Task 5 – Software Requirements Specification (SRS)

Project

CSE6224 Software Requirement Engineering
Term 2510

Tutorial Section	TT2L
SRS Contribution Group	Group E
Validation Group	**Group A**
Project Title	Campus Ride-Sharing Platform with Parking System Integration

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1.0 Introduction

1.1 Purpose

The purpose of this document is to outline the specific requirements needed to develop the Campus Ride-Sharing Platform with Parking System Integration, designed for use by students, staff, and faculty of Multimedia University (MMU). This platform aims to encourage eco-friendly commuting, reduce campus congestion, and optimize parking space usage by allowing verified users to share rides and view real-time parking availability.

The development team, project manager, quality assurance team, university stakeholders, and IT support personnel involved in the system's integration and deployment are the target audience for this document.

1.2 Scope

1.2.1 Functional Scope

User Onboarding & Digital ID Verification

- MMU single sign-on (SSO) ensures only one log in is required for a session.
- User profiles include name, university ID, photo, contact details, and vehicle information (make, model, license plate).

Ride Offer & Request

- Drivers publish ride offers with origin, destination, date/time, available seats, and vehicle type (e.g., sedan, SUV, van).
- Passengers search for or filter rides by schedule, proximity, or preferred vehicle type, then request to join.
- Matching is manual: drivers approve or decline incoming requests through the app.

Parking Availability

- Real-time campus parking occupancy map, highlighting “carpool-only” zones and general lots.

Rewards

- Reward Points System:
  - **Earn**: Drivers and riders earn points per trip (e.g., 10 points for drivers, 5 points for riders).
  - **Redeem**: Points can be redeemed for priority parking reservations in high demand lots, campus bookstore vouchers, or meal discounts at campus cafeterias.
  - **Leaderboard**: Top carpoolers receive badges and extra rewards to encourage regular participation.

Communication & Notifications

- Push notifications for ride confirmations, cancellations, parking spot reservations, and incentive milestones.
- In-app chat between matched drivers and riders for coordinating exact pickup/drop-off locations.

Ride History

- Users view a chronological log of past rides, seats offered/used, parking spots reserved, and rewards earned.

Safety & Emergency Features

- Users can add emergency contact information.
- Includes an SOS button that alerts selected contacts and shares ride details for safety.

User Ratings & Feedback System

- After each ride, drivers and passengers can rate and comment on each other.

Admin Dashboard & Reporting

- Web-based dashboard for administrators to view key KPIs immediately (total rides, active carpools, parking occupancy trends, reward redemptions).
- Custom report generation and export (CSV/PDF) on ride usage, parking utilization, reward redemption, and user growth over any selected period.

1.2.2 Non-Functional Scope

Performance & Reliability

- Support an initial user base of up to 500 simultaneous active sessions during initial release phase that lasts for 3 months.
- The system shall provide a fallback display (such as last cached data with offline mode warning label) if real-time parking data is delayed or unavailable."

Security & Privacy

- The system shall ensure that all user data is protected, with access restricted to verified MMU-affiliated users only.
- All data shall be encrypted in transit using TLS and encrypted at rest within database.

Usability

- Follow a mobile-first design approach, optimized for use on both iOS and Android devices.
- Provide simple, intuitive screens (3-tap workflows) for creating/joining rides.

1.2.3 Stakeholder Identification & Analysis

Stakeholder	Role & Needs
Students	• Require affordable, eco-friendly commute • Prefer easy and fast scheduling
Lecturers & Staff	• Require reliable on-time rides • Obtain secure, university-verified access
Parking Admin Team	• Require accurate occupancy data • Tasked to define carpool zones
IT & Security Office Staff	• Ensure compliance with university policies • Approve SSO system.
Project Team	• Plan, build, test, and deploy the platform
Student Representative Council (SRC)	• Facilitate partnerships with external businesses to support incentive programs

1.3 Product Overview

The Campus Ride-Sharing Platform with Parking System Integration is an integrated module in MMU's online environment, providing ride-sharing coordination and parking management. It connects students, faculty, and employees with university infrastructure for secure, efficient, and environmentally friendly trips.

This platform communicates with several MMU infrastructure's central components, enabling seamless data exchanges between security, transport logistics, and parking management. It communicates with the MMU SSO Authentication to ensure user entry authentication, employs the Campus Parking Database for real-time tracking, and employs a Carpool Matching Engine to process ride requests and approval. Additionally, a notification system provides the alerts on ride confirmations, parking spots, incentive notifications, and emergency alerts.

Part of MMU's overall drive for increased mobility on campus, the platform supports safe and verified ride-sharing, better use of parking space, and sustainable behavior encouragement through reward-based incentives. Fully integrated with MMU's IT infrastructure, security controls, and parking facilities management, the platform offers a convenient commuting experience in compliance with the university policy.

1.3.1 Product Perspective

Figure 1.0 shows the context of Campus Ride-Sharing Platform with Parking System Integration.

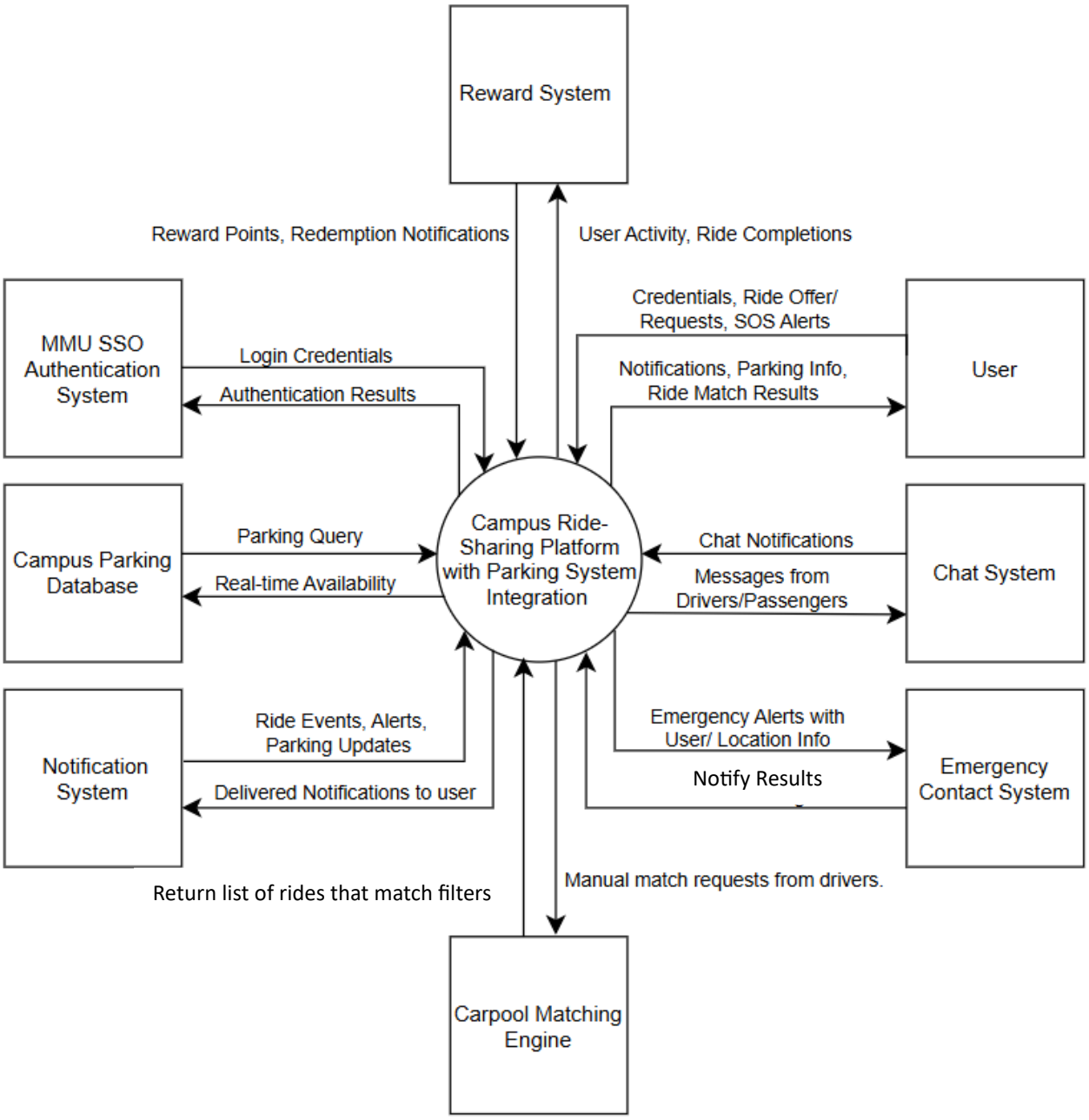

Figure 1.0 Campus Ride-Sharing Platform with Parking System Integration Context Diagram

The users authenticate login via the MMU SSO Authentication System, book rides, send SOS messages, and get parking lot availability and ride matching updates. The Reward System tracks complete rides and redemption alerts, and the Chat System is used for one-to-one chat between the passenger and the driver. In case of emergencies, the Emergency Contact System processes SOS messages and sends messages with user and location status. Ride-sharing coordination is facilitated through the Carpool Matching Engine, responsible for handling manual match requests and confirmations. To keep users informed in a timely fashion, the notification system provides notice regarding ride events as well as parking spaces. The Campus Parking Database provides real-time feedback to queries about parking, again increasing accessibility speed. All these elements balance increasing campus transport efficiency with a safe and user-friendly experience.

1.3.2 Product Functions

The Campus Ride-Sharing Platform with Parking System Integration shall provide the following primary functions:

User Account Management

ID	Description	Accessible Role
FR-1	Allow users to register using their MMU credentials	Driver, Passenger
FR-2	Enable users to create and manage their profile information	Driver, Passenger
FR-3	Support user preference settings for ride matching	Driver, Passenger

Ride Offering and Requesting

ID	Description	Accessible Role
FR-4	Allow users to offer rides by specifying origin, destination, time, and available seats	Driver, Passenger
FR-5	Enable users to request rides by specifying pickup location, destination, and time	Driver, Passenger
FR-6	Support recurring ride scheduling for regular commutes	Driver, Passenger
FR-7	Provide ride modification and cancellation capabilities	Driver, Passenger

Ride Matching and Coordination

ID	Description	Accessible Role
FR-8	Allow users to manually browse, select, and confirm ride matches based on preferences.	Driver, Passenger
FR-9	Facilitate in-app communication between drivers and passengers	Driver, Passenger
FR-10	Receive Notification for each successful interaction with the system.	Driver, Passenger

Parking System Integration

ID	Description	Accessible Role
FR-11	Display real-time parking availability across campus zones	Driver, Passenger
FR-12	Reserve priority parking spots for verified carpools	Driver, Passenger
FR-13	Provide navigation to available parking areas	Driver, Passenger

Safety and Security

ID	Description	Accessible Role
FR-14	Verify user identity through MMU SSO authentication	Driver, Passenger
FR-15	Provide SOS emergency alert functionality	Driver, Passenger
FR-16	Enable ride tracking for designated emergency contacts	Driver, Passenger
FR-17	Support rider rating and review system	Driver, Passenger

Reward Management

ID	Description	Accessible Role
FR-18	Award eco-points for successful carpooling participation	Driver, Passenger
FR-19	Provide a leaderboard of top carpoolers	Driver, Passenger
FR-20	Enable redemption of rewards (parking credits, campus vouchers)	Driver, Passenger

Reporting and Analytics

ID	Description	Accessible Role
FR-21	Generate personal ride history and statistics	Admin
FR-22	Provide system usage reports for administrators	Admin
FR-23	Calculate environmental impact metrics	Admin
FR-24	Support customizable data export functionality	Admin

1.3.3 User Characteristics

The system will serve the following user groups, each with specific characteristics and expectations:

Role	Description	Characteristic
Student	Primary user group representing approximately 70% of the user base	• Typically, aged 18-25 with high technological proficiency • Have varied and sometimes irregular schedules • Usually operate on limited budgets, making cost-sharing appealing • Often live in clusters near campus or in designated student housing • Primary motivation: cost savings and convenience
Lecturer & Staff	Representing approximately 15% of the user base	• Regular working hours (typically 8:00 AM - 5:00 PM) • Consistent commuting patterns • Primary motivation: convenience and potential for social connections

System Administrator	Small group responsible for system maintenance and monitoring	• Require comprehensive understanding of all system features • Need access to administrative functions and reports • Technical expertise allowing system configuration and troubleshooting • Primary focus: system efficiency, security, and user satisfaction
All User		• Must possess basic mobile device proficiency • Require MMU digital credentials for authentication • Need reliable internet access for real-time features • Should understand basic navigation concepts • Will need clear guidelines on emergency procedures

The system shall accommodate these diverse user groups by providing intuitive interfaces, clear instructions, and tailored messaging appropriate to each user's role and technical proficiency level.

1.3.4 Limitations

The Campus Ride-Sharing Platform with Parking System Integration operates under the following constraints and limitations:

Technical Limitations

- The system operates only within the geographical boundaries of MMU campuses and immediate surroundings (within 10km radius).
- Real-time parking data accuracy depends on the reliability of MMU's existing parking sensors and infrastructure.
- GPS accuracy is limited to approximately 5-10 meters, which may affect precise pickup coordination.
- The platform requires internet connectivity for core functionalities; offline mode supports only limited features.
- Mobile application performance may vary across different device specifications and operating system versions.

