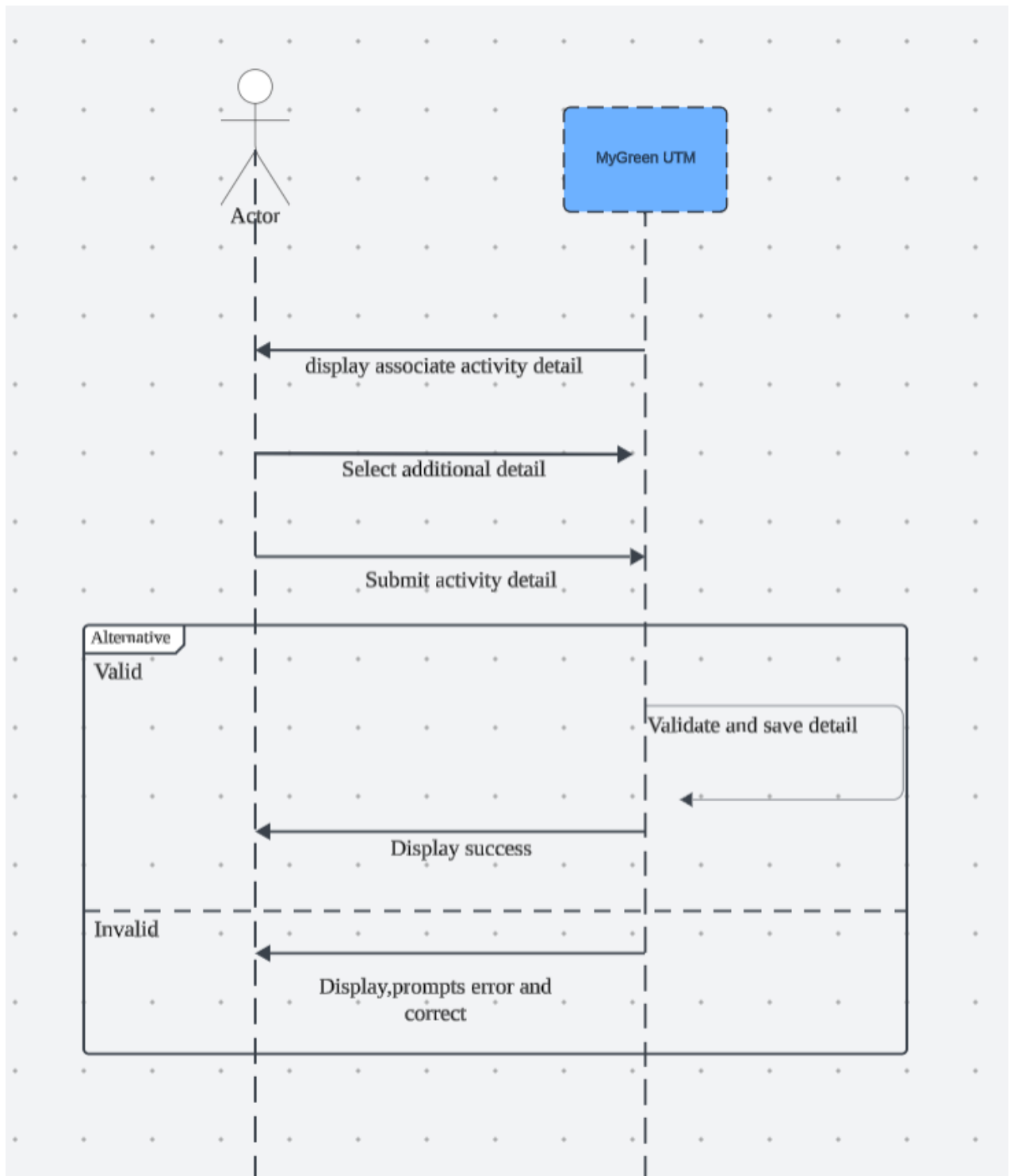




### 2.3.8 UC08: Use Case <Submit Activity Details>

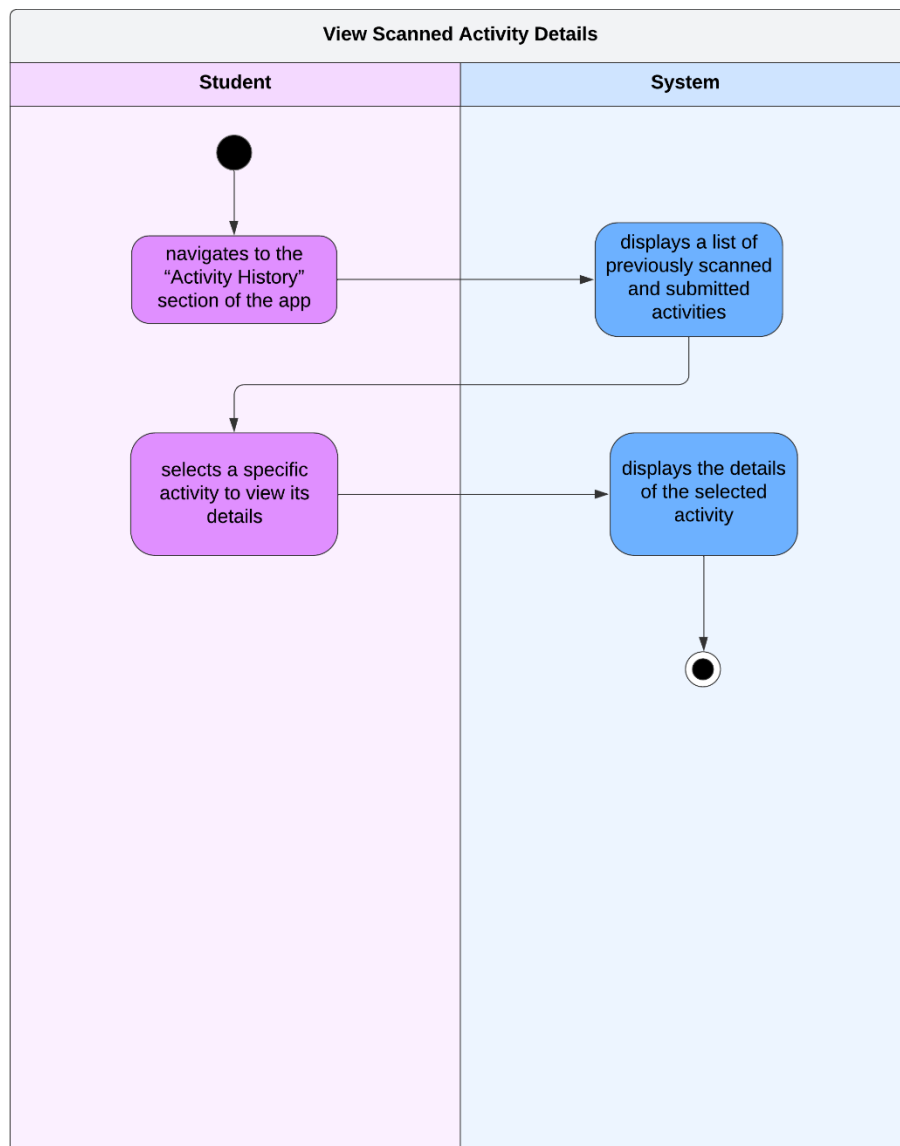
<b>Use Case:</b> Submit Activity Details
<b>ID:</b> UC08
<b>Actors:</b> UTM Students, UTM Staff
<b>Includes:</b> <UC07: Select Activity Type and Scan QR Code>
<b>Preconditions:</b> The user must have successfully scanned a QR code.
<b>Flow of Events:</b> <ol style="list-style-type: none"><li>1. The system displays the activity details associated with the scanned QR code.</li><li>2. The user selects additional details (e.g., location, user type).</li><li>3. The user submits the activity details.</li><li>4. The system validates and saves the activity details:<ol style="list-style-type: none"><li>4.1 If valid, proceed to Step 5.</li><li>4.2 If invalid, show an error message. (AF1)</li></ol></li><li>5. A success message is displayed to the user.</li></ol>
<b>Postconditions:</b> The activity details are successfully submitted and saved in the system.
<b>Alternative Flow 1:</b> If the entered details are invalid, the system displays an error message and prompts the user to correct them.
<b>Exception Flow:</b>

