The TEZ App

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TEZ

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1.   Introduction

1.1   Purpose

The TEZ app is designed to modernize and enhance bus transportation management for educational institutions, businesses, and public transport companies in Pakistan. It provides a centralized platform that allows administrators, drivers, and passengers to coordinate, track, and manage bus services more efficiently.

This document outlines the software requirements for the TEZ app, detailing its features to plan the route, real-time seat viewing, live bus tracking, scheduling, and maintenance. By ensuring accurate, real-time information flow between users, drivers, and administrators, the app aims to improve user experience, organization efficiency, avoiding miscommunication, and ensure the effective utilization of transport resources. It addresses a growing need in Pakistan, where no comprehensive transport management system currently exists, while drawing inspiration from successful international solutions such as Singapore's metro system.

1.2   Product Scope

Key features include real-time seat availability, live bus tracking, maintenance scheduling, emergency notifications, and online payment handling as well as virtual bus passes.

TEZ aims to streamline transportation logistics, reduce operational delays, and improve overall user satisfaction by providing real-time information and automating various administrative tasks. By integrating these features into one platform, the TEZ app satisfies corporate goals of improving service quality, ensuring passenger safety, and optimizing resource utilization. It also supports at a large scale business strategies by enhancing operational efficiency, enabling better decision-making, and fostering customer trust through reliable transport management.

The TEZ app fills a significant gap in the local market, where no competing rivals exist, by introducing a system that has been proven effective in international markets.

1.3   Title

TEZ - One stop solution for all public transport needs.

1.4   Objectives

-   ***Transportation Management***
    Provide a unified platform for efficiently managing the public transport experience.

-   ***Real-Time Bus Tracking***
    Enable passengers to track buses live and receive timely updates on delays or route changes. Help citizens/students organize their time better by knowing their transport vehicle's location and distance, breakdowns, roadblocks, etc.

- ***Optimized Resource Use***
  Improve bus utilization by managing seats more optimally and ensuring timely maintenance scheduling.

- ***Enhanced Safety and Convenience***
  Offer features like emergency notifications, secure payments, and digital bus passes for a safer, more convenient experience.

- ***Better Stakeholder Communication***
  Automate key interactions between administrators, drivers, and passengers for smoother operations. This includes Admin assigning buses and routes to drivers, Passengers being able to communicate issues directly with the

- ***Scalable and Adaptable System***
  Design a system that can grow to support a wider range of networks beyond a single organization or a single institute's organizations.

1.5   Problem Statement

The primary reason for choosing the TEZ project is to address the inefficiencies faced by students using Uzair Transport to travel to and from FAST University. Students often miss their bus due to the lack of real-time tracking, only to find it full when they catch the next one. Additionally, payment verification is slow, requiring drivers to manually authenticate fees in the database, wasting valuable time. Students are also unable to easily provide feedback or report issues like rude drivers, creating frustration with the service.

The lack of notifications about blockages, congestion areas or bus breakdowns is another significant issue. Frequent delays to class can result from students waiting for a long amount of time without knowing whether the bus is delayed, broken down, missed or canceled entirely. By offering real-time tracking, seat availability updates, digital payment verification, and emergency notifications, the TEZ app directly addresses these problems and guarantees a more effective and convenient travel experience.

While hurdles such as limited adoption of online payments in Pakistan still exist, the system is designed to be adaptable, allowing future integration of more common payment methods. Its feasibility lies in improving transportation efficiency and enhancing the overall user experience for both students and administrators.

2.   Overall Description

2.1   Product Perspective

TEZ App is a new standalone product specifically designed to address the inefficiencies and shortcomings of the current bus transport management system used by educational institutions, businesses and public transport companies in Pakistan. It is not an add-on or replacement to the existing system, as there is currently no similar standard or unified solution in use in the country. The app was created to meet the real-world challenges faced by FAST University students who rely on Uzair Transport for their daily commute.
The TEZ app will function mainly independently, as well as interacting with existing third-party systems, such as payment gateways and Google Maps for GPS Tracking.

2.2   Product Functions

The TEZ app must perform or facilitate the following major functions to meet the needs of its users:

1. User Account Management
   - Registration, login, and profile management for students, drivers, and administrators.
   - Role-based access control to ensure appropriate permissions for each user type.

2. Bus Tracking and Updates
   - Real-time GPS tracking of buses.
   - Display live bus location, estimated arrival times, and delay notifications.

3. Seat Reservation
   - View available seats on buses in real-time.
   - Reserve seats for passengers, ensuring no overbooking.

4. Payment Management
   - Allow students to add funds and make bus fare payments.
   - Verify and authenticate payments through integrated online payment systems.

5. Route and Schedule Information
   - Display detailed bus routes, schedules, and stop timings.
   - Update students on route changes and bus schedules in real-time.

6. Emergency Notifications
   - Send alerts regarding roadblocks, bus breakdowns, or delays.
   - Update users with alternate route options if necessary.

7. Feedback and Complaint System
   - Allow students to submit feedback or complaints regarding services or drivers.
   - Provide a communication channel for administrators to respond and manage complaints.

8. Maintenance Scheduling
   - Enable administrators to schedule and track bus maintenance.
   - Notify users of buses unavailable due to maintenance or other issues.

2.3   List of Use Cases

2.4   Extended Use Cases

2.5   Use Case Diagram

3.   Other Nonfunctional Requirements

3.1   Performance Requirements

1. Real-Time Bus Tracking and Updates

Requirement: The system must update the live location of the bus and status (e.g., delays, route changes) in real time with no more than a 5-minute delay.
Rationale: Real-time information is essential for students to plan their journey effectively, particularly when dealing with delays or missed buses. A delay of more than 5 minutes can lead to poor user experience and mismanagement of time.

2. Seat Reservation System

Requirement: Seat availability must be updated instantly after a user reserves or cancels a seat.
Rationale: Ensuring that seat availability is up to date in real-time is important to prevent overbooking.

3. Data Storage and Retrieval

Requirement: User and bus data must be accessible within 20 seconds for any admin, driver, or passenger end queries, such as checking bus schedules, verifying payments, or retrieving feedback, etc.
Rationale: Quick data retrieval is essential for providing real-time, dynamic updates within the app. Slow data retrieval times can result in users encountering outdated information, which could affect decision-making, such as whether to catch a particular bus.

3.2   Safety Requirements

- *Each bus should display a clear number plate and the same number plate will be displayed within the app, allowing passengers to confirm they are sitting in the correct bus before getting on. This helps prevent confusion and ensures passengers are on the right route.*
- *Passengers should have access to real-time bus tracking through the app, so they can verify the bus's arrival time and location, ensuring they are not unnecessarily waiting or getting on the wrong bus.*

- *A dedicated feedback feature should be available in the app to allow passengers to report any issues they encounter, such as unsafe driving, uncomfortable conditions, or any incidents with the driver or fellow passengers. This ensures timely action can be taken to resolve safety concerns.*

3.3   Security Requirements

The TEZ app must ensure the safety and security of user data, restrict unauthorized access, and avoid any potential harm caused by system failures or misuse. Key safety requirements include:

- *Sensitive user information, such as payment details and personal data, must be encrypted.*
- *The system must have a good error handling mechanism to prevent crashes or loss of data during usage. In the occurrence of a failure, users should be notified promptly with clear instructions on how to resolve the issue.*
- *Implement secure payment gateways and fraud detection reinforcements to prevent unauthorized transactions.*

3.4   Software Quality Attributes

Requirement: The app should have an intuitive user interface that is easy to navigate for all users, with minimal training or instruction required. Since this app is going to be used by Drivers with little tech experience, focusing on the User Experience and simplifying it as much as possible was crucial.
Rationale: Ease of use is critical to ensure that students, administrators, and drivers can efficiently interact with the app without frustration.