Operational Limitations

- The system can support a maximum of 1,000 concurrent active ride sessions.
- Ride matching will operate only during campus operational hours plus an additional buffer of 2 hours before and after (5:00 AM - 11:00 PM).
- Emergency SOS features require campus security personnel availability, which may fluctuate.
- System maintenance windows will be scheduled weekly, during which certain features may be unavailable.
- User verification is contingent upon the reliability of MMU's SSO authentication system.

Regulatory Limitations

- The system does not provide commercial ride-sharing services and cannot be used for profit-generating activities.
- The platform is not a substitute for public transportation or commercial ride-hailing services.
- Insurance coverage for ride-sharing activities is not provided by the system or the university.
- Data retention policies comply with Malaysian personal data protection regulations, limiting historical data availability.
- The system does not enforce legal agreements between riders beyond the user terms and conditions.

Business Limitations

- Initial rollout will be limited to the main campus, with phased expansion to satellite campuses.
- The reward system operates within the constraints of the university's allocated budget for sustainability initiatives.
- Integration with third-party services is subject to existing university contracts and procurement procedures.
- System customization capabilities are constrained by the development team's resources and timeline.
- Priority parking spot allocation is subject to availability and university parking management policies.

1.4 Definition

Carpool Matching Engine	The system component responsible for pairing ride requests and ride offerings based on route and timing compatibility
Campus Parking System	A real-time system that tracks available parking spaces and occupancy rates across different campus zone
Eco-Points	Reward points earned through carpool participation that can be redeemed for rewards such as priority parking or vouchers
Emergency Contact System	A module designed to notify pre-configured contacts and campus security in case of ride-sharing emergencies
KPIs	Key Performance Indicators for tracking ride efficiency.
Push Notifications	Automated alerts sent to users via the mobile application to inform them of ride matches, confirmations, parking updates, or emergency messages
REST API	an application programming interface (API) that conforms to the design principles of the representational state transfer (REST) architectural style, a style used to connect distributed hypermedia systems
SOS	Emergency notification feature for safety alerts.
SSO	Single Sign-on authentication for users.

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3.0 Requirements

3.1 Functions

This section details the functional requirements of the Campus Ride-Sharing Platform with Parking System Integration through use cases and their specifications. The functionality is organized based on the primary user roles: Student, Faculty/Staff, and Administrator. Figure 2.0 shows the overall use case of the Campus Ride-Sharing Platform with Parking System Integration:

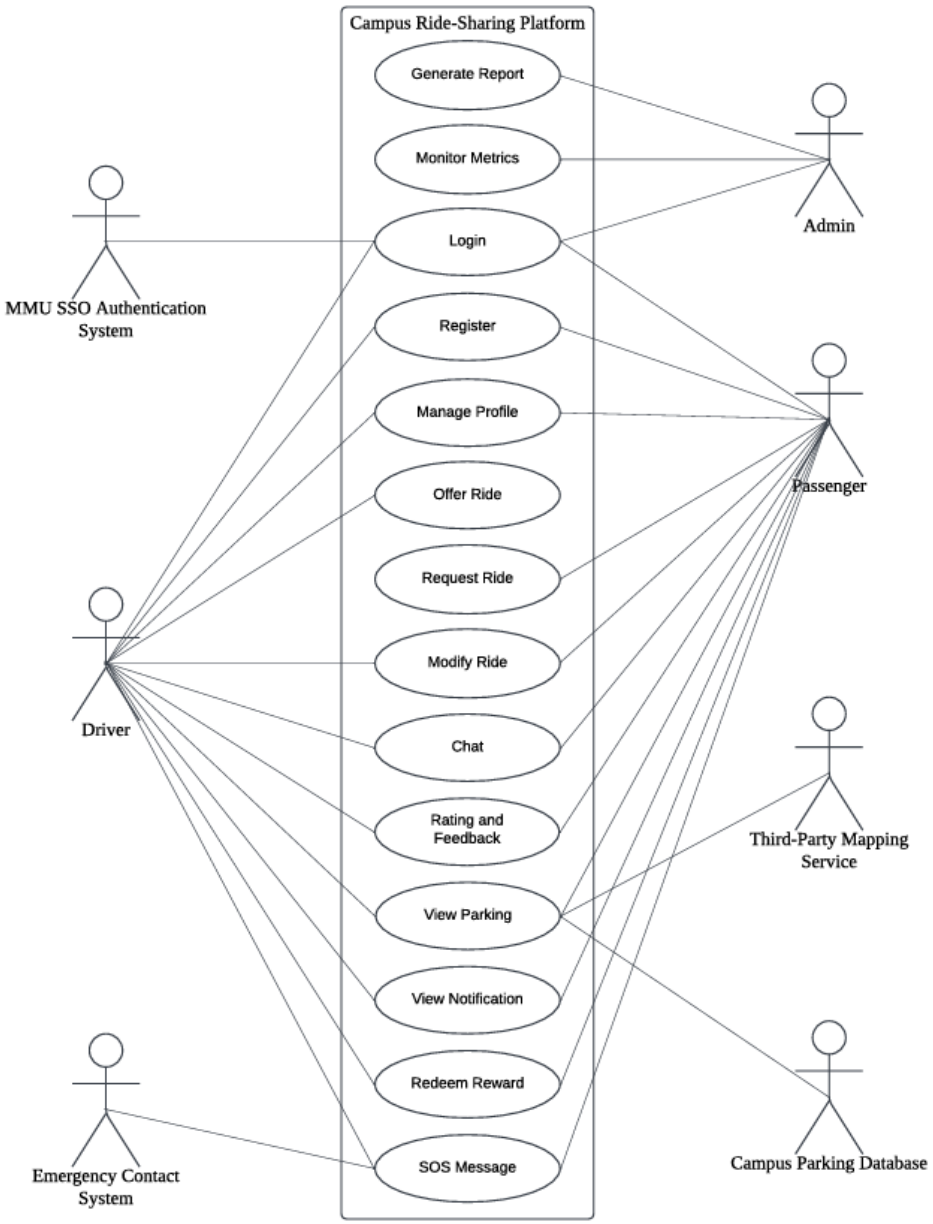
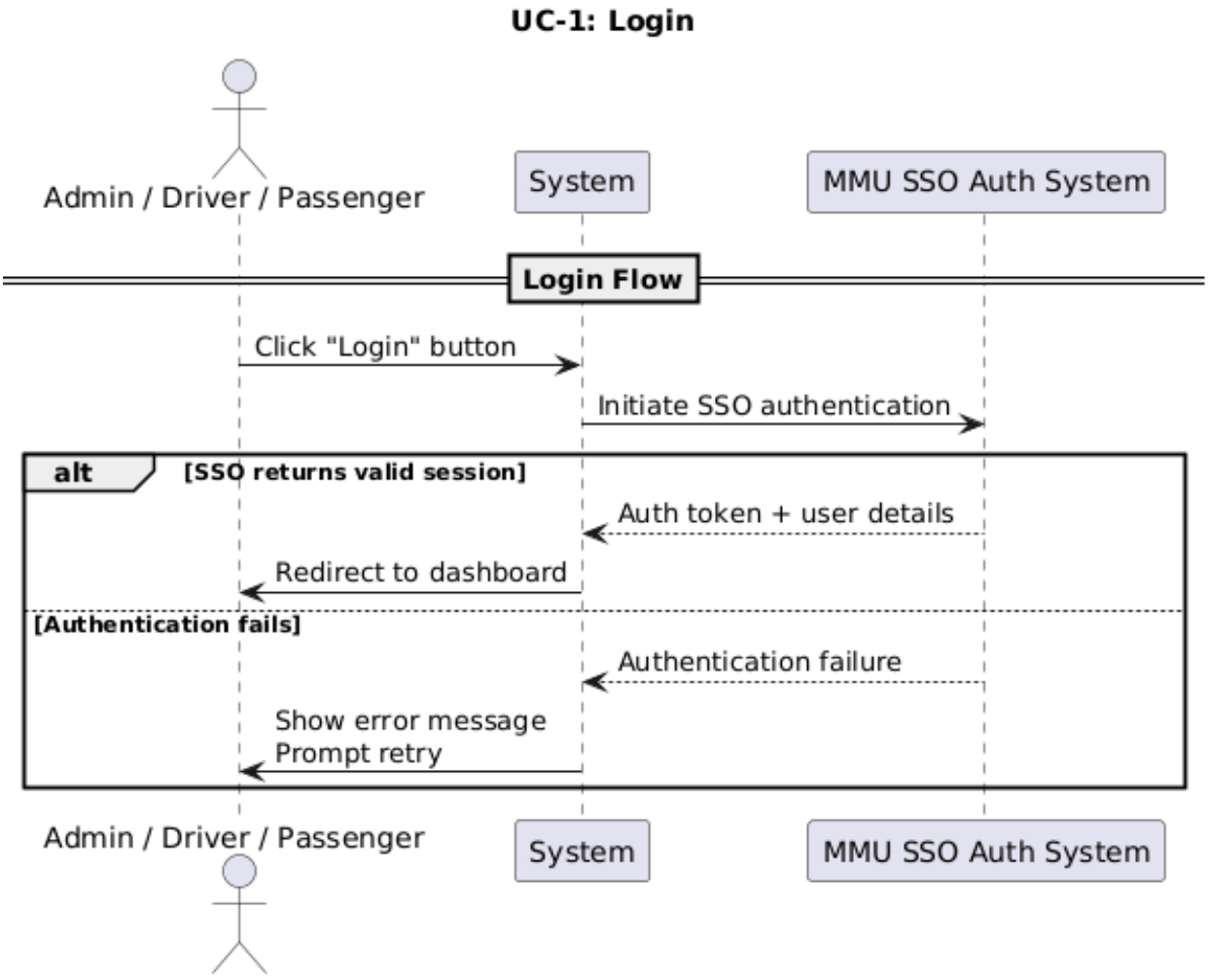


Figure 2.0 Campus Ride-Sharing Platform with Parking System Integration Overall Use Case

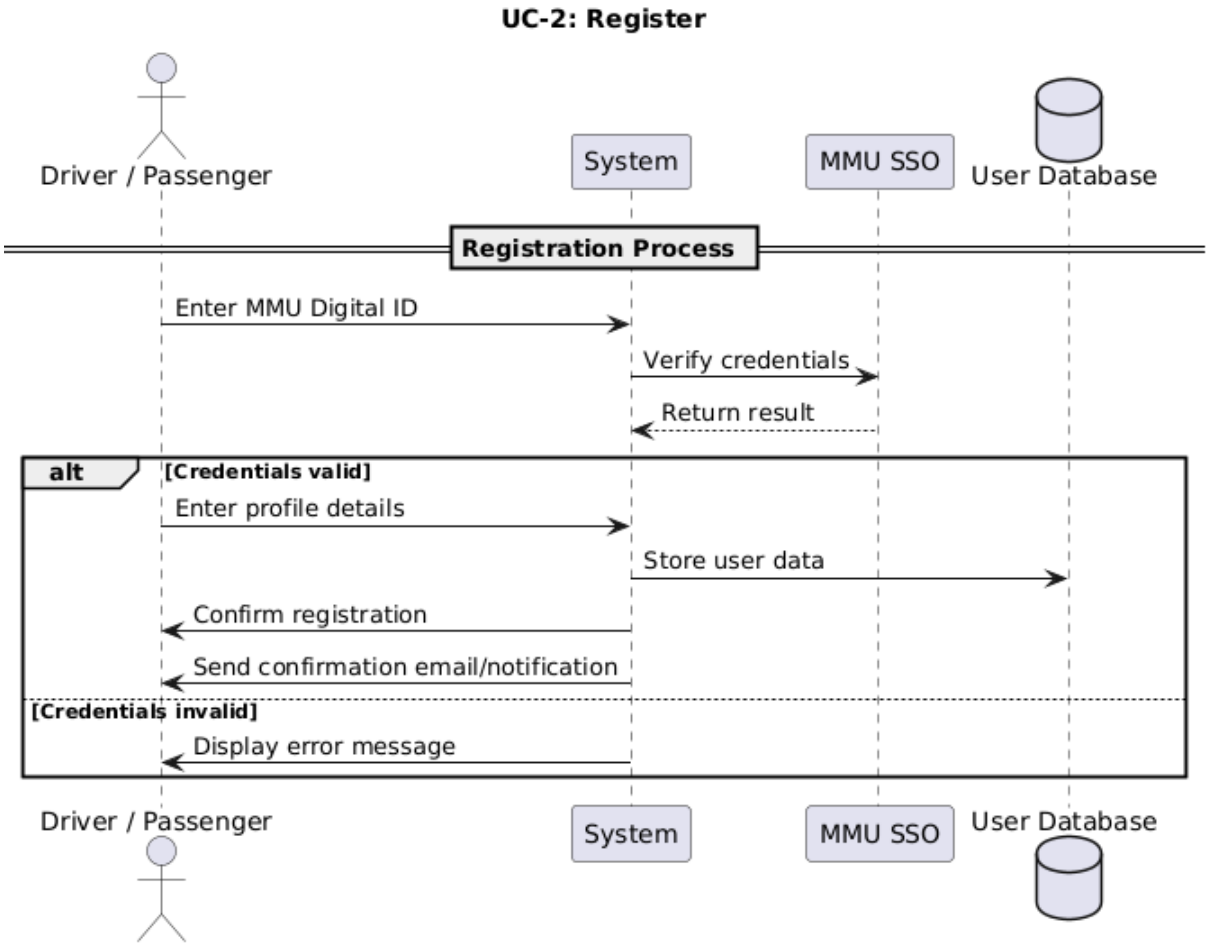
3.1.1 Login

Use Case ID	UC-1	**Use Case**	Login
Description	Allows users to securely access the platform using their MMU credentials. Ensures authorized access to features based on user role		
Actors	Admin, Driver, Passenger, MMU SSO Authentication System		
Preconditions	User must be registered		
Postconditions	User gains access to the platform		
Basic Flow	1. Users click login button. 2. The system verifies credentials via MMU SSO Authentication System. 3. If valid, the system grants access to the dashboard. 4. If invalid, the system displays an error message and prompts retry.		