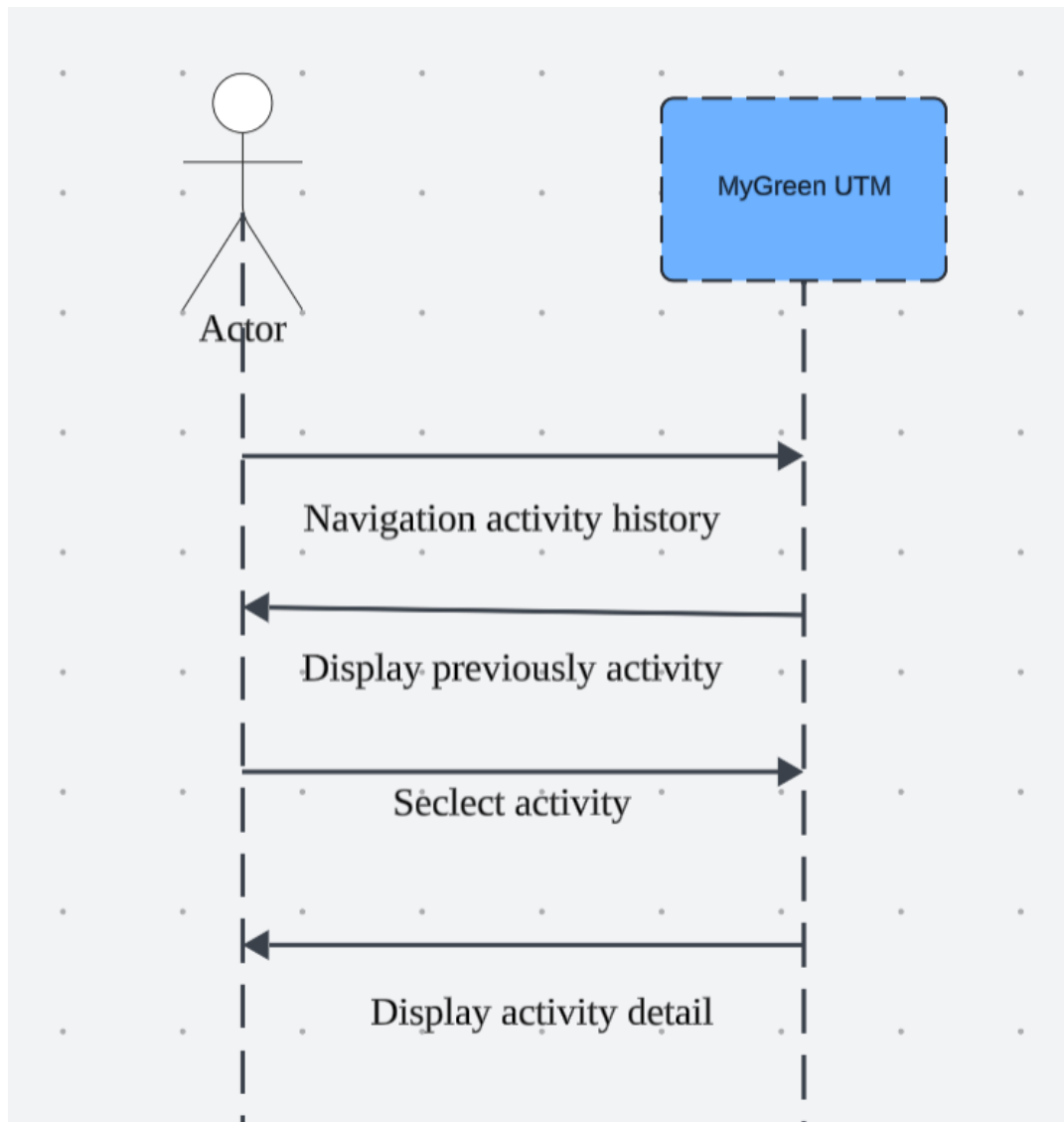




### 2.3.9 UC09: Use Case <View Scanned Activity Details>

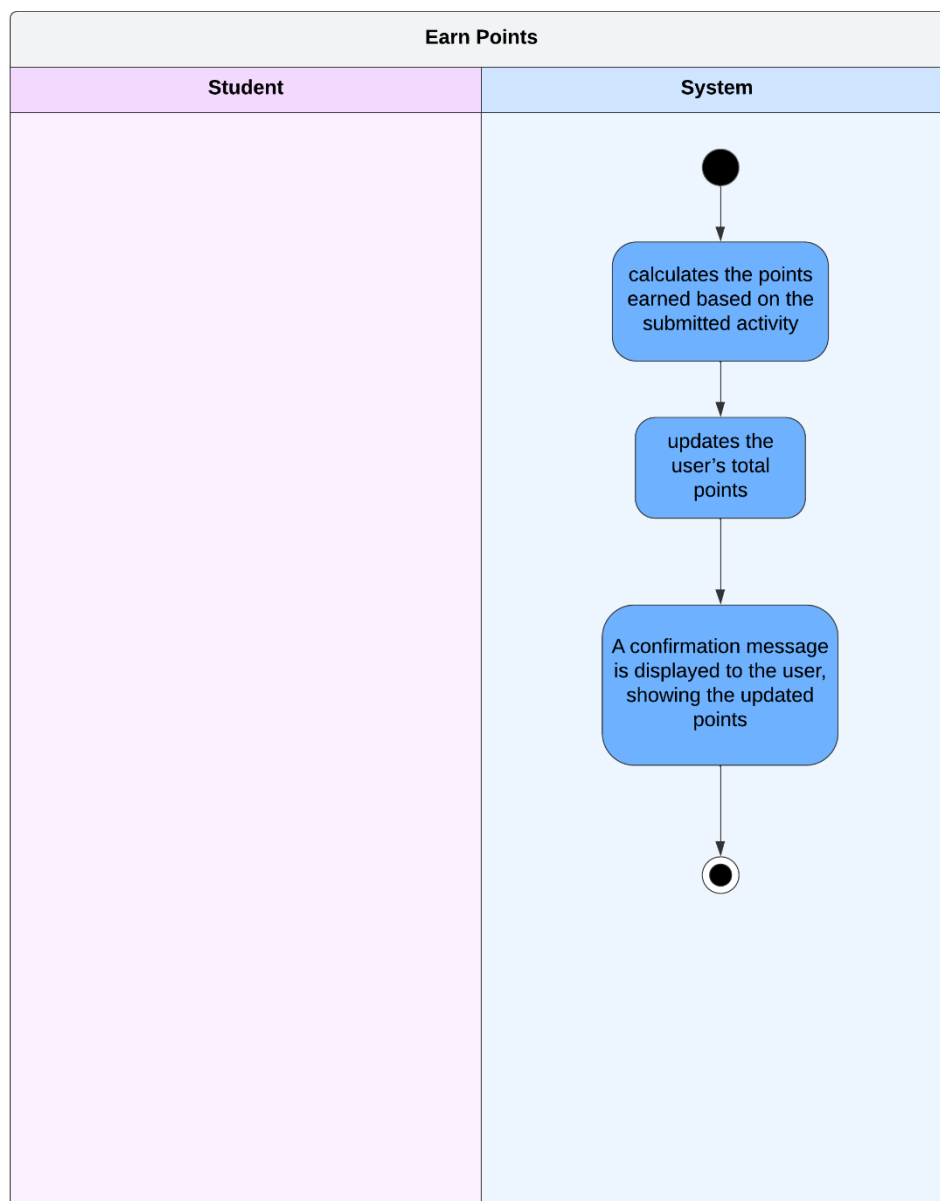
<b>Use Case:</b> View Scanned Activity Details
<b>ID:</b> UC09
<b>Actors:</b> UTM Students, UTM Staff
<b>Includes:</b> <UC08: Submit Activity Details>
<b>Preconditions:</b> The user must have successfully submitted activity details.
<b>Flow of Events:</b> <ol style="list-style-type: none"><li>1. The user navigates to the “Activity History” section of the app.</li><li>2. The system displays a list of previously scanned and submitted activities.</li><li>3. The user selects a specific activity to view its details.</li><li>4. The system displays the details of the selected activity (e.g., activity type, location, timestamp).</li></ol>
<b>Postconditions:</b> The user successfully views the details of a previously scanned activity.
<b>Alternative Flow:</b>
<b>Exception Flow:</b>