Requirement: The system must be designed to handle a lot of users, during peak periods (e.g., morning and evening commutes) without significant performance degradation.
Rationale: The app must be able to scale to support growing user bases in different organizations (e.g., universities, transport companies).

Requirement: The app must be able to integrate with third-party systems, such as GPS tracking devices like Google Maps, payment gateways, and student databases, using APIs.

Rationale: Interoperability is essential for integrating the app with existing infrastructure used by universities or transport companies.

3.5   Business Rules

Students: Can view routes, reserve seats, track buses, make payments, and provide feedback. Must complete payments before reserving a seat. If payment fails, the reservation cannot be made or confirmed. Seats must be marked as available in the system before they can be reserved. Once reserved, the seat becomes unavailable to

others. Students can report issues or complaints, and administrators are responsible for reviewing and addressing feedback.

Drivers: Can view assigned routes and bus schedules, but cannot access student or payment information.

Administrators: Manage users, bus routes, schedules, feedback, and payments with full system access. Admins must send real-time notifications in the event of delays, breakdowns, or roadblocks.

3.6   Operating Environment

<Describe the environment in which the software will operate, including the hardware platform, operating system and versions, and any other software components or applications with which it must peacefully coexist.>

3.7   User Interfaces

The overall goal is to create a simple, intuitive interface that works well for both tech-savvy users and those with minimal tech experience, such as drivers taking influence from inDrive.

General Interface Standards

Consistency: The design will be simple, using large, easy-to-read fonts and clear icons. Common buttons (e.g., "Submit," "Cancel") will appear consistently across screens.

Student Interface

Home Screen: Displays available bus routes and departure times. Simple buttons for bus tracking, seat reservation, and payments.

Seat Reservation: Color-coded availability (green for available, red for taken) with easy "Reserve" buttons.