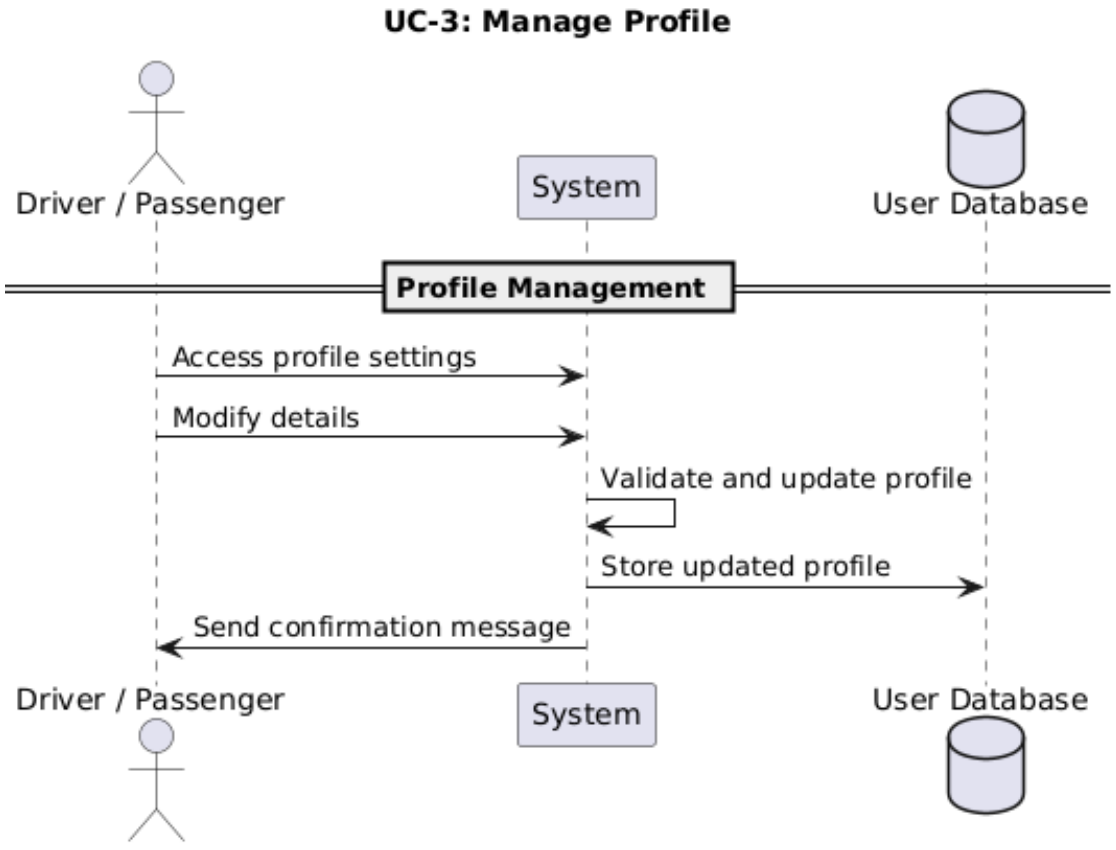
3.1.2 Register

Use Case ID	UC-2	**Use Case**	Register
Description	Enables new users to create accounts using their MMU digital ID for identity verification		
Actors	Driver, Passenger		
Preconditions	User has valid MMU credentials		
Postconditions	Users can create accounts		
Basic Flow	1. User enters MMU digital ID details. 2. The system verifies credentials via MMU SSO. 3. User fills in profile information (name, car details, preferences). 4. System stores detail and confirms registration. 5. User receives confirmation email or notification.		



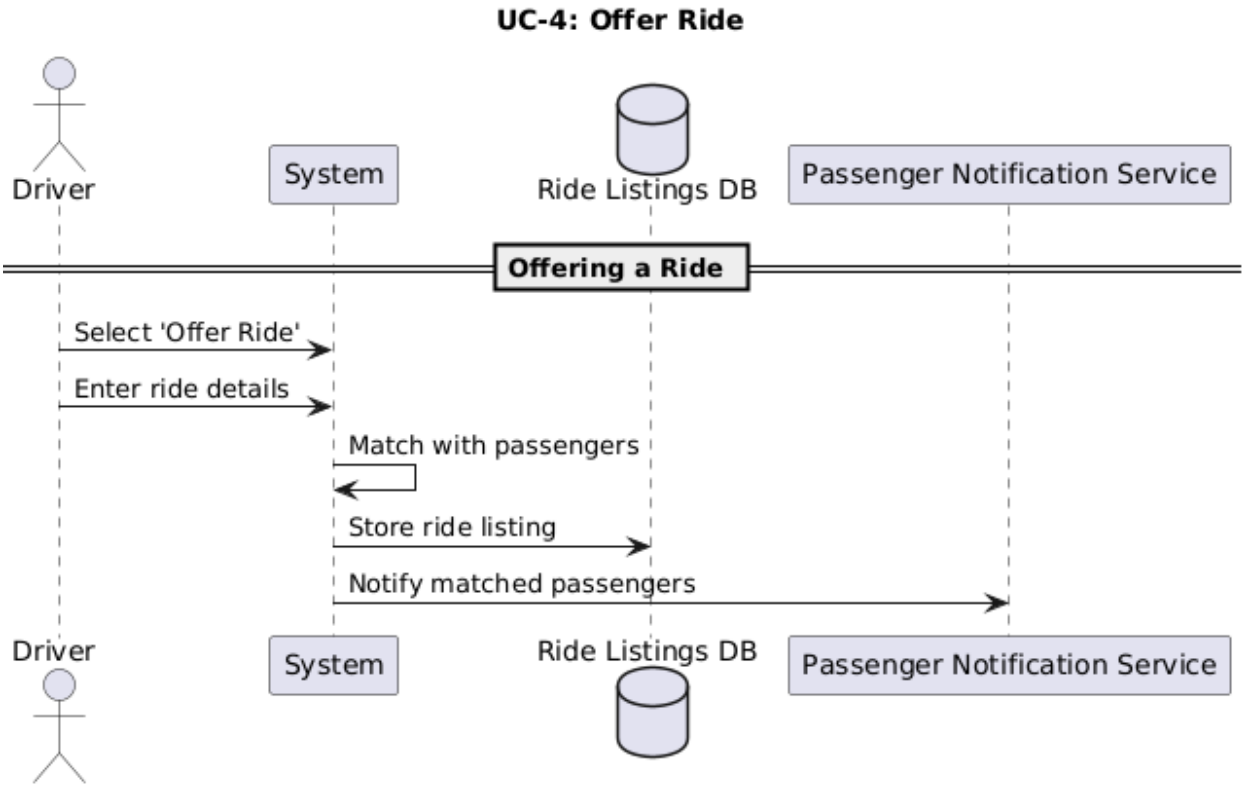
3.1.3 Manage Profile

Use Case ID	UC-3	**Use Case**	Manage Profile
Description	Allows users to update personal details, preferences, and vehicle information in their profile		
Actors	Driver, Passenger		
Preconditions	User must be authenticated		
Postconditions	Profile details are successfully updated		
Basic Flow	1. Users access the profile settings page. 2. Users modify personal details, preferences, or vehicle information. 3. System validates and updates changes. 4. System stores updated details in the database. 5. User receives confirmation message		



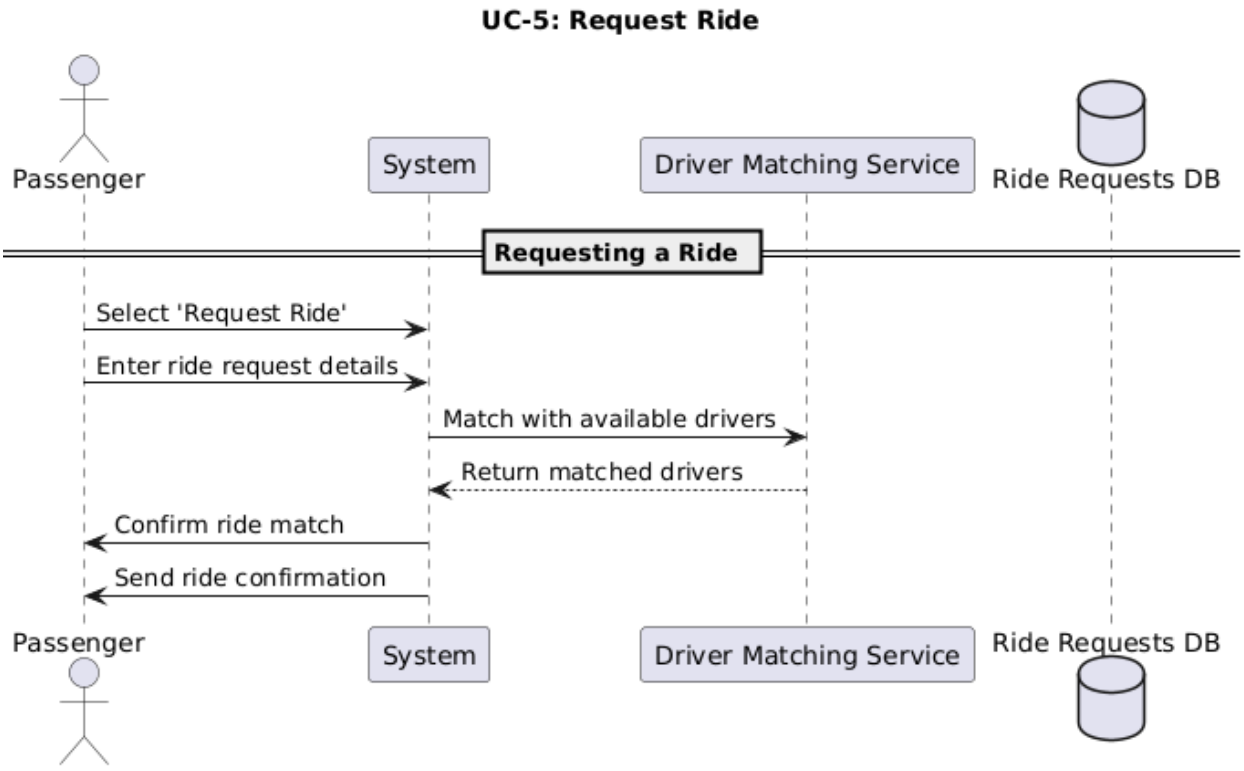
3.1.4 Offer Ride

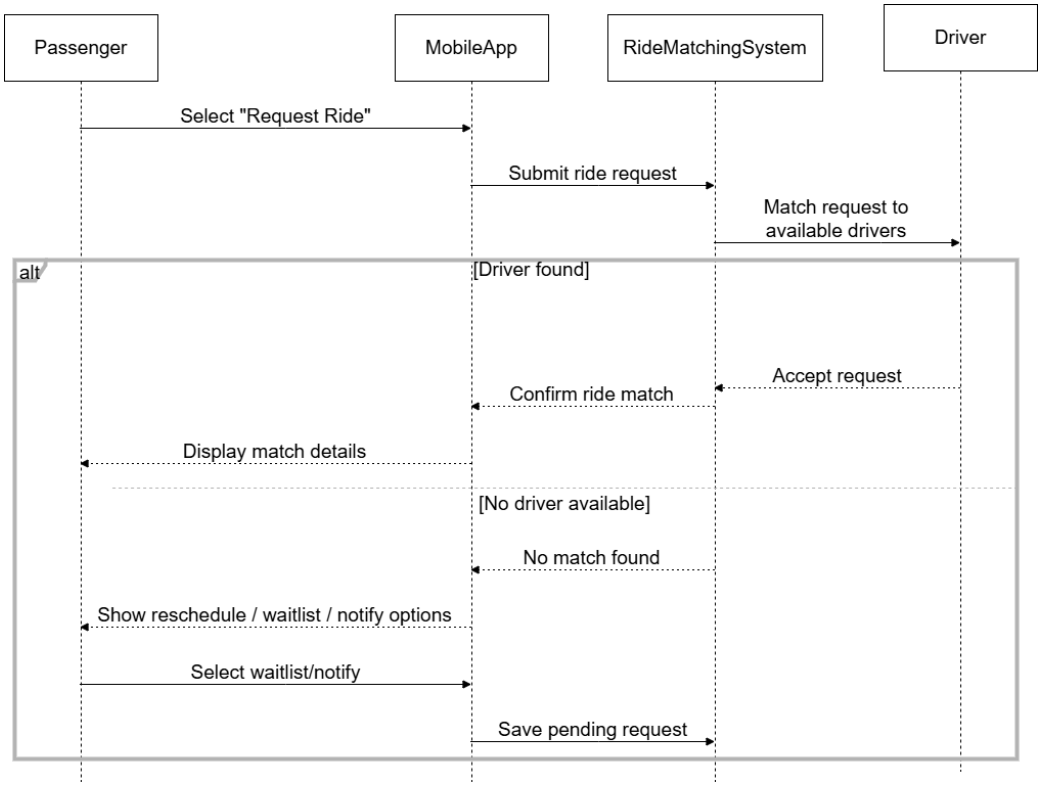
Use Case ID	UC-4	**Use Case**	Offer Ride
Description	Enables drivers to create a ride listing, specifying route, time, and seat availability		
Actors	Driver		
Preconditions	Users must be authenticated and have a registered vehicle		
Postconditions	Ride listing is created and available for passenger matching		
Basic Flow	1. The driver selects the “Offer Ride" option. 2. Driver enters the ride details (origin, destination, time, seats available). 3. The system verifies details and matches with potential passengers. 4. System stores ride listing in the database. 5. System sends notifications to matched passengers		