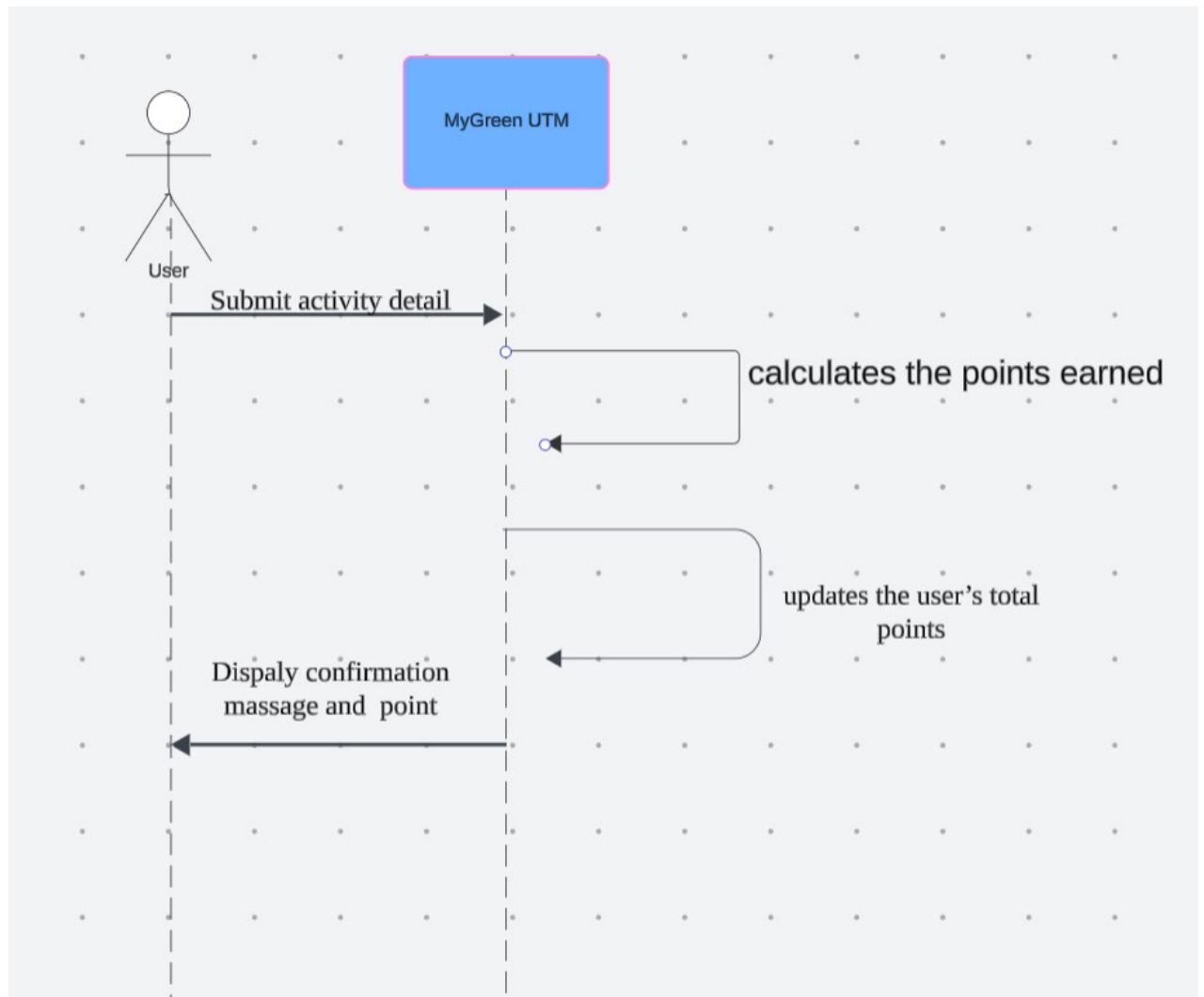




### 2.3.10 UC10: Use Case <Earn Points>

<b>Use Case:</b> Earn Points
<b>ID:</b> UC10
<b>Actors:</b> UTM Students
<b>Includes:</b> <UC08: Submit Activity Details>
<b>Preconditions:</b> The user must have successfully submitted activity details.
<b>Flow of Events:</b> <ol style="list-style-type: none"><li>1. The system calculates the points earned based on the submitted activity.</li><li>2. The system updates the user's total points.</li><li>3. A confirmation message is displayed to the user, showing the updated points.</li></ol>
<b>Postconditions:</b> The user's total points are successfully updated in the system.
<b>Alternative Flow:</b>
<b>Exception Flow:</b>