Driver Interface

Simplified Design: Since many drivers may not be tech-savvy, the UI will use large, clear icons and simple words(e.g., "Bus Status: Start" or "End") to reduce confusion.
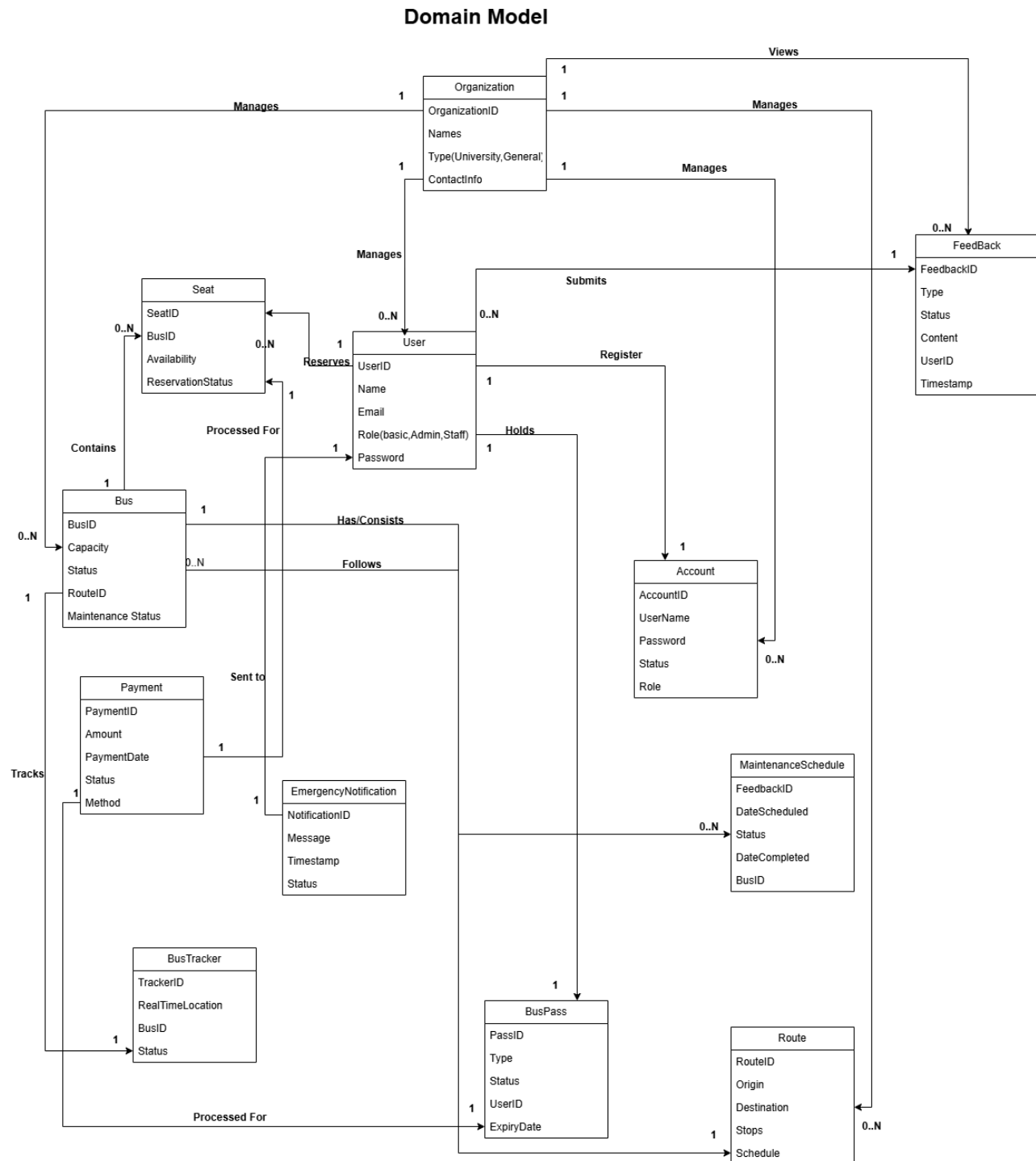