3.1.5 Request Ride

Use Case ID	UC-5	**Use Case**	Request Ride
Description	Allows passengers to find and request available rides based on their preferred pickup location and destination		
Actors	Passenger		
Preconditions	User must be authenticated		
Postconditions	The ride request is either successfully matched with a driver or placed into a pending queue for further notification.		
Basic Flow	1. Passenger selects the “Request Ride" option. 2. Passenger enters pickup location, destination, and preferred time. 3. The system verifies details and matches requests with available drivers. 4. The system confirms match and notifies passengers. 5. Passenger receives ride confirmation details		
Alternate Flow	If no suitable driver is available when the ride request is submitted: 1. Notify the user that no immediate match was found. 2. The system shall offer the user the option to: o Reschedule the request for another time. o Join a waitlist for auto-matching. o Receive a notification when a driver becomes available for the route.		

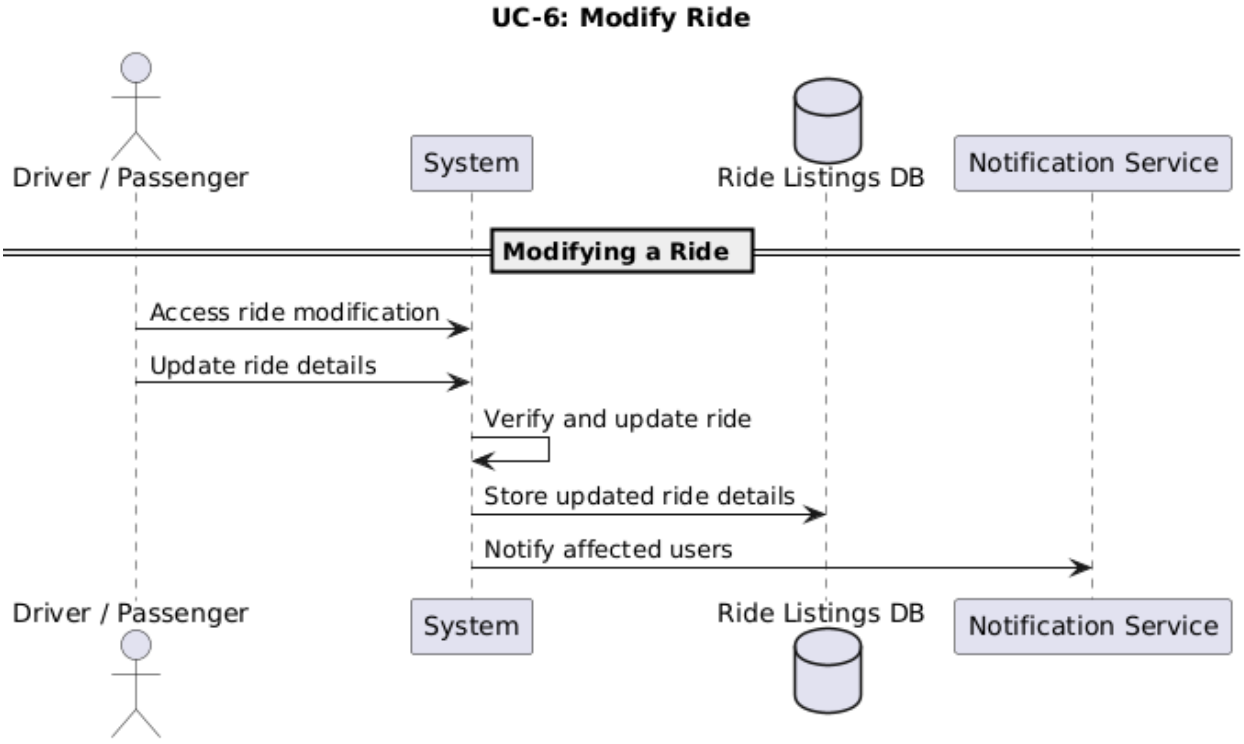




Alternate Flow to UC-5

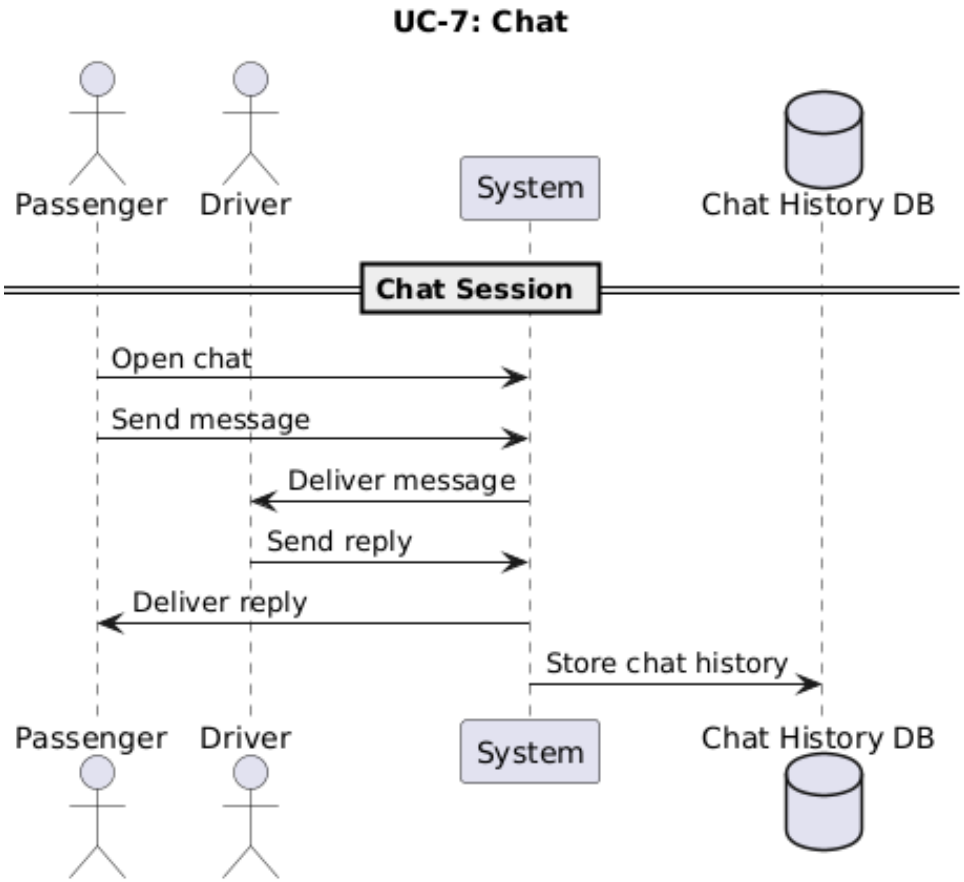
3.1.6 Modify Ride

Use Case ID	UC-6	**Use Case**	Modify Ride
Description	Let users update ride details such as destination, timing, or passenger count		
Actors	Driver, Passenger		
Preconditions	User must have an active ride listing or request		
Postconditions	Ride details are successfully modified		
Basic Flow	1. User accesses ride modification settings. 2. User updates ride details (timing, destination, passenger count). 3. The system verifies modifications and updates ride listing. 4. System notifies affected users of changes		



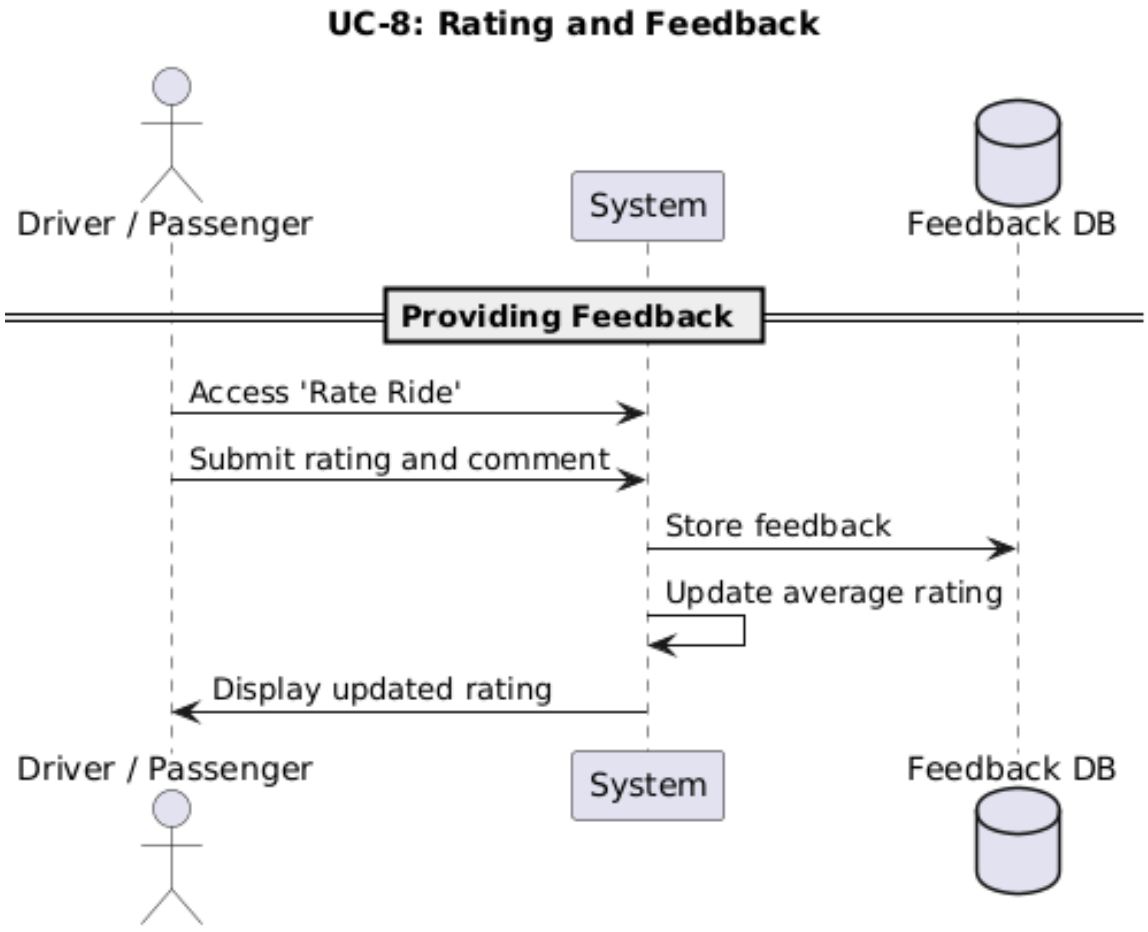
3.1.7 Chat

Use Case ID	UC-7	**Use Case**	Chat
Description	Provides an in-app messaging feature for drivers and passengers to coordinate rides effectively		
Actors	Driver, Passenger		
Preconditions	User must have a matched ride session		
Postconditions	Messages exchanged between rider and driver are stored and delivered		
Basic Flow	1. Passenger selects chat options within ride details. 2. Passenger sends messages. 3. The system delivers messages to the driver. 4. The driver responds and the system delivers a reply. 5. The system retains chat history for future reference.		