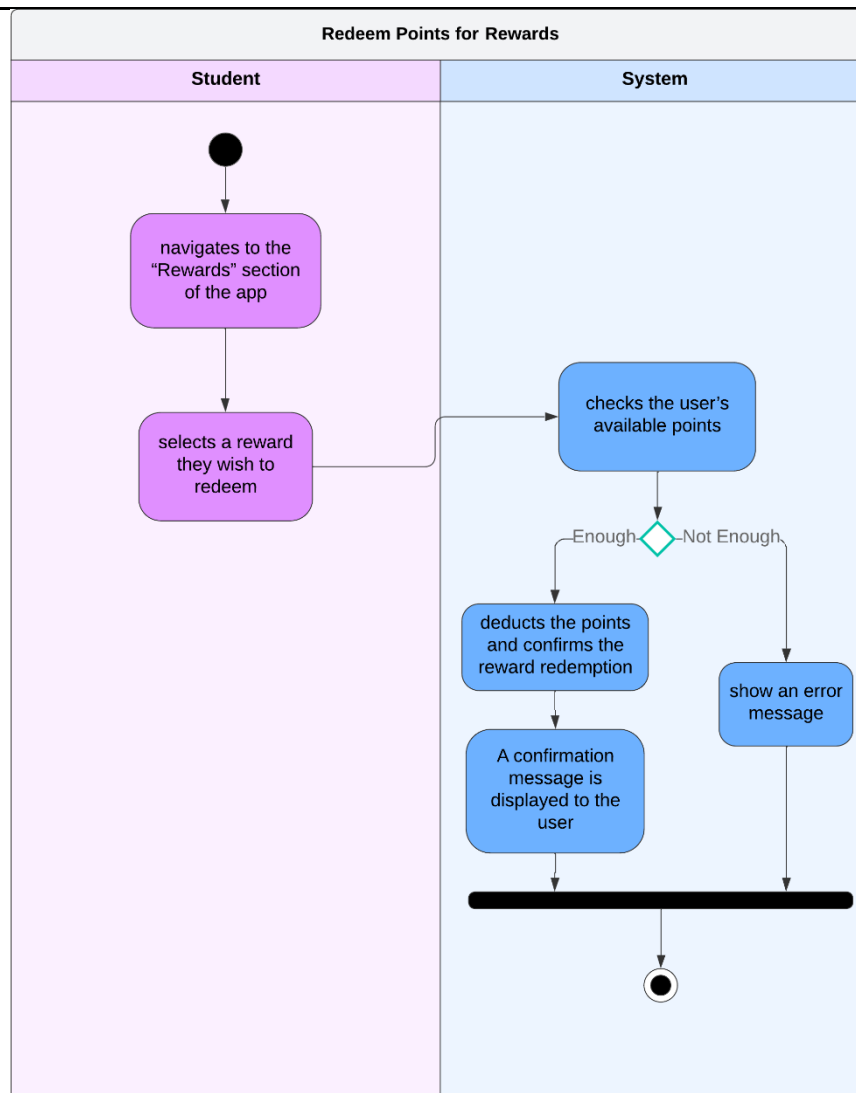


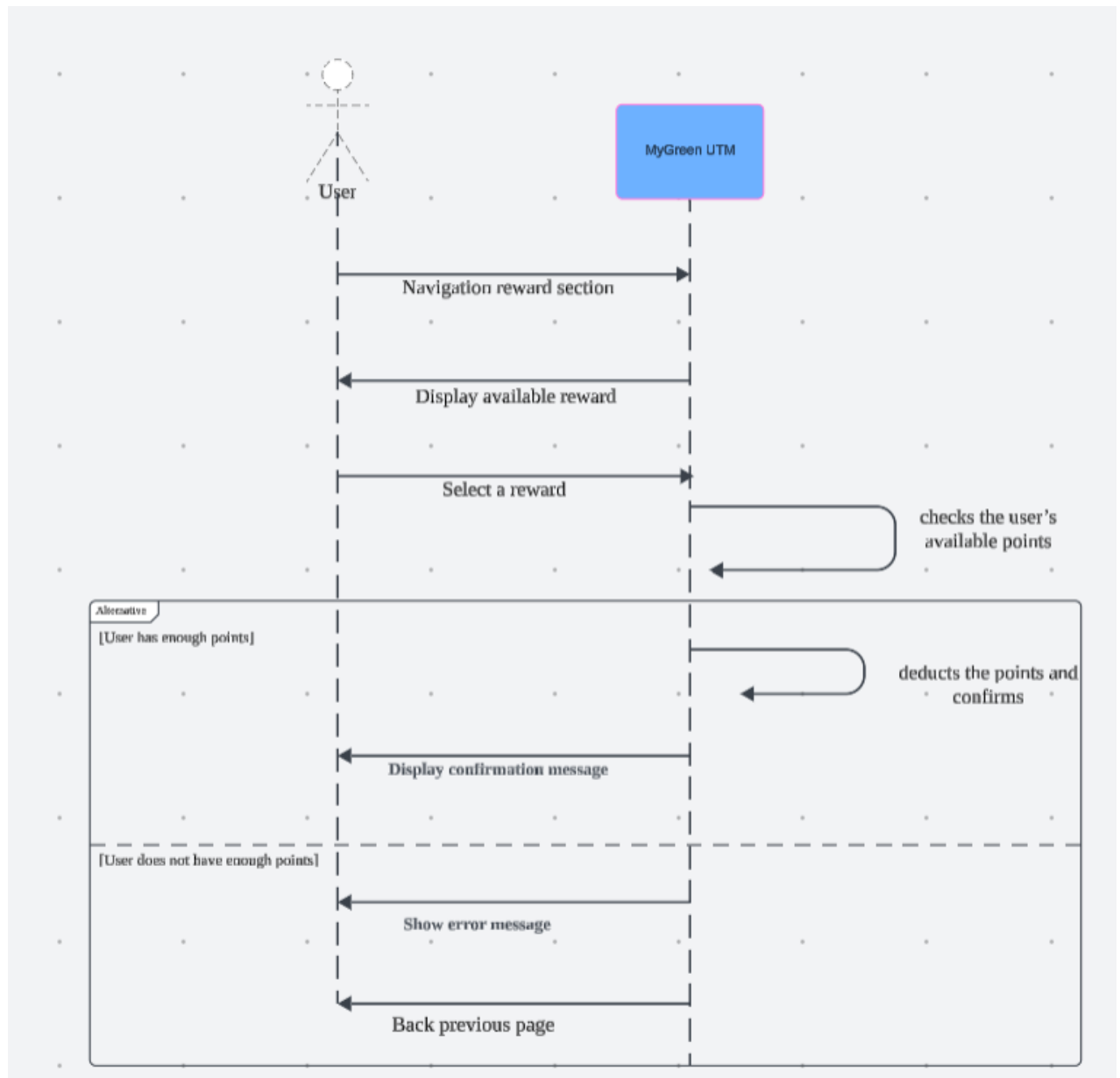




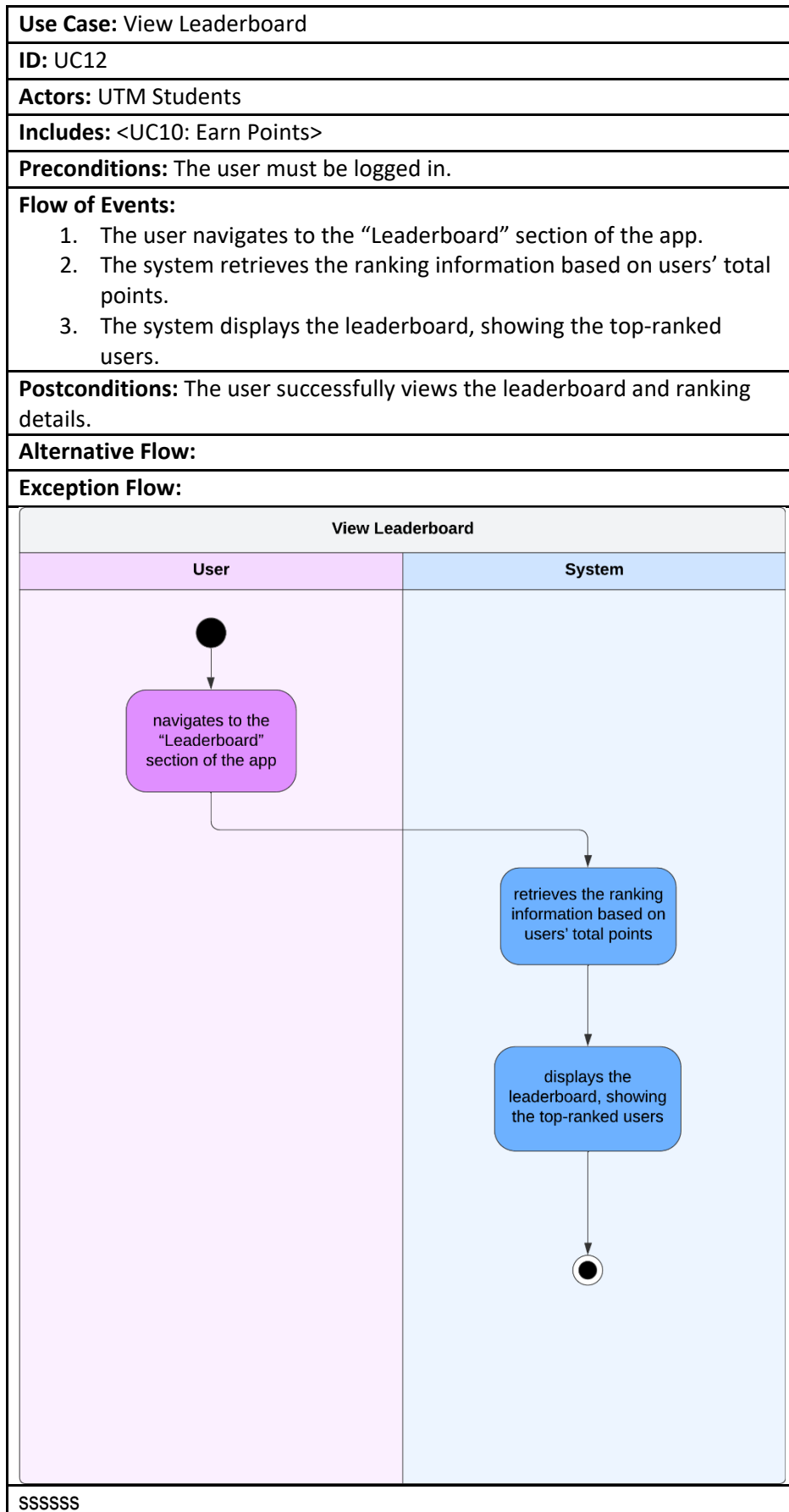
### 2.3.11 UC11: Use Case < Redeem Points for Rewards >

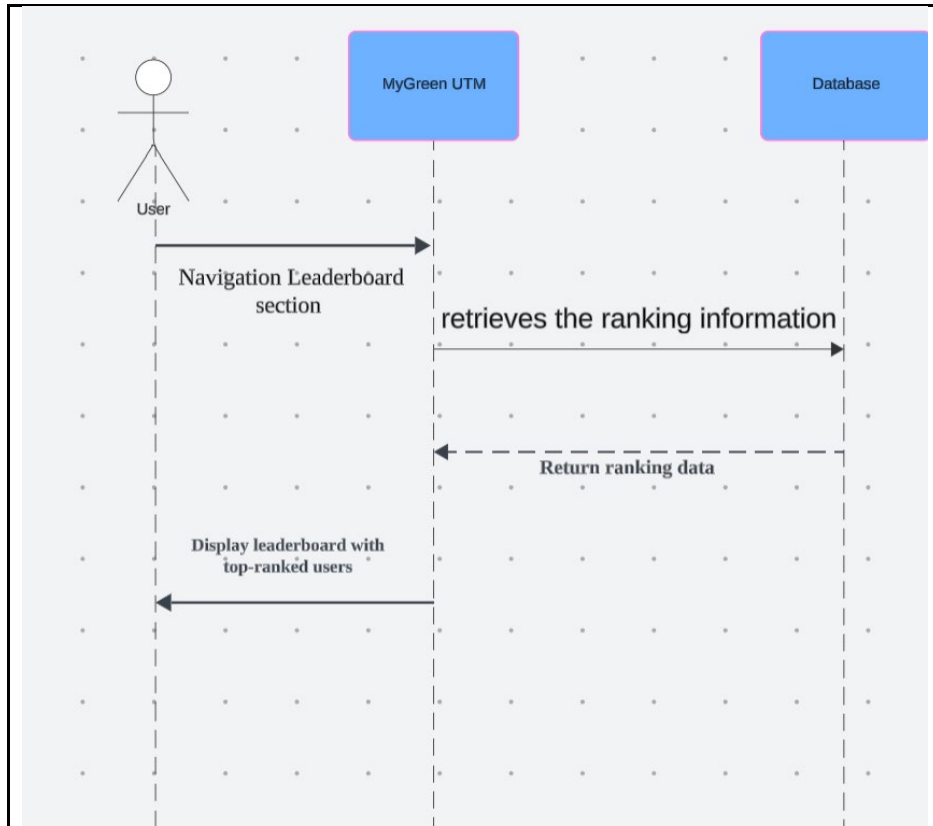
<b>Use Case:</b> Redeem Points for Rewards
<b>ID:</b> UC11
<b>Actors:</b> UTM Students
<b>Includes:</b> <UC10: Earn Points>
<b>Preconditions:</b> The user must have accumulated sufficient points.
<b>Flow of Events:</b> <ol style="list-style-type: none"> <li>1. The user navigates to the “Rewards” section of the app.</li> <li>2. The user selects a reward they wish to redeem.</li> <li>3. The system checks the user’s available points: <ol style="list-style-type: none"> <li>3.1 If the user has enough points, proceed to Step 4.</li> <li>3.2 If the user does not have enough points, show an error message. (AF1)</li> </ol> </li> <li>4. The system deducts the points and confirms the reward redemption.</li> <li>5. A confirmation message is displayed to the user.</li> </ol>
<b>Postconditions:</b> The user successfully redeems the reward, and their points are updated.
<b>Alternative Flow 1:</b> If the user does not have enough points, the system displays an error message and goes back to the previous page.
<b>Exception Flow:</b>