Route and Bus Information: Drivers will have a simple screen showing their assigned route and key details, with as little text as possible and easy-to-understand symbols.
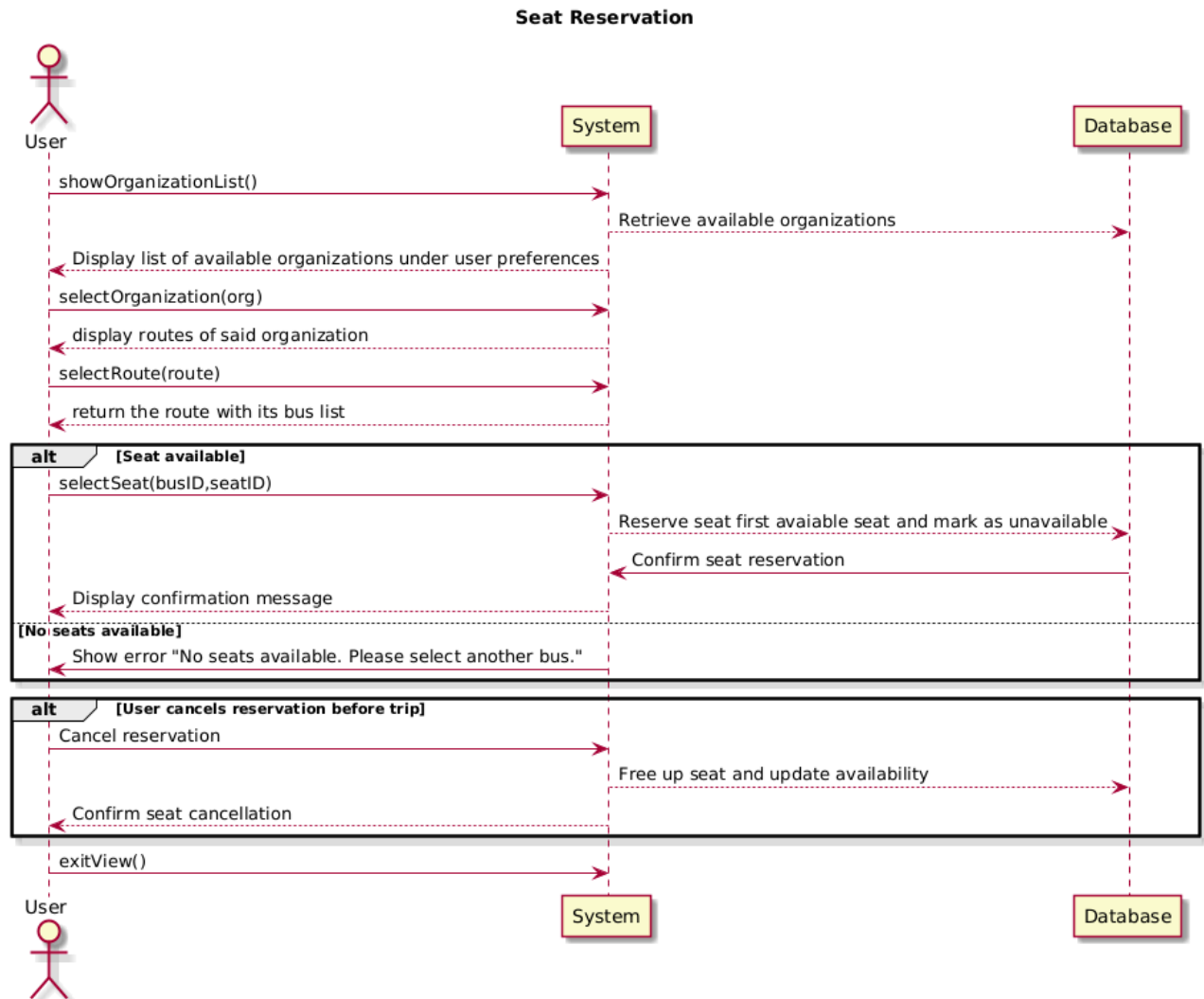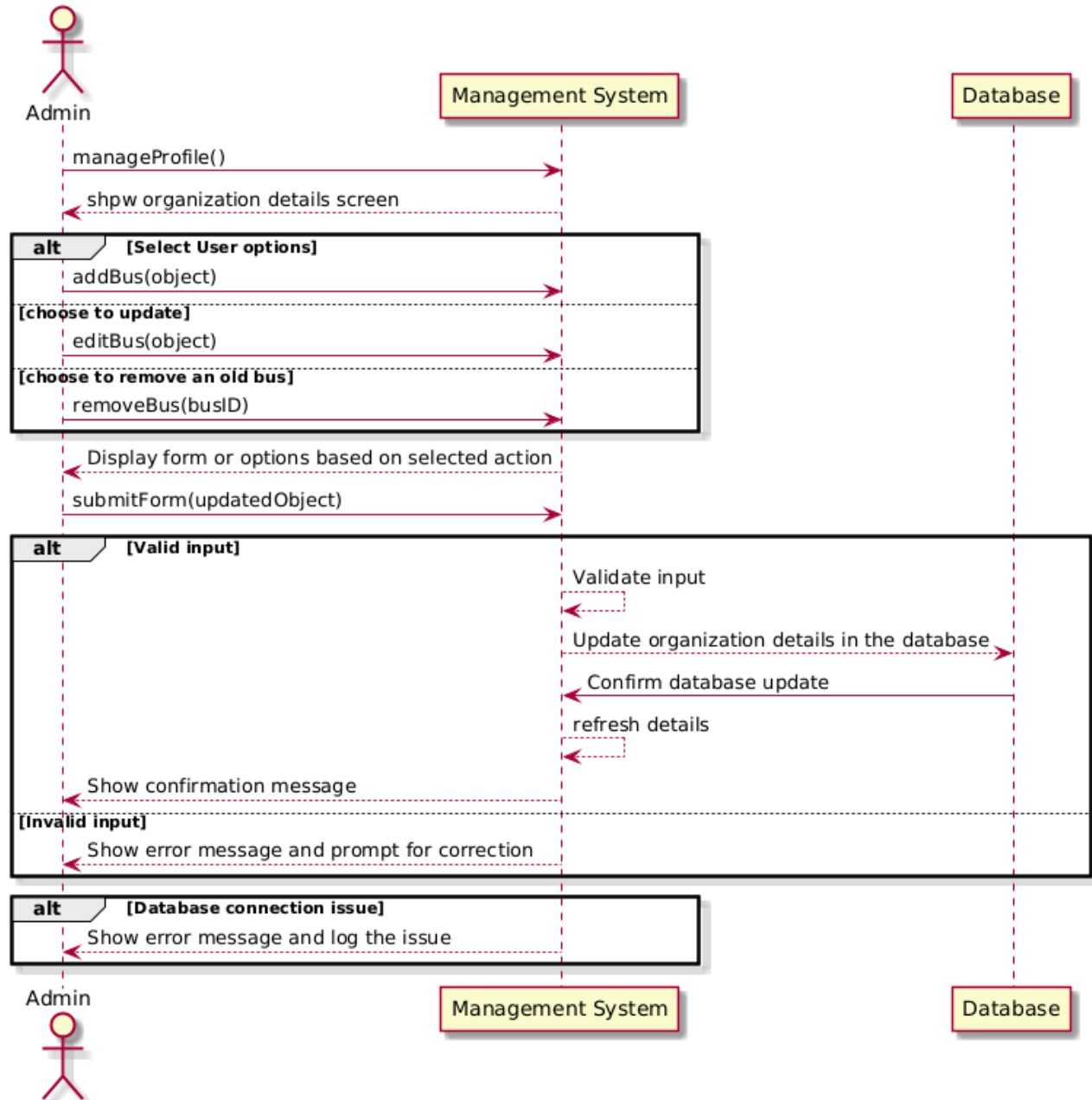
Administrator Interface