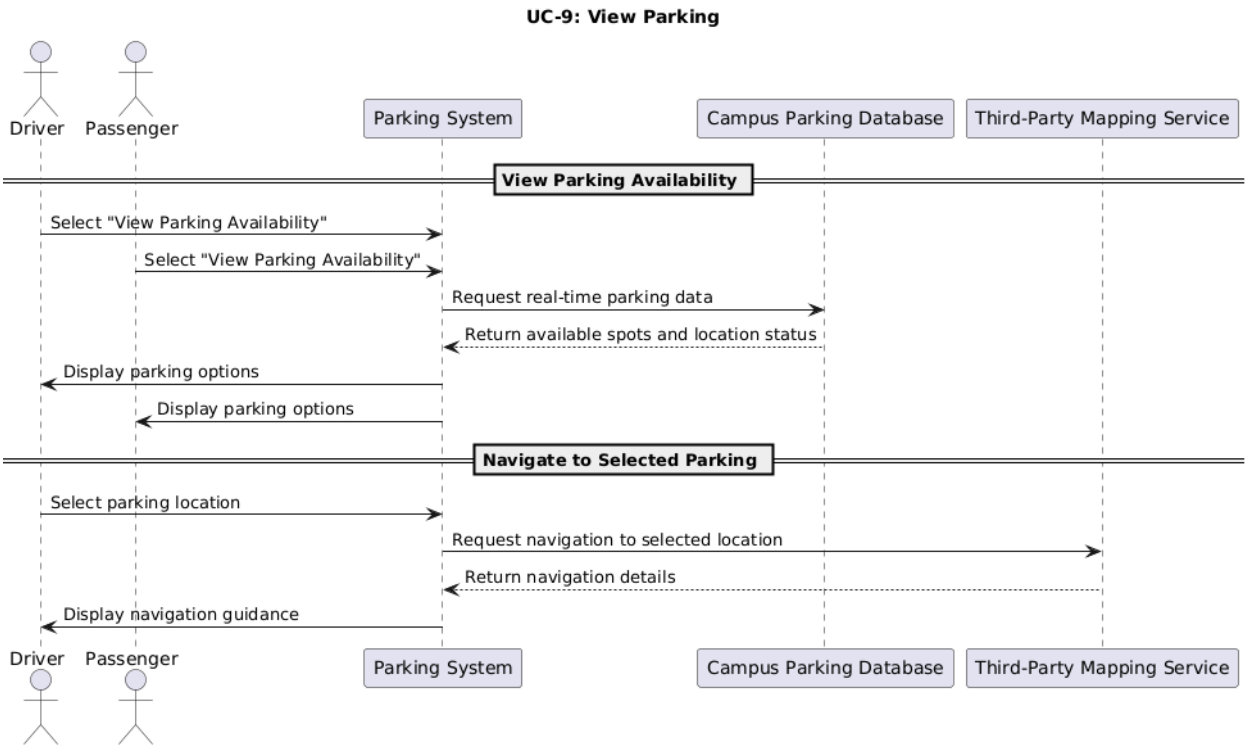
3.1.8 Rating and Feedback

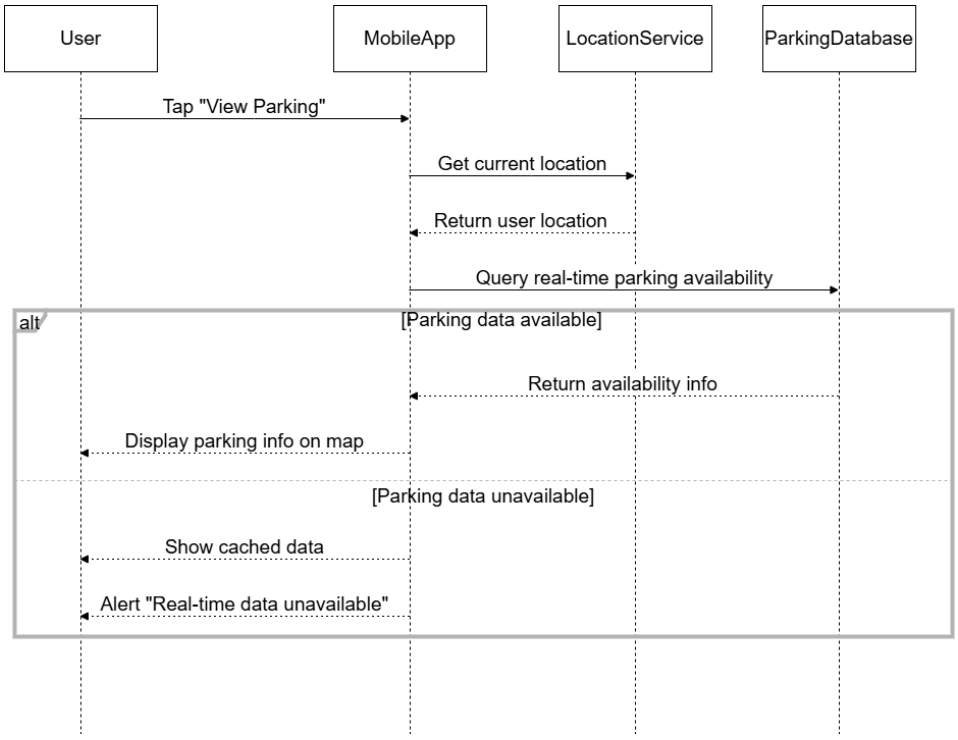
Use Case ID	UC-8	**Use Case**	Rating and Feedback
Description	Allows users to provide reviews and rate their ride-sharing experience		
Actors	Driver, Passenger		
Preconditions	User must have completed a ride		
Postconditions	Feedback is stored and reflected in user ratings		
Basic Flow	1. User accesses the “Rate Ride" option after trip completion. 2. User selects rating and enters optional comments. 3. The system stores feedback and updates driver/passenger profile. 4. The system calculates an average rating score and displays it in the system.		



3.1.9 View Parking

Use Case ID	UC-9	**Use Case**	View Parking
Description	Displays real-time campus parking availability for drivers		
Actors	Driver, Passenger, Campus Parking Database, Third-Party Mapping Service		
Preconditions	User must be authenticated		
Postconditions	Parking availability is displayed with real-time updates		
Basic Flow	1. Driver selects "View Parking Availability." 2. System requests real-time parking data from Campus Parking Database. 3. Campus Parking Database returns available parking spots and location status. 4. System displays parking options to the driver. 5. Driver selects a parking location. 6. System interacts with Third-Party Mapping Service for navigation.		
Alternate Flow	**Parking Data Unavailable** If real-time parking data cannot be fetched: 1. The system shall display the most recently cached parking data. 2. The system shall notify the user that the current parking data may be outdated due to data source issues.		

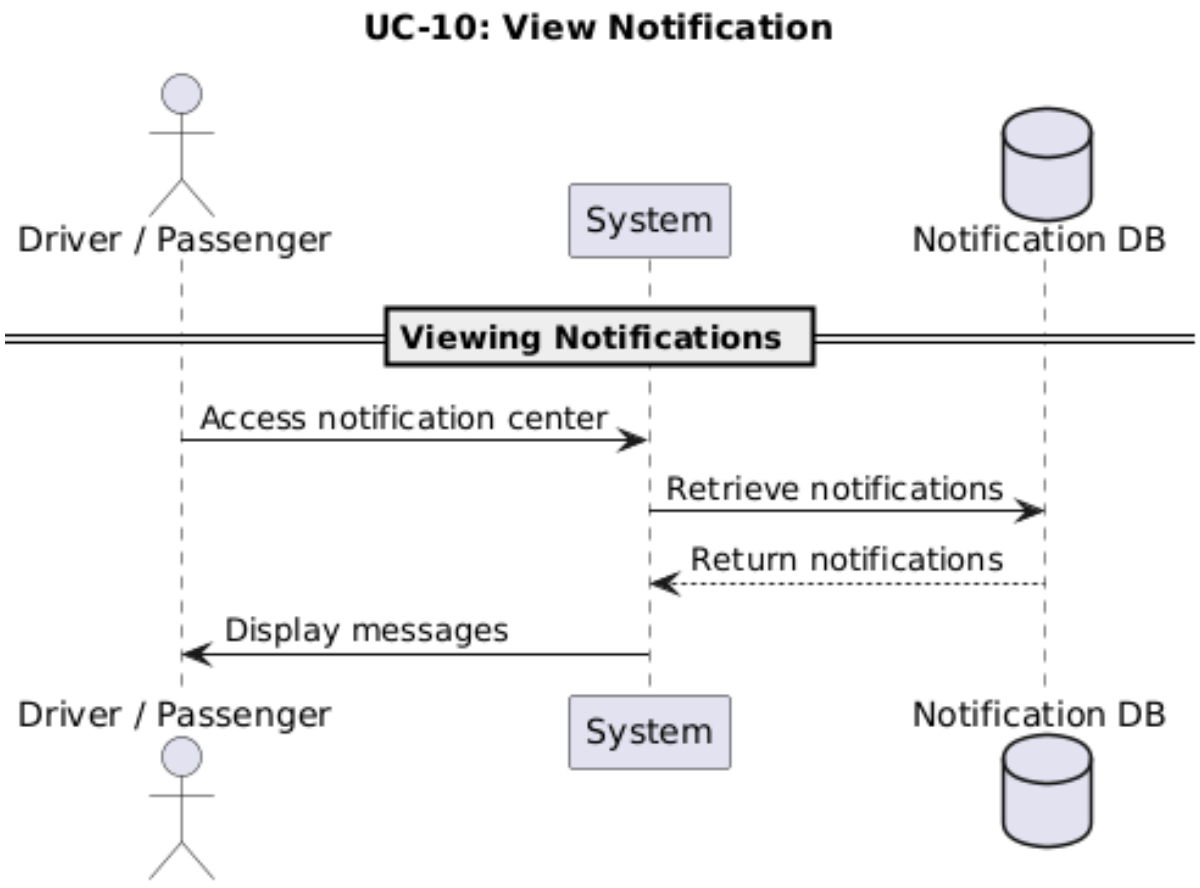




Alternate Flow to UC-9 View Parking

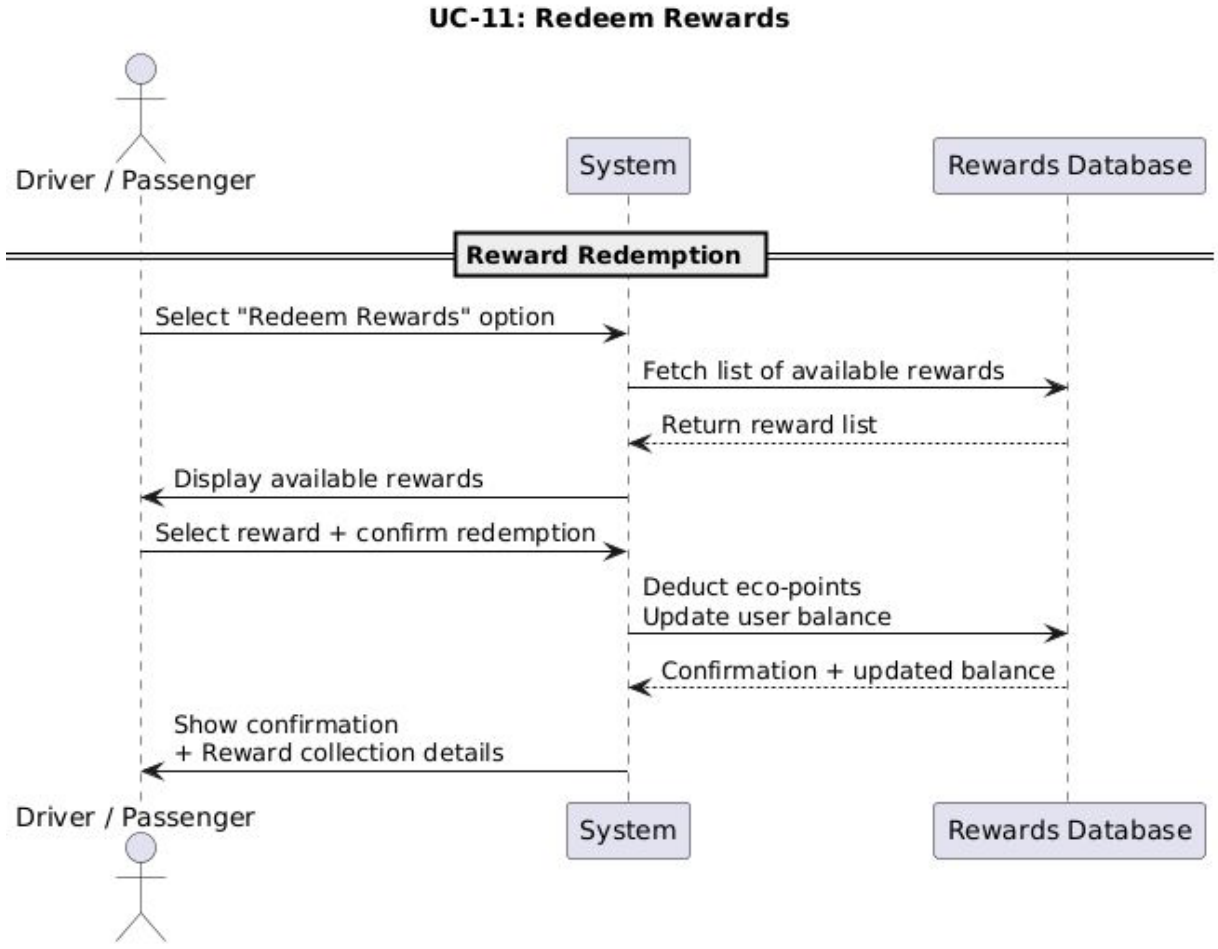
3.1.10 View Notification

Use Case ID	UC-10	**Use Case**	View Notification
Description	Shows important alerts regarding ride status, parking updates, and system notifications		
Actors	Driver, Passenger		
Preconditions	User must be authenticated		
Postconditions	Notifications are viewed and acknowledged		
Basic Flow	1. User accesses the notification center. 2. The system retrieves relevant notifications (ride matches, confirmations, alerts). 3. User views detail and acknowledge messages.		