### 2.3.12 UC12: Use Case <View Leaderboard>





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## 2.4 Performance and Other Requirements

### 2.4.1 Performance Requirements

**Response Time:** The application must respond to user inputs within 1 second under normal conditions and within 2 seconds during peak usage.

**Throughput:** The system should handle up to 1,000 concurrent users during peak events like sustainability campaigns.

**Capacity:** Support for 20,000 registered users with the ability to scale for future increases.

**Availability:** Achieve 99.95% uptime to ensure users can access features reliably during green events.

### 2.4.2 Software System Attributes:

**Usability:** Intuitive UI for users with varying levels of technical expertise, including accessibility options like screen readers and adjustable font sizes.

**Reliability:** The app must log all user actions accurately and recover from any crashes within 5 minutes.

**Maintainability:** Modular code structure to allow for quick bug fixes and feature enhancements.

**Portability:** Compatible with both Android and iOS platforms, supporting their latest versions.

**Compatibility:** Integration with UTM's existing IT infrastructure and support for external systems such as QR code readers.

### 2.4.3 Security Requirements:

**Data Protection:** Use end-to-end encryption (AES-256) for sensitive information, such as user registration details and activity logs.

**Authentication:** Implement multi-factor authentication for staff accounts to secure sensitive data.

### 2.4.4 Environmental Impact

**Low Power Usage:** Optimize system algorithms to reduce power consumption on mobile devices, aligning with UTM's green initiatives.

**Cloud Efficiency:** Leverage energy-efficient cloud solutions to minimize carbon footprint.

## 2.5 Design Constraints

### Environmental Constraints

The system must operate effectively in various environments, including areas with intermittent or low network

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connectivity. Offline caching should enable users to log activities even when internet access is unavailable. The system should minimize energy consumption on mobile devices to align with UTM's green initiatives. Algorithms must be optimized for battery efficiency, especially during activities like QR code scanning. All cloud operations should utilize energy-efficient and eco-friendly server solutions, contributing to reduced carbon emissions from backend operations.

#### **Hardware Constraints**

The application must run on mobile devices with at least:

- 2GB of RAM.

- Dual-core processors for standard processing requirements.

Compatibility should include Android 9.0/iOS 13 or later versions, ensuring seamless operation across both operating systems.

Devices with limited resources (e.g., older models) should still experience acceptable performance by utilizing adaptive features like reducing graphical intensity.

#### **Security Constraints**

All user data, including personal information and activity logs, must be encrypted using AES-256 encryption both during transmission and storage.

Multi-factor authentication (MFA) should be implemented for UTM staff to prevent unauthorized access to sensitive data, particularly during green event management.

The system should regularly conduct security audits to identify and resolve potential vulnerabilities, maintaining compliance with UTM's IT policies and industry best practices.

#### **Legal and Regulatory Constraints**

The application must comply with the Malaysian Personal Data Protection Act 2010, ensuring that user information is securely collected, stored, and processed.

Any data collection must be limited to what is necessary for the system's functionality, with explicit user consent for activities like leaderboard participation or public activity sharing.

Environmental data collected (e.g., carbon footprint or waste reduction statistics) must adhere to Malaysian environmental reporting standards for sustainability initiatives.

#### **Performance Constraints**

The system should:- Support up to 1,000 active users logging activities simultaneously without performance degradation, especially during high-demand periods like green events.

- Maintain a response time of under 3 seconds for all major functions, including event registration and activity submission, even under peak loads.

- Scale efficiently to handle a 20% increase in concurrent users during special campaigns, leveraging cloud infrastructure for dynamic resource allocation.

Ensure smooth operation for real-time functionalities like QR code scanning, with error recovery mechanisms in place to handle failed scans.

#### **Organizational Standards**

The design and implementation must follow IEEE 830-1998 standards for Software Requirements Specifications to ensure clarity and consistency.

Documentation and system architecture must be reviewed and approved by UTM's designated project governance body to ensure alignment with institutional goals and standards.

All system components should integrate seamlessly with UTM's existing IT infrastructure, including student and staff databases.

*Compatibility constraints: These constraints relate to the compatibility requirements for the system, such as compatibility with specific software or hardware components. An example of a compatibility constraint is: "The system must be designed to be compatible with Windows 10 operating system."*