Management Dashboard*: Admins will have a dashboard to manage routes, users, payments, and feedback. Simple charts and lists will provide key information in an easy to understand format.*
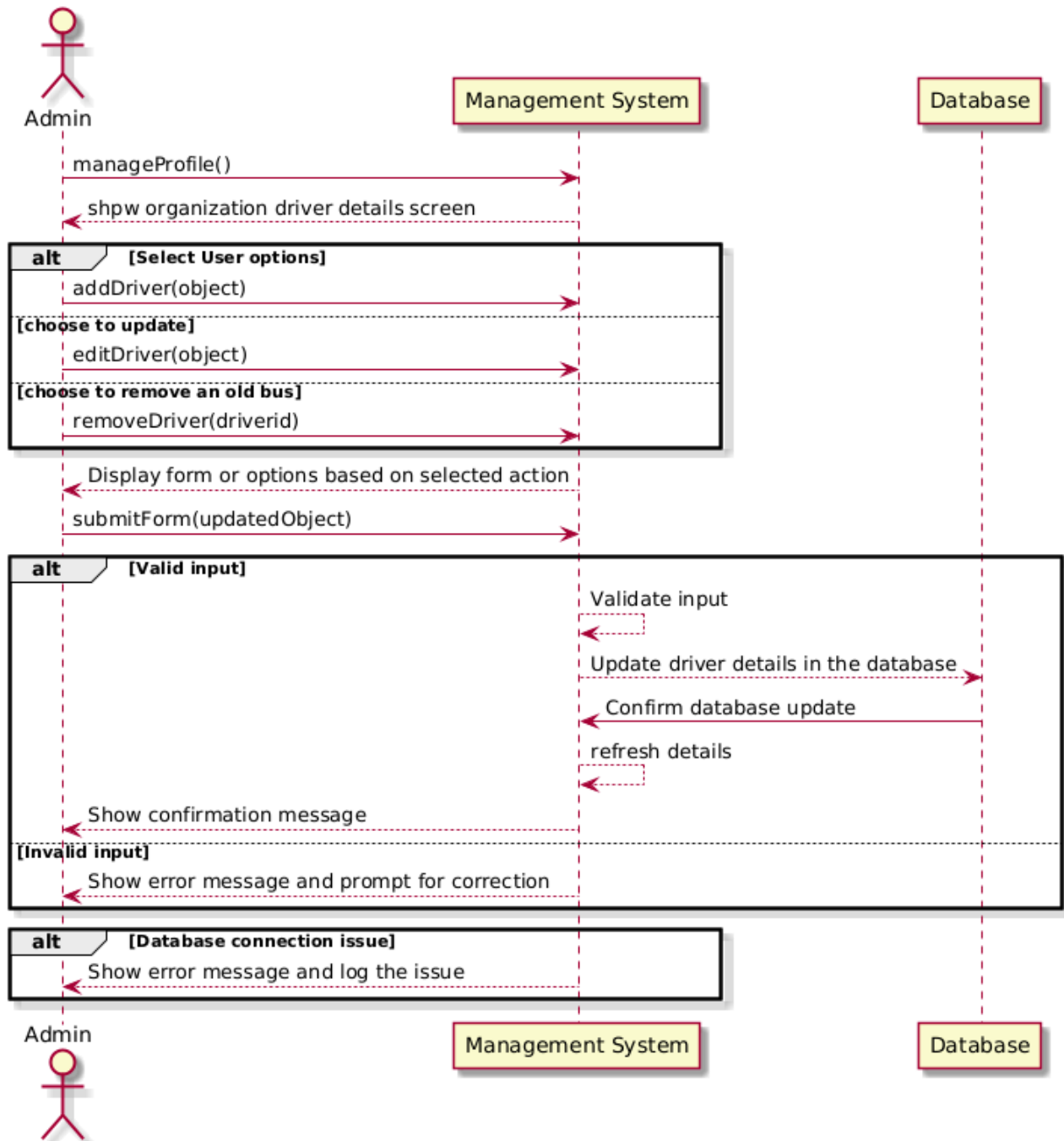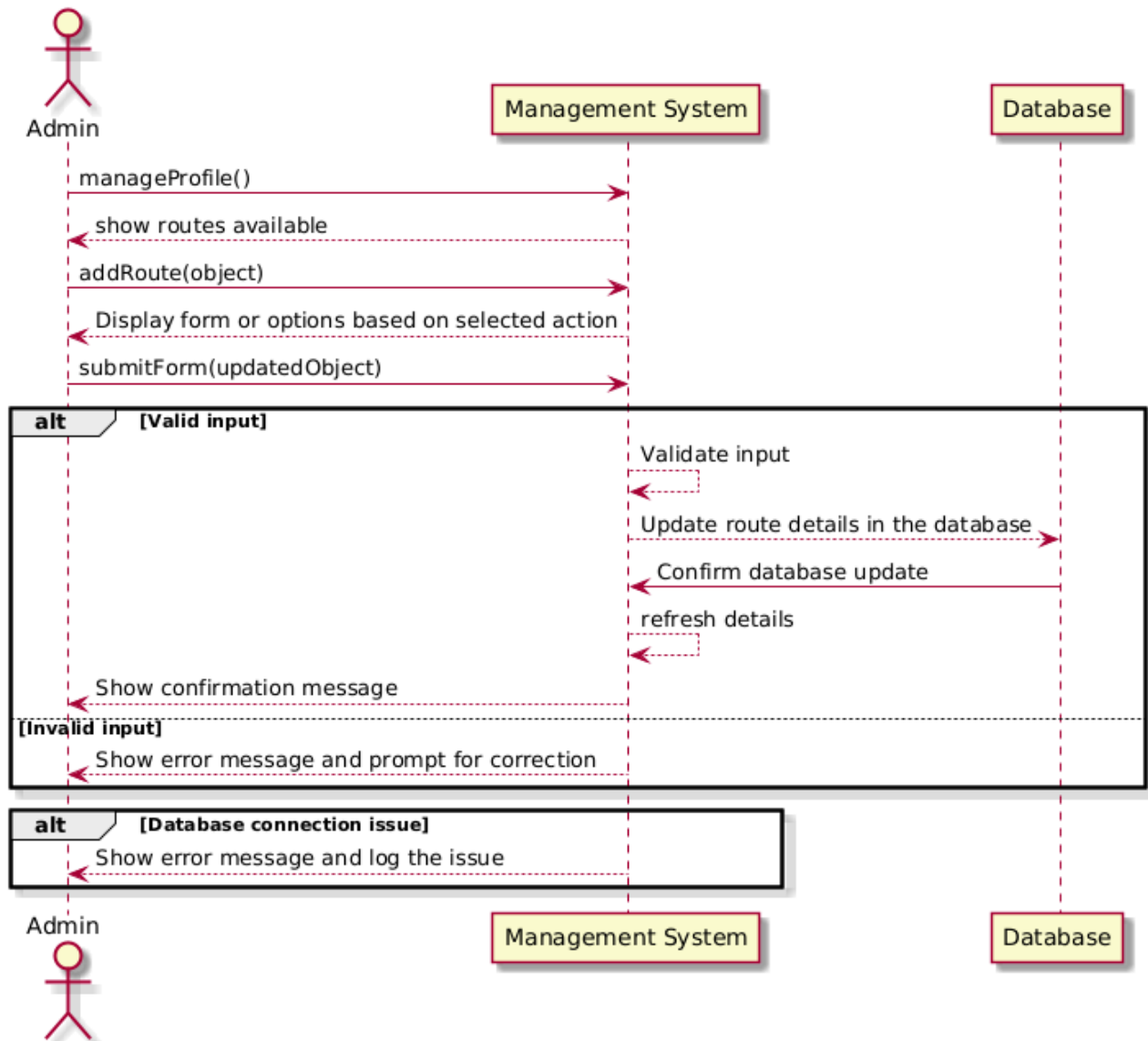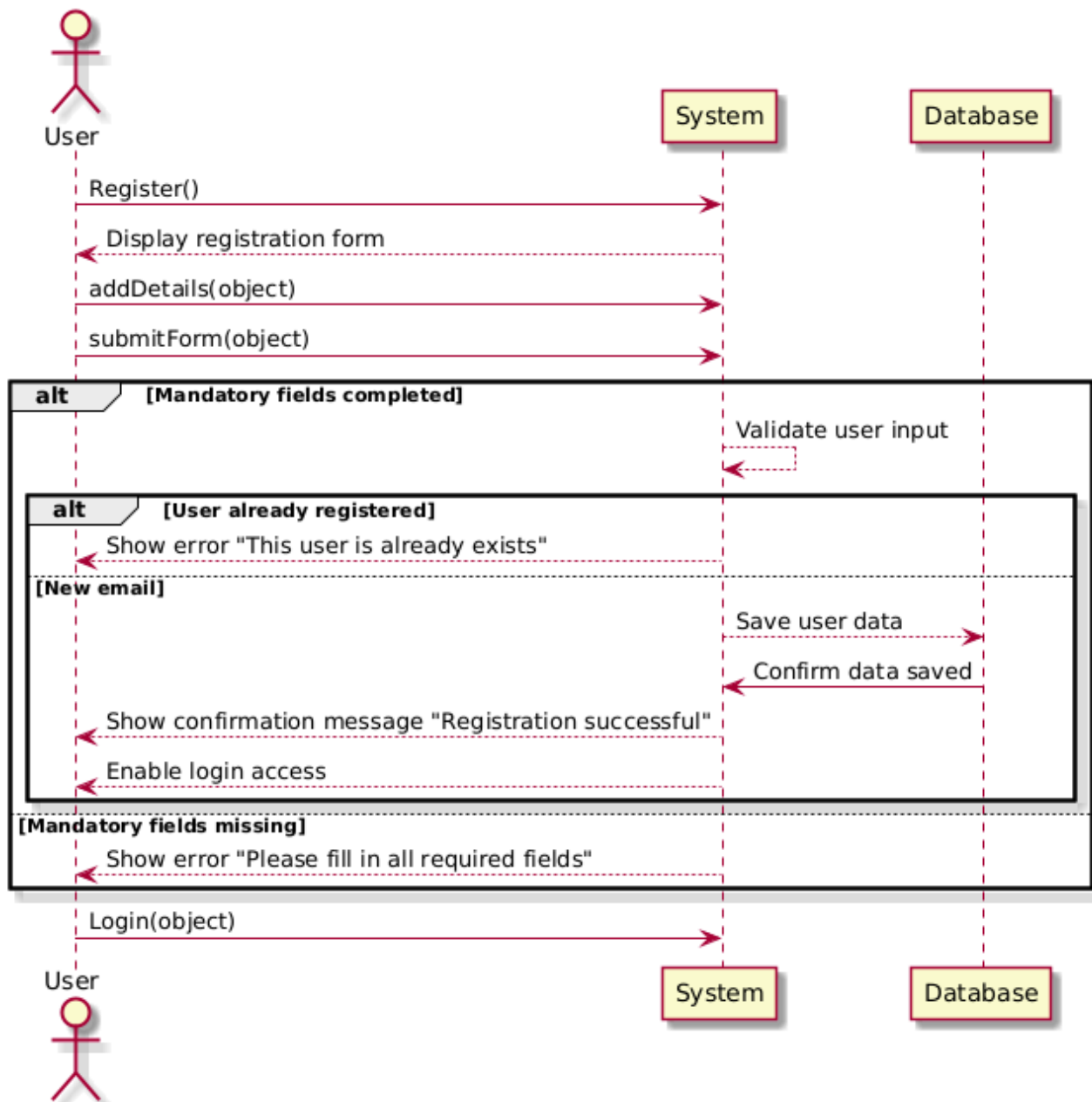
4. Domain Model