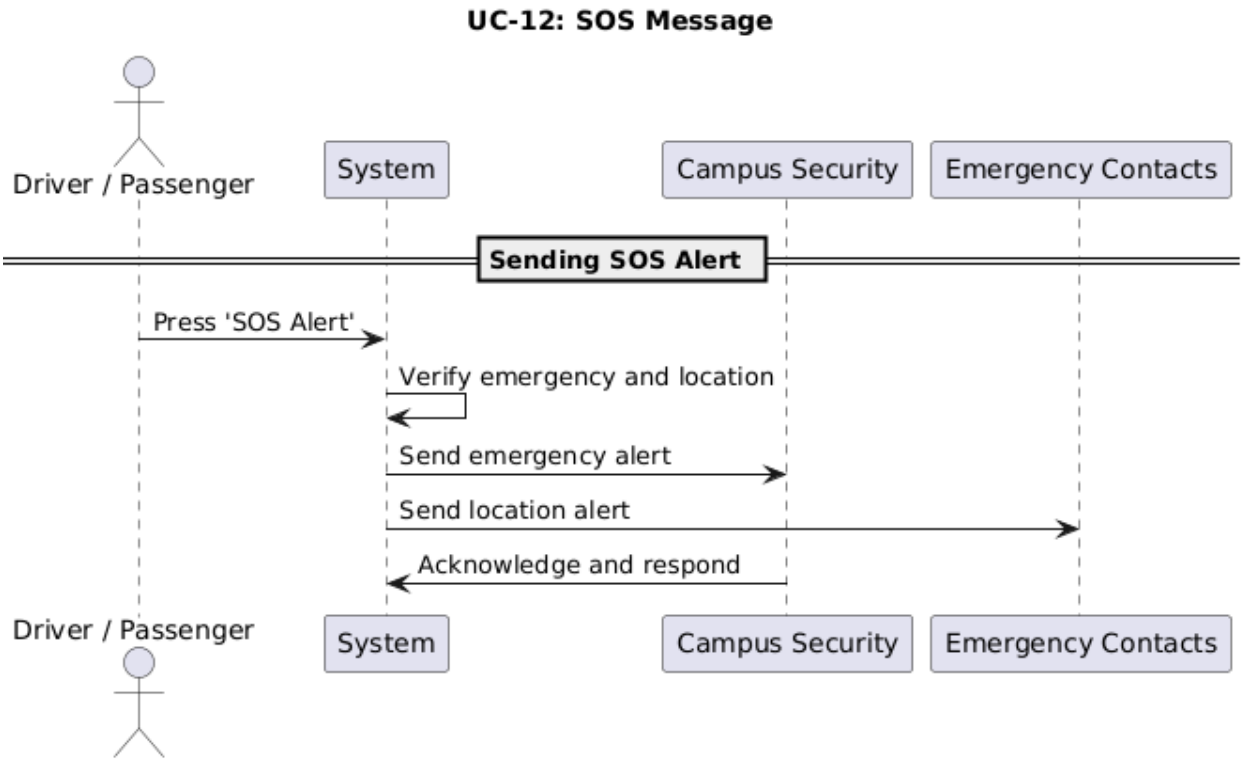
3.1.11 Redeem Rewards

Use Case ID	UC-11	**Use Case**	Redeem Rewards
Description	Enables users to exchange accumulated eco-points for rewards like priority parking or vouchers		
Actors	Driver, Passenger		
Preconditions	User must have accumulated eco-points or ride-sharing rewards		
Postconditions	Rewards are redeemed and reflected in the user account		
Basic Flow	1. User selects the “Redeem Rewards" option. 2. User browses available rewards. 3. The user selects a reward and confirms redemption. 4. System deducts eco-points and updates balance. 5. The system provides confirmation and details on reward collection		



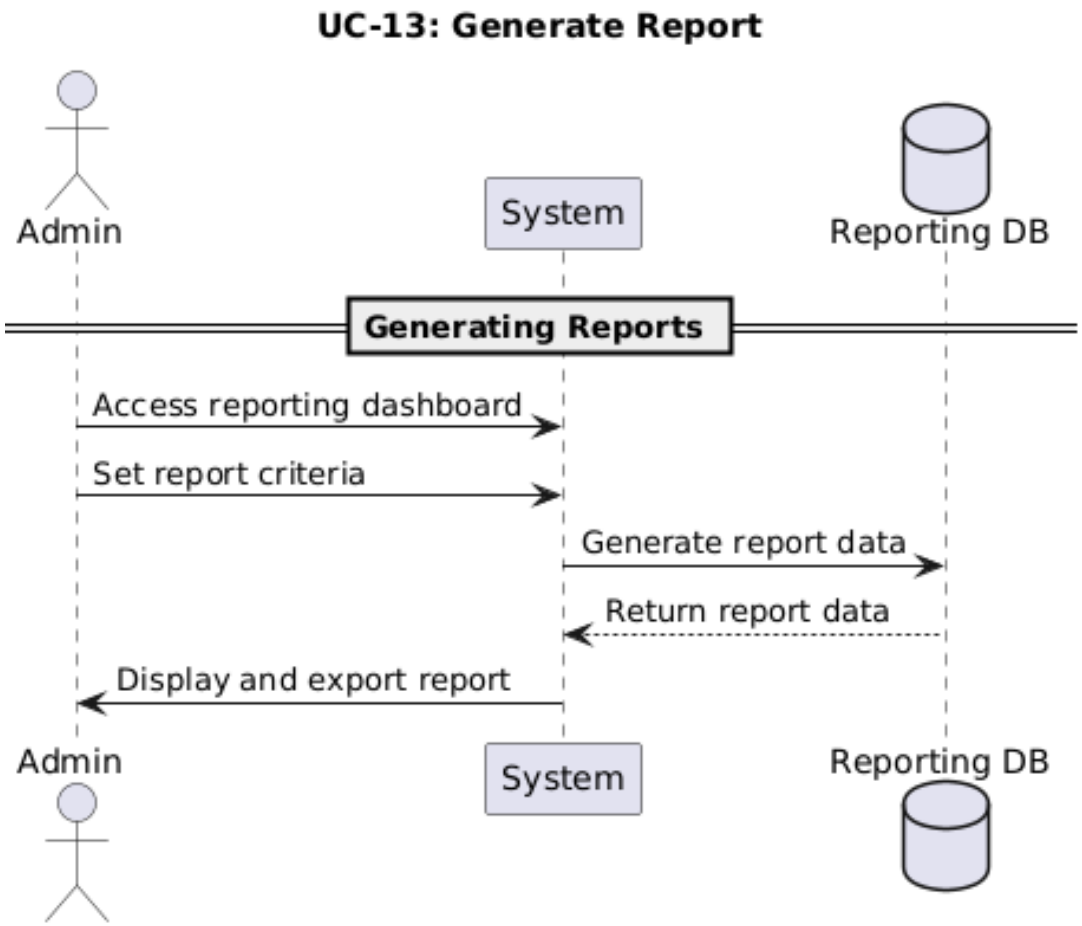
3.1.12 SOS Message

Use Case ID	UC-12	**Use Case**	SOS Message
Description	Provides emergency alert functionality for users in distress during rides		
Actors	Driver, Passenger, Emergency Contact System		
Preconditions	User must be in an active ride session		
Postconditions	Emergency alerts are sent to campus security and designated contacts		
Basic Flow	1. User presses the “SOS Alert” button. 2. The system verifies emergency status and location. 3. System sends alerts to Emergency Contact System, notifying security personnel and designated contacts. 4. Security personnel respond accordingly.		



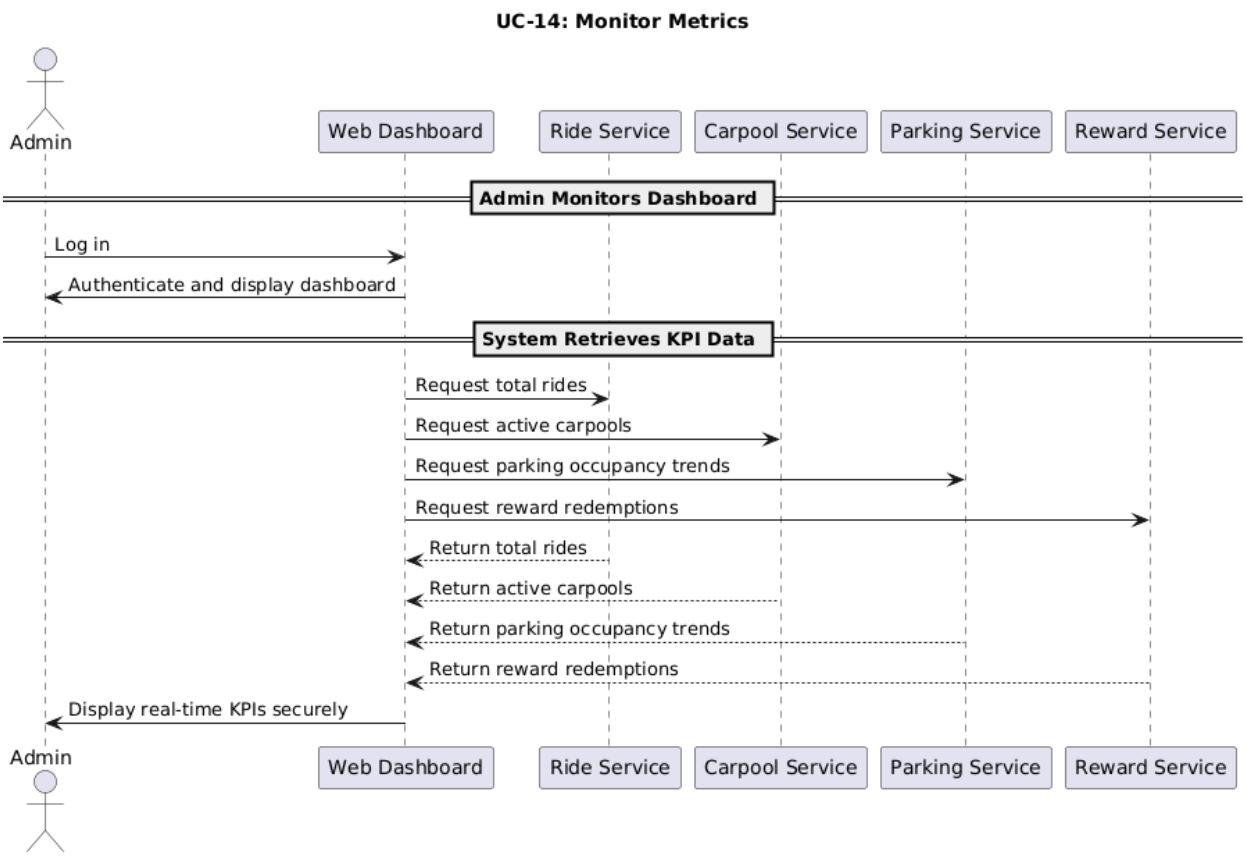
3.1.13 Generate Report

Use Case ID	UC-13	Use Case	Generate Report
Description	Allows administrators to generate reports on ride-sharing activities, system usage, and environmental impact		
Actors	Admin		
Preconditions	Administrator must have access to reporting functions		
Postconditions	System-generated reports are available for review and export		
Basic Flow	1. Admin accesses reporting dashboard. 2. Admin selects report criteria (date range, user activity, ride statistics). 3. The system retrieves data and generates structured reports. 4. Admin views report details and downloads/export data.		



3.1.14 Monitor Metrics

Use Case ID	UC-14	**Use Case**	Monitor Metrics
Description	Grants administrators control over system settings, permissions, and configurations		
Actors	Admin		
Preconditions	Admin must be authenticated with appropriate privileges		
Postconditions	Key performance indicators (KPIs) are displayed successfully on the dashboard		
Basic Flow	1. Admin logs into the web-based dashboard. 2. Admin navigates to the KPI overview section. 3. The system retrieves and displays real-time data, including: • Total rides • Active carpools • Parking occupancy trends • Reward redemptions 4. Admin reviews the KPIs to monitor system performance. 5. The system ensures data is up-to-date and securely presented.		


UC-14: Monitor Metrics
Admin
Web Dashboard
Ride Service
Carpool Service
Parking Service
Reward Service
Admin Monitors Dashboard
Log in
Authenticate and display dashboard
System Retrieves KPI Data
Request total rides
Request active carpools
Request parking occupancy trends
Request reward redemptions
Return total rides
Return active carpools
Return parking occupancy trends
Return reward redemptions
Display real-time KPIs securely
Admin
Web Dashboard
Ride Service
Carpool Service
Parking Service
Reward Service

3.2 Performance Requirements

The Campus Ride-Sharing Platform with Parking System Integration must meet the following performance requirements to ensure user satisfaction and system reliability:

Response Time Requirements

Requirement ID	PR-1
Requirement	User Interface Responsiveness
Description	• The mobile application shall load the main dashboard within 3 seconds of launch under normal network conditions. • Menu transitions shall occur within 0.5 seconds of user selection. • Form submissions shall be processed within 2 seconds, with feedback provided to the user. • Performance will be monitored using real device simulations under normal 4G conditions.

Requirement ID	PR-2
Requirement	Parking System Integration
Description	• Real-time parking availability data shall be refreshed at maximum every 2 minutes. • Parking availability queries shall return results within 3 seconds. • Parking space reservation confirmations shall be processed within 10 seconds.

Throughput Requirements

Requirement ID	PR-3
Requirement	Concurrent Users
Description	• The system shall support a minimum of 500 concurrent users during normal operations. • During peak periods (8:00-10:00 AM and 4:00-6:00 PM), the system shall support up to 1,000 concurrent users. • Performance degradation shall not exceed 15% during peak usage periods.

Requirement ID	PR-4
Requirement	Transaction Volume
Description	• The system shall process up to 100 ride requests per minute during peak periods. • The system should handle up to 50 ride matches per minute during peak periods. • The system should support up to 200 parking availability queries per minute.

Scalability Requirement

Requirement ID	PR-5
Requirement	User Base Expansion
Description	• The system shall be scaled to accommodate a 50% increase in user base without performance degradation. • Database architecture shall support efficient expansion to handle increased data volume. • The system shall maintain performance metrics, including response time, availability, and data accuracy when expanded to additional campus locations.

Requirement ID	PR-6
Requirement	Feature Expansion
Description	• Architecture shall support the addition of new features without requiring major redesign. • API endpoints shall be designed to accommodate additional functionality through version control.

Capacity Requirements

Requirement ID	PR-7
Requirement	Data Storage
Description	• The system shall store ride history data for a minimum of 12 months. • User profiles and preferences shall be maintained indefinitely (until account deletion). • The database should be designed to efficiently handle up to 10,000 active users.

Requirement ID	PR-8
Requirement	Network Bandwidth
Description	• Mobile data usage shall not exceed 5MB per hour during active use. • Backend systems shall support up to 50Mbps of data transfer during peak periods.

Reliability Requirements

Requirement ID	PR-9
Requirement	Uptime
Description	• The system will maintain 99.5% uptime during academic semesters. • Scheduled maintenance shall occur during off-peak hours (typically 2:00-4:00 AM). • The maximum allowed unplanned downtime shall not exceed 1 hour per month.

Requirement ID	PR-10
Requirement	Fault Tolerance
Description	• The system shall recover from crashes within 2 minutes without data loss. • Ride matching data shall be preserved in case of system failure. • User sessions shall be automatically restored after network interruptions.

3.3 Usability Requirements

The Campus Ride-Sharing Platform with Parking System Integration must meet the following usability requirements to ensure positive user experience for all target user groups:

Learnability Requirements

Requirement ID	UR-1
Requirement	Intuitive Interface
Description	• First-time users shall be able to complete the registration process without assistance within 5 minutes. • 90% of new users shall be able to successfully offer or request a ride within their first three attempts. • The system should provide an interactive tutorial for first-time users that can be completed in under 3 minutes.

Requirement ID	UR-2
Requirement	Help and Documentation
Description	Context-sensitive help should be available for all major functions. • The helpful documentation shall be searchable with relevant results appearing within 2 seconds. • Video tutorials shall be available for complex operations, with each tutorial lasting no longer than 2 minutes.

Efficiency Requirements

Requirement ID	UR-3
Requirement	Task Completion
Description	• Regular users shall be able to complete a ride request in less than 30 seconds. • Regular users shall be able to offer a ride in less than 45 seconds. • Checking parking availability shall be achievable in less than 15 seconds from any screen.

Requirement ID	UR-4
Requirement	Navigation Efficiency
Description	• Primary functions shall be accessible within 2 taps/clicks from the main dashboard. • Users shall be able to switch between primary functions without returning to the home screen. • The most recently used functions should be prominently displayed for quick access.

Satisfaction Requirements

Requirement ID	UR-5
Requirement	User Satisfaction Metrics
Description	• The system shall achieve a minimum satisfaction rating of 4.0 out of 5.0 in user surveys. • The system shall maintain an app store rating of at least 4.2 out of 5.0. • Post-use surveys show that at least 85% of users would recommend the platform to others.

Requirement ID	UR-6
Requirement	Visual Design
Description	• The interface shall comply with MMU branding guidelines for color schemes and typography. • The design shall be visually consistent across all screens and functions. • Animation and transitions shall be smooth and enhance rather than distract from the user experience.

Accessibility Requirements

Requirement ID	UR-7
Requirement	Inclusive Design
Description	• The system shall comply with WCAG 2.1 Level AA accessibility standards. • Text elements have adjustable size options to accommodate users with visual impairments. • Color schemes should accommodate color-blind users with appropriate contrast ratios.

Requirement ID	UR-8
Requirement	Device Compatibility
Description	• The mobile application should function properly on devices running iOS 13+ and Android 8.0+. • The interface shall be responsive and fully functional on screens from 4.7" to 10" diagonal. • Touch targets shall be at least 9mm in diameter for accessibility on all supported devices.

Error Prevention and Recovery

Requirement ID	UR-9
Requirement	Error Prevention
Description	• Input fields shall validate data in real-time before submission. • Confirmation dialogs shall be presented for irreversible actions. • The system shall provide clear, non-technical error messages when issues occur.

Requirement ID	UR-10
Requirement	Recovery Options
Description	• Users shall be able to cancel or modify ride requests up to 15 minutes before the scheduled departure. • The system shall provide a "reset to defaults" option for all customizable settings. • Form data shall be preserved if the application is unintentionally closed during input.

User Groups Accommodation

Requirement ID	UR-11
Requirement	Student-Specific Feature
Description	• The interface shall highlight cost-saving benefits prominently for student users. • Quick access to popular campus destinations shall be available for frequent routes. • Budget tracking features shall help students monitor transportation costs.

Requirement ID	UR-12
Requirement	Faculty/Staff Features
Description	• Schedule integration shall allow syncing with faculty/staff calendars for regular commutes. • Professional networking options shall be available for faculty/staff carpooling groups. • Priority notification settings shall be available for time-sensitive commuting needs.

3.4 Interface Requirements

This section defines all interfaces involved in the Campus Ride-Sharing Platform with Parking System Integration**,** including system interactions, user interface design, hardware connections, software dependencies, communication protocols, memory constraints, operational considerations, site adaptations, and service integrations.

3.4.1 System Interfaces

Name	University Authentication System (MMU SSO)
Purpose	Validates users via MMU credentials, ensuring only authorized students, staff, and faculty access the platform.
Source of Input	User-provided MMU login credentials.
Destination of Output	Verified user authentication result.
Valid Range/Accuracy	Strict access control ensuring 100% verified user identity.
Units of Measure	Authentication response time (ms).
Timing	Immediate verification upon login.
Relationships	Integrates with user management and security policies.
Data Format	Encrypted login data (TLS-secured JSON payload).
Command Format	API request to MMU SSO endpoint.
Included Information	User ID, session token.

3.4.2 User Interfaces

Name	Mobile Application UI (iOS & Android)
Purpose	Provides an intuitive interface for ride management and parking integration.
Source of Input	User interactions via touchscreen.
Destination of Output	Ride requests, parking searches, notifications.
Valid Range/Accuracy	Optimized for mobile usability (responsive layout).
Units of Measure	Screen resolution, interaction speed (ms).
Timing	Instantaneous feedback (< 0.5s).
Relationships	Connects to carpool engine, parking database, and notification system.
Data Format	UI elements (HTML/XML for Android/iOS rendering).
Command Format	Touch inputs, gesture events.
Included Information	User selections, ride data, and parking preferences.

3.4.3 Hardware Interfaces

Name	GPS & Sensor Interfaces
Purpose	Tracks ride location for safety and trip coordination.
Source of Input	Mobile device GPS and motion sensors.
Destination of Output	Real-time ride tracking updates.
Valid Range/Accuracy	±5-10m location accuracy.
Units of Measure	Latitude/longitude, movement detection.
Timing	Refresh every 15s.
Relationships	Links to ride history, emergency alert system.
Data Format	GPS data (decimal degrees).
Command Format	Location update requests.
Included Information	User coordinates, movement speed.

3.4.4 Software Interfaces

Name	Campus Parking Database API
Purpose	Fetches real-time parking availability.
Source of Input	Database query for parking spots.
Destination of Output	Parking availability response.
Valid Range/Accuracy	Live updates every 2 minutes.
Units of Measure	Occupancy percentage.
Timing	API query response within 3s.
Fallback Mechanism	If the API fails or times out, the system shall display the last cached parking data (valid for up to 5 minutes) with a warning label indicating offline mode.
Relationships	Links with carpool matching incentives.
Data Format	JSON response (spot ID, status).
Command Format	RESTful API request.
Included Information	Parking zone ID, availability status.

3.4.5 Communications Interfaces

Name	Secure Data Transmission (HTTPS)
Purpose	Encrypts user communication, ride confirmations, and parking alerts.
Source of Input	Mobile app request.
Destination of Output	Server-side response.
Valid Range/Accuracy	AES-encrypted messages ensuring secure transactions.
Units of Measure	Data packet size (bytes).
Timing	Network latency-dependent, expected <100ms response.
Relationships	Integrated with notifications and system security.
Data Format	TLS-secured API messages.
Command Format	HTTPS request-response.
Included Information	Ride status, parking updates, emergency alerts.

3.4.6 Memory Constraints

Name	Local Storage and Cache Management
Purpose	Minimizes data storage requirements by caching ride history and parking availability locally.
Source of Input	Ride requests, parking lookups, user preferences.
Destination of Output	Cached data for faster access.
Valid Range/Accuracy	Cached ride history retained for 12 months; parking availability refreshes every 2 minutes.
Units of Measure	Data size in MB.
Timing	Real-time cache updates, periodic cleanup of expired data.
Relationships	Links to ride history, parking database, user profile settings.
Data Format	JSON, indexed database.
Command Format	Local storage read/write operations.
Included Information	Cached ride requests and responses, temporarily stored parking availability, session-based user preferences.

3.4.7 Operations

Name	Ride Matching and Parking Coordination
Purpose	Handles user-initiated ride sharing and parking spot identification.
Source of Input	User ride requests, parking availability queries.
Destination of Output	Matched ride details, available parking spaces.
Valid Range/Accuracy	The system shall achieve at least 95% successful ride-match rate, calculated as (successful matches / total ride requests) over a 7-day rolling window.
Units of Measure	Number of requests per minute.
Timing	Ride matching completed within 5 seconds; parking updates every 2 minutes.
Relationships	Connects with user profile, parking system, notification engine.
Data Format	JSON responses.
Command Format	API requests for ride searching and parking lookup.
Included Information	Ride request details (origin, destination, seat count, timestamps), approved ride matches, parking allocation status.

3.4.8 Site Adaptation Requirements

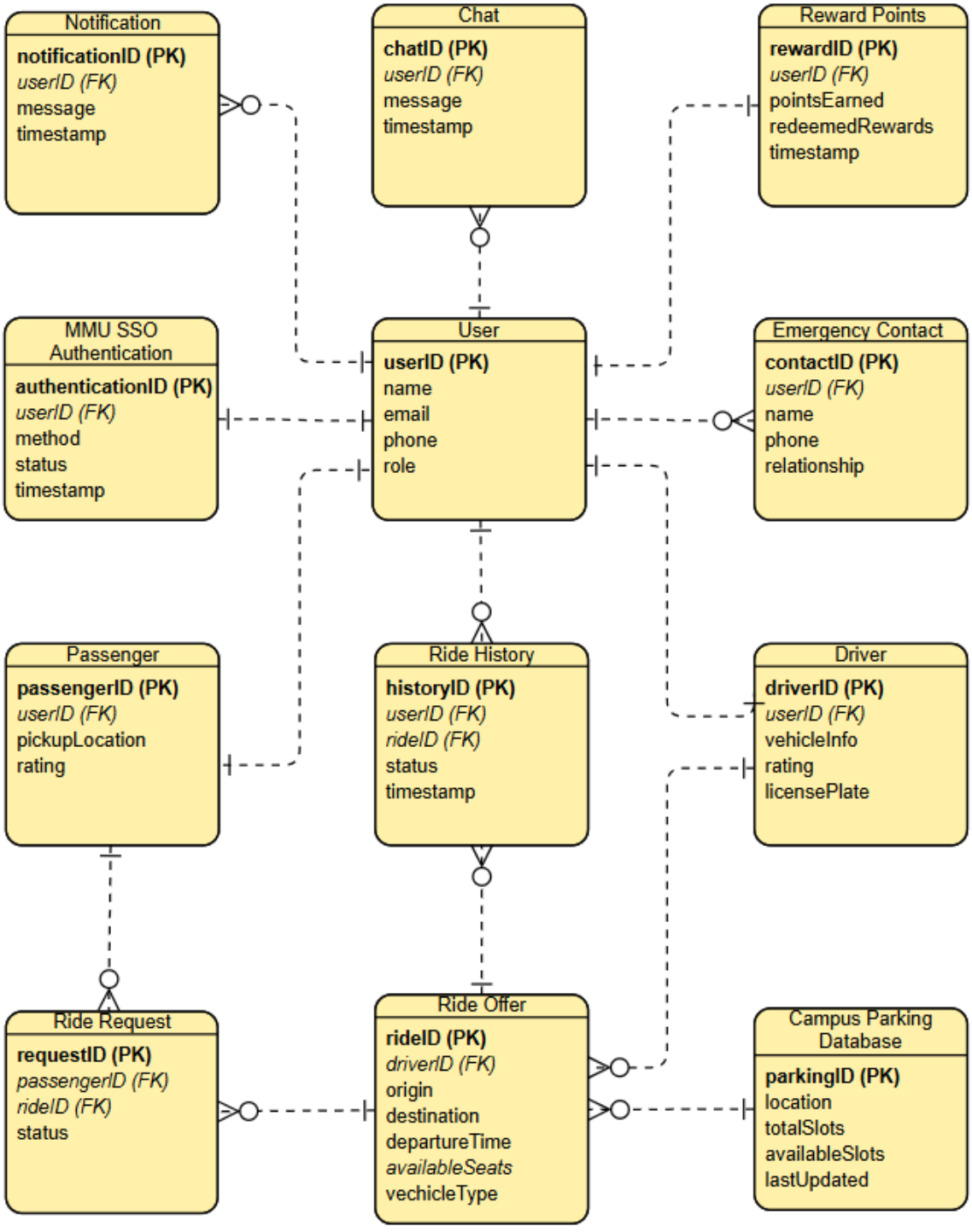
Name	Campus Parking Map and Access Controls
Purpose	Adjusts functionality based on MMU-specific parking zones and security policies.
Source of Input	Campus infrastructure data.
Destination of Output	Location-specific parking availability and restrictions.
Valid Range/Accuracy	Zone-based parking enforcement, mapped entry validation.
Units of Measure	Number of designated carpool zones.
Timing	Updates occur as per administrative configurations.
Relationships	Connects with parking system, user authentication, incentive tracking.
Data Format	GIS-enabled parking data.
Command Format	Database queries for real-time parking assignments.
Included Information	Campus map with designated carpool zones, branding elements for MMU policy compliance, site-specific parking constraints.