Domain Model

5. System Sequence Diagram

Seat Reservation

User → System: showOrganizationList()
System ⇢ Database: Retrieve available organizations
System ⇢ User: Display list of available organizations under user preferences
User → System: selectOrganization(org)
System ⇢ User: display routes of said organization
User → System: selectRoute(route)
System ⇢ User: return the route with its bus list

alt [Seat available]
User → System: selectSeat(busID,seatID)
System ⇢ Database: Reserve seat first avaiable seat and mark as unavailable
Database → System: Confirm seat reservation
System ⇢ User: Display confirmation message

[No seats available]
System ⇢ User: Show error "No seats available. Please select another bus."

alt [User cancels reservation before trip]
User → System: Cancel reservation
System ⇢ Database: Free up seat and update availability
System ⇢ User: Confirm seat cancellation

User → System: exitView()

Manage organization (BUS)

Manage organization (DRIVER)

Admin — Management System — Database

manageProfile()

shpw organization driver details screen

alt [Select User options]
addDriver(object)

[choose to update]
editDriver(object)

[choose to remove an old bus]
removeDriver(driverid)

Display form or options based on selected action

submitForm(updatedObject)

alt [Valid input]

Validate input

Update driver details in the database

Confirm database update

refresh details

Show confirmation message

[Invalid input]
Show error message and prompt for correction

alt [Database connection issue]
Show error message and log the issue

Admin — Management System — Database

Manage organization (Routes)
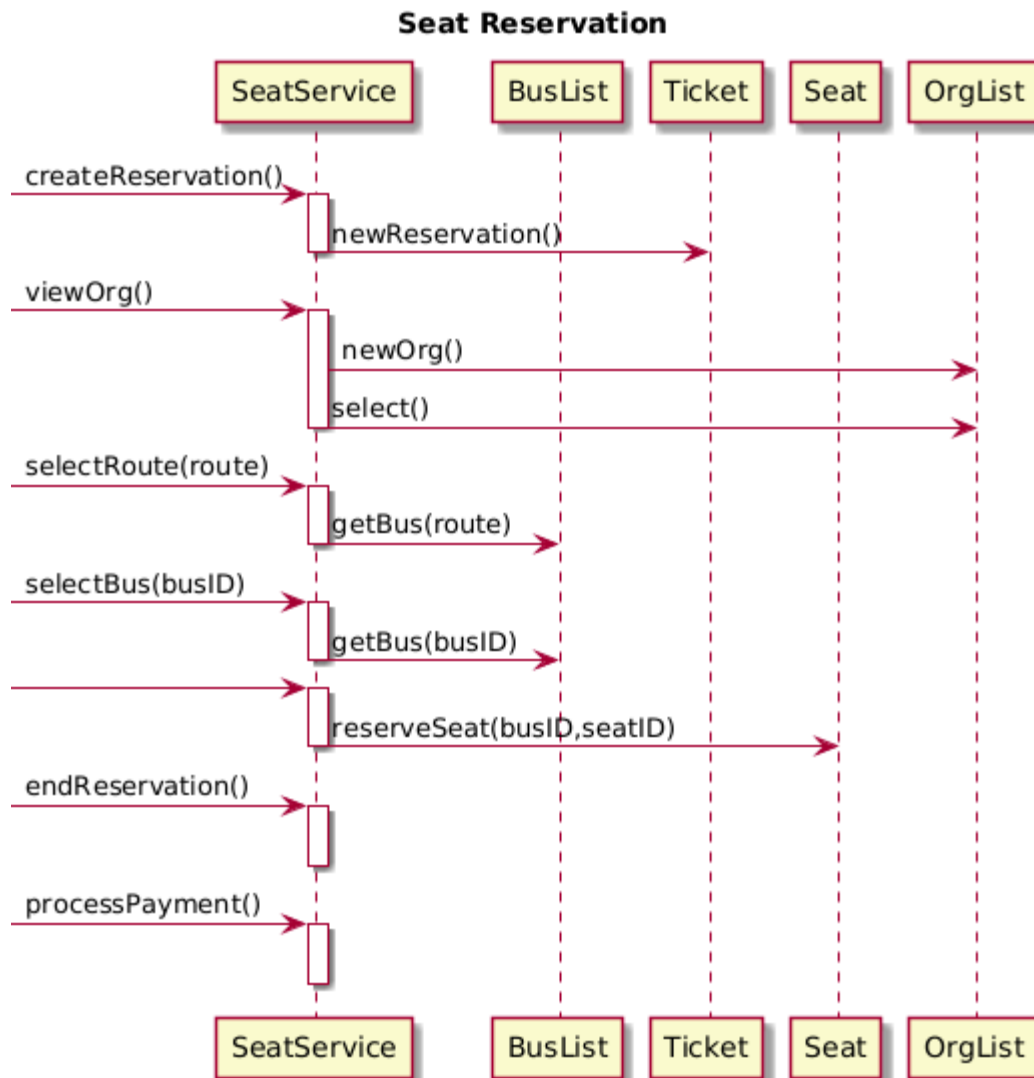
Register User

Generate Student Pass

6.   Sequence Diagram
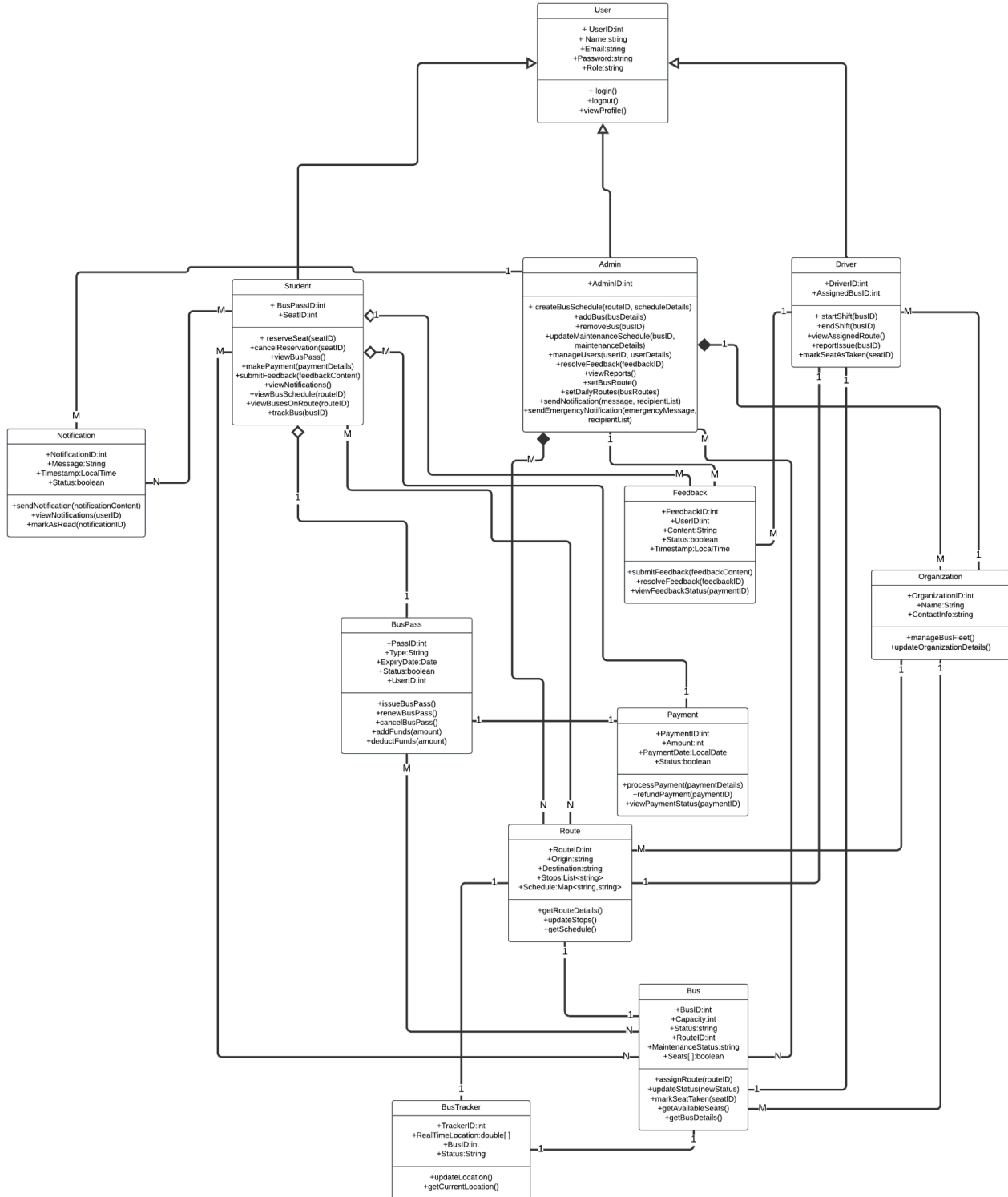
University Bus Pass

Feedback Report
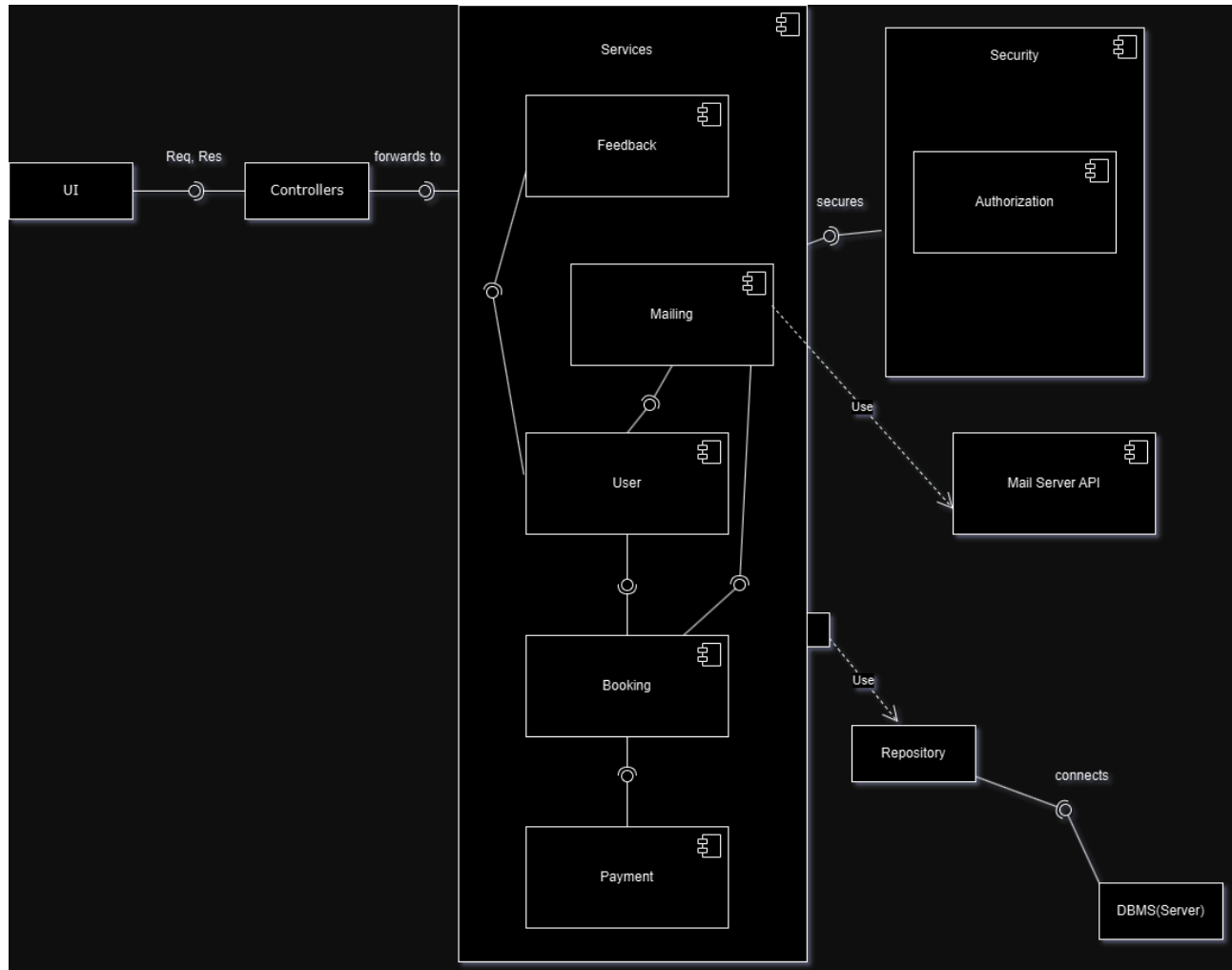
Seat Reservation

View available bus seats
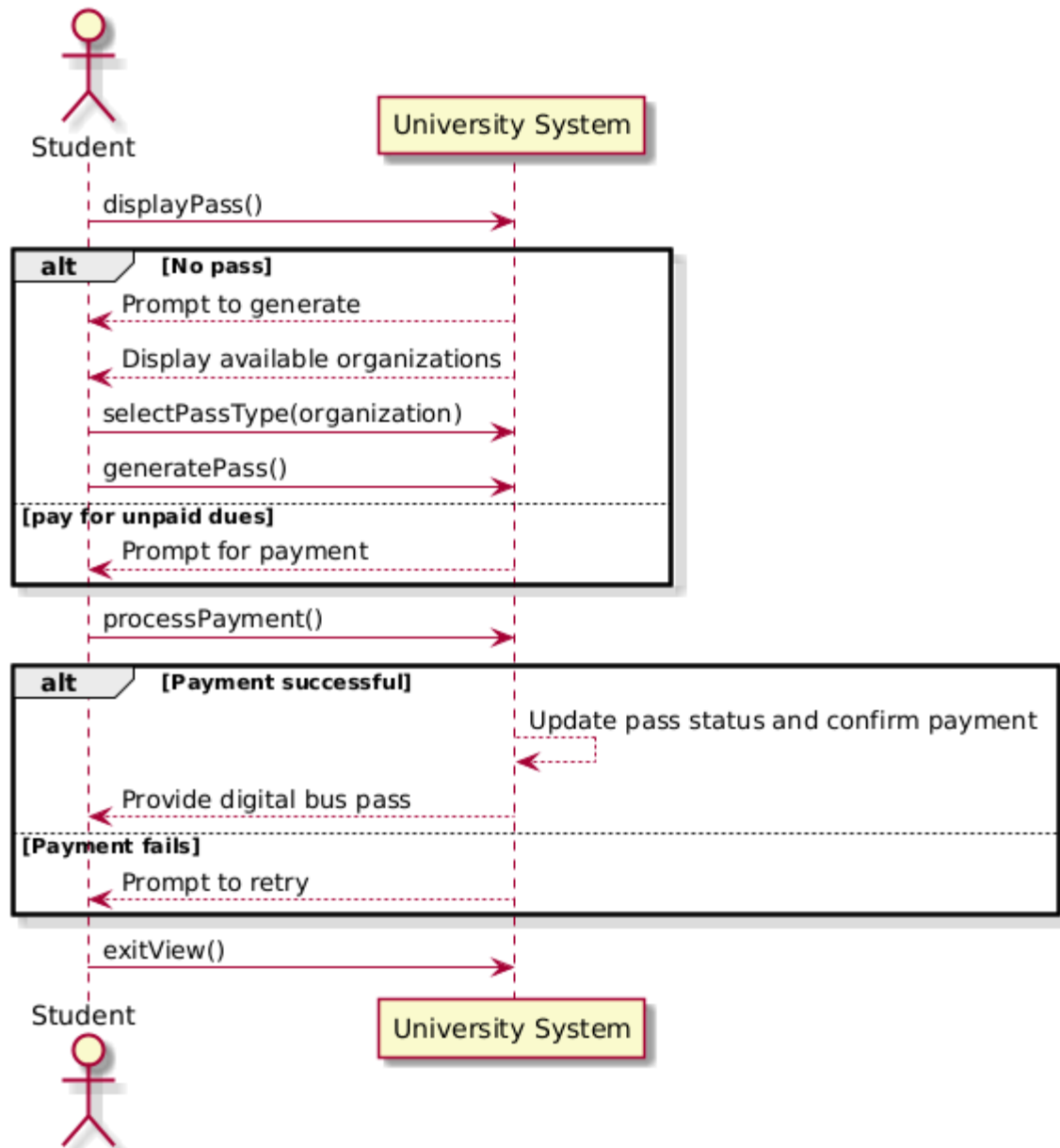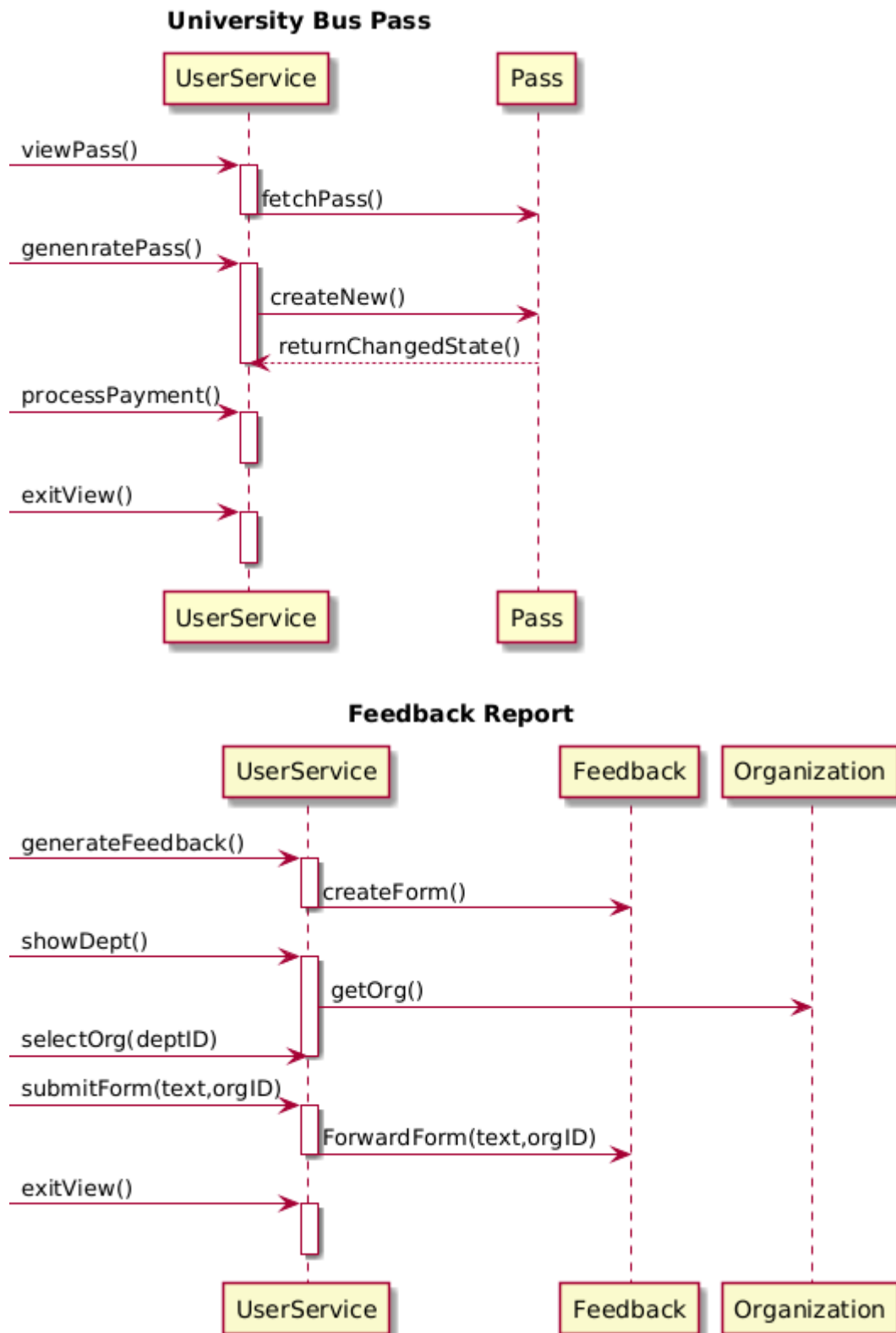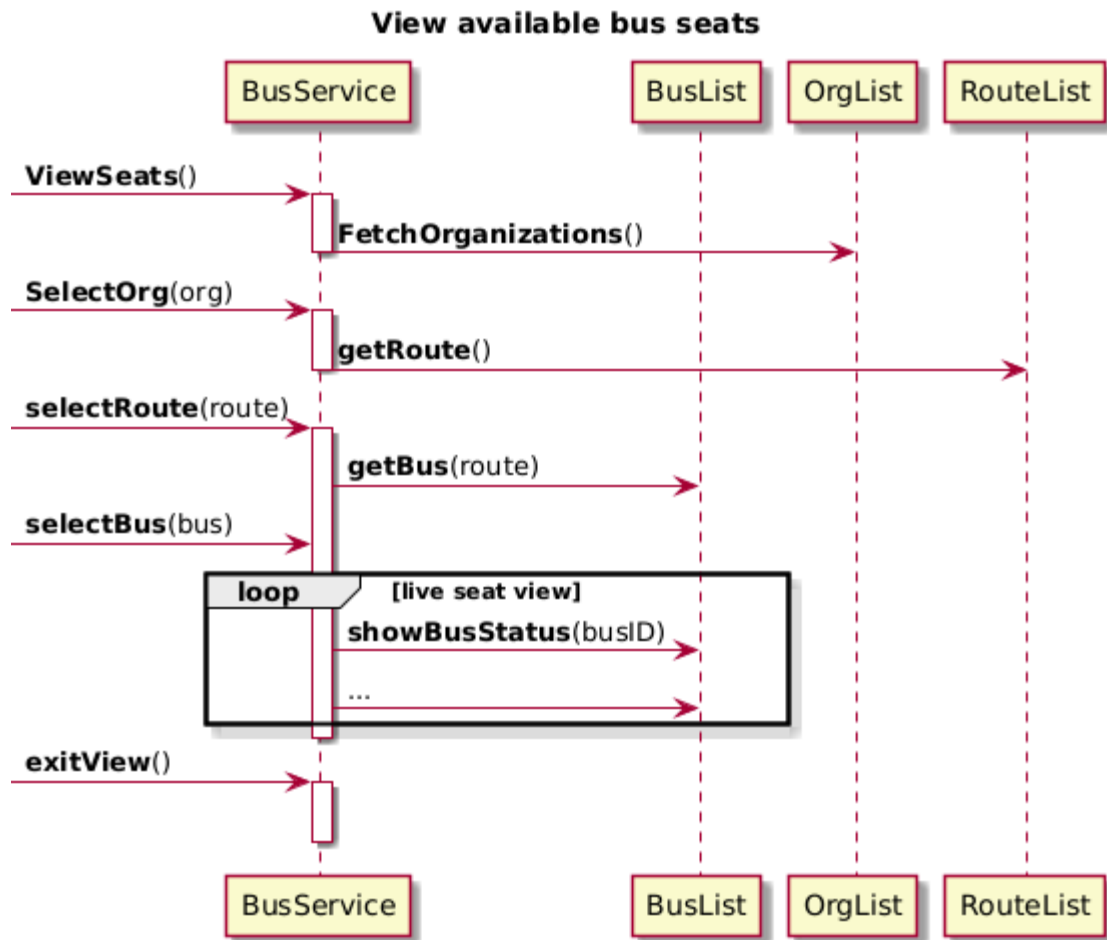
7. Class Diagram

8. Component Diagram

9.   Package Diagram

10. Deployment Diagram