3.4.9 Interfaces with Services

Name	Cloud-Based Ride Management & Security Services
Purpose	Supports authentication, ride storage, and notifications through cloud integration.
Source of Input	MMU SSO authentication, ride data submission.
Destination of Output	Secure storage of ride history, user profiles, reward calculations.
Valid Range/Accuracy	Secure encrypted transactions (TLS protocol).
Units of Measure	Transaction speed in ms.
Timing	Authentication <2s; ride storage <5s.
Relationships	Connected to MMU IT infrastructure, notification system, ride database.
Data Format	Secure REST API responses (JSON).
Command Format	HTTPS-secured API requests.
Included Information	Secure authentication tokens for MMU SSO, ride history logs stored in cloud databases, push notification preferences.

3.5 Logical Database Requirements

The Campus Ride-Sharing Platform with Parking System Integration comprises entities such as User, Passenger, Driver, Ride Offer, and Ride Request. These entities are interconnected through relationships that enable authentication, ride matching, and seamless user interactions.



- The "User" entity has attributes such as userID, name, email, phone, and role, and it is related to the "Passenger”, "Driver", "Ride History", "MMU SSO Authentication", "Reward Points" and "Emergency Contact" entity.
- The "Driver" entity has attributes such as driverID, userID, vehicleModel, vehicleYear, vehicleColor, vehicleType, rating and licensePlate, and it is related to the "User" and "Ride Offer" entity.
- The "Passenger" entity has attributes such as passengerID, userID, pickupLocation, and rating, and it is related to the "User" and "Ride Request" entity.
- The "Ride Offer" entity has attributes such as rideID, driverID, origin, destination, departureTime, availableSeats, and vehicleType, and it is related to the "Ride Request", "Ride History", "Campus Parking Database" and "Driver" entity.
- The "Ride Request" entity has attributes such as requestID, passengerID, rideID, and status, and it is related to the "Passenger" and "Ride Offer" entities.
- The "Ride History" entity has attributes such as historyID, userID, rideID, status, and timestamp, and it is related to the "User" and “Ride Offer" entity.
- The "MMU SSO Authentication" entity has attributes such as authenticationID, userID, method, status, timestamp, and it is related to the "User" entity.
- The "Reward Points" entity has attributes such as rewardID, userID, pointsEarned, redeemedRewards, and timestamp, and it is related to the "User" entity.
- The "Emergency Contact" entity has attributes such as contactID, userID, name, phone, and relationship, and it is related to the "User" entity.
- The "Campus Parking Database" entity has attributes such as parkingID, location, totalSlots, availableSlots and lastUpdated, and it is related to the "User" and “Ride Offer" entity.
- The "Chat" entity has attributes such as chatID, userID, message, and timestamp, and it is related to the "User" entity.
- The "Notification" entity has attributes such as notificationID, userID, message, and timestamp, and it is related to the "User" entity.

3.5.1 Data Dictionary

The data dictionary defines the structure of the database tables, describing each field's data type, length, constraints, and purpose within the system.

User Table

Field Name	Data Type	Length	PK/FK	Null/Not Null	Description
userID	Short Text	10	PK	Not Null	Primary key, unique identifier for the user
name	Short Text	25		Not Null	Full name of the user
email	Short Text	25		Not Null	Email address of the user
phone	Short Text	25		Not Null	User's phone number
role	Short Text	25		Not Null	Role of the user (passenger, driver)

Passenger Table

Field Name	Data Type	Length	PK/FK	Null/Not Null	Description
passengerID	Short Text	10	PK	Not Null	Primary key, unique identifier for the passenger
userID	Short Text	10	FK	Not Null	Foreign key referencing User table
pickupLocation	Short Text	50		Not Null	Passenger's pickup location
rating	Decimal	3, 2		Not Null	Passenger's rating

Driver Table

Field Name	Data Type	Length	PK/FK	Null/Not Null	Description
driverID	Short Text	10	PK	Not Null	Primary key, unique identifier for the driver
userID	Short Text	10	FK	Not Null	Foreign key referencing User table
vehicleModel	Short Text	25		Not Null	Driver's vehicle model (e.g., Myvi)
vehicleYear	Integer	4		Not Null	Year of manufacture (e.g., 2021)
vehicleColor	Short Text	15		Not Null	Vehicle color (e.g., Black)
vehicleType	Short Text	15		Not Null	Vehicle type (e.g., Sedan)
rating	Decimal	3, 2		Not Null	Driver's rating
licensePlate	Short Text	25		Not Null	Vehicle's license plate number

Ride Offer Table

Field Name	Data Type	Length	PK/FK	Null/Not Null	Description
rideID	Short Text	10	PK	Not Null	Primary key, unique identifier for the ride offer
driverID	Short Text	10	FK	Not Null	Foreign key referencing Driver table
origin	Short Text	50		Not Null	Starting location
destination	Short Text	50		Not Null	End location
departureTime	Date/Time	10		Not Null	Departure time
availableSeats	Integer	10		Not Null	Number of available seats

Ride Request Table

Field Name	Data Type	Length	PK/FK	Null/Not Null	Description
requestID	Short Text	10	PK	Not Null	Primary key, unique identifier for the ride request
passengerID	Short Text	10	FK	Not Null	Foreign key referencing Passenger table
rideID	Short Text	10	FK	Not Null	Foreign key referencing Ride Offer table
status	Short Text	25		Not Null	Status of the ride request

Ride History Table

Field Name	Data Type	Length	PK/FK	Null/Not Null	Description
historyID	Short Text	10	PK	Not Null	Primary key, unique identifier for the ride history
userID	Short Text	10	FK	Not Null	Foreign key referencing User table
rideID	Short Text	10	FK	Not Null	Foreign key referencing Ride Offer table
status	Short Text	25		Not Null	Status of the ride history
timestamp	Date/Time	10		Not Null	Date and time of the ride

Campus Parking Database Table

Field Name	Data Type	Length	PK/FK	Null/Not Null	Description
parkingID	Short Text	10	PK	Not Null	Primary key, unique identifier for the campus parking system
location	Short Text	50		Not Null	Physical location
totalSlots	Integer	10		Not Null	Total parking slots
availableSlots	Integer	10		Not Null	Available parking slots
lastUpdated	Date/Time	10		Not Null	Timestamp of the last update

MMU SSO Authentication Table

Field Name	Data Type	Length	PK/ FK	Null/Not Null	Description
authenticationID	Short Text	10	PK	Not Null	Primary key, unique identifier for the SSO authentication system
userID	Short Text	10	FK	Not Null	Foreign key referencing User table
method	Short Text	25		Not Null	Authentication method
status	Short Text	15		Not Null	Authentication status
timestamp	Date/Time	10		Not Null	Timestamp of authentication

Emergency Contact Table

Field Name	Data Type	Length	PK/FK	Null/Not Null	Description
contactID	Short Text	10	PK	Not Null	Primary key, unique identifier for the emergency contacts system
userID	Short Text	10	FK	Not Null	Foreign key referencing User table
name	Short Text	25		Not Null	Contact person's name
phone	Short Text	25		Not Null	Contact phone number
role	Short Text	25		Not Null	Relationship to the user

Reward Points Table

Field Name	Data Type	Length	PK/FK	Null/Not Null	Description
rewardID	Short Text	10	PK	Not Null	Primary key, unique identifier for the reward points
userID	Short Text	10	FK	Not Null	Foreign key referencing User table
pointEarned	Integer	10		Not Null	Total points collected
redeemedRewards	Integer	10		Not Null	Points spent on redeeming rewards
timestamp	Date/Time	10		Not Null	Date and time of the reward points update

Chat Table

Field Name	Data Type	Length	PK/FK	Null/Not Null	Description
chatID	Short Text	10	PK	Not Null	Primary key, unique identifier for the chat
userID	Short Text	10	FK	Not Null	Foreign key referencing User table
message	Short Text	50		Not Null	Message of the chat
timestamp	Date/Time	10		Not Null	Date and time of the chat

Notification Table

Field Name	Data Type	Length	PK/FK	Null/Not Null	Description
notificationID	Short Text	10	PK	Not Null	Primary key, unique identifier for the notification
userID	Short Text	10	FK	Not Null	Foreign key referencing User table
message	Short Text	50		Not Null	Message of the notification
timestamp	Date/Time	10		Not Null	Date and time of the notification

3.6 Design Constraints

The design constraints of the Campus Ride-Sharing Platform with Parking System Integration ensure a secure, efficient, and university-compliant ride-sharing experience while maintaining operational integrity.

Compliance with MMU Policies

- The user interface must adhere to Multimedia University (MMU) branding guidelines, including official colours, logos, and design elements.
- User authentication must follow MMU Single Sign-On (SSO) standards to verify only registered students, staff, and faculty.
- All user data must comply with MMU's privacy and IT security policies to protect personal information.

Technical Limitations

- The system must operate within MMU's digital infrastructure, meaning third-party integrations are restricted unless explicitly approved by the university.
- The mobile application must be compatible with iOS and Android devices, but initial deployment will support only the latest stable versions of each OS (minimum iOS 13, Android 8.0).
- The GPS accuracy is limited to 5–10 meters, affecting precise pickup location tracking.

Regulatory Constraints

- The platform does not support financial transactions (e.g., payment processing, fare splitting) due to university regulations.
- Ride-sharing activities must comply with Malaysian transportation policies, meaning only non-commercial rides are permitted.

Scalability & Performance Constraints

- The system must support up to 500 concurrent users in Phase 1, scaling up to 1,000 users in later releases, with the performance degradation not more than 25% during peak periods.
- The ride-matching engine must process requests within 5 seconds to ensure quick response times.
- Parking occupancy updates every 2 minutes, with the reservation confirmations shall be confirmed processed within 10 seconds but refresh rates may depend on MMU's existing infrastructure.
- System response time for critical user actions shall not exceed 3 seconds under normal load.

Security & Data Protection

- Access control must be role-based, restricting administrative functions to designated university personnel.
- Ride history and reward data must follow data retention policies, limiting storage to 12 months.
- The platform shall comply with WCAG 2.1 Level AA for accessibility, ISO 27001 for information security management, and all applicable provisions of the Malaysian Personal Data Protection Act (PDPA) 2010 for data privacy.

3.7 Software System Attributes

This section specifies the required software quality attributes of the Campus Ride-Sharing Platform:

Reliability

ID	Attribute	Measurement
SSA-1	The system shall achieve 99/5% uptime during university operational hours	Measured through system monitoring logs and reported as monthly uptime percentage
SSA-2	The system shall have a Mean Time Between Failures (MBTF) of at least 720 hours	Measured through system monitoring and calculated monthly
SSA-3	The system shall have a Mean Time To Repair (MTTR) of less than 2 hours for critical functions	Measured from incident logs and reported monthly
SSA-4	The system shall maintain data integrity with zero corruption incidents	Verified through database consistency checks and audit logs
SSA-5	The system shall implement automatic recovery from common error conditions	Validated through fault injection testing

Availability

ID	Attribute	Measurement
SSA-6	The system shall be available 24/7 with scheduled maintenance windows communicated 48 hours in advance	Tracked through system monitoring and maintenance logs
SSA-7	The system shall implement redundancy for critical components to avoid single points of failure	Verified through architecture review and failover testing
SSA-8	The system shall degrade gracefully under high load conditions, maintaining core functionality	Validated through load testing and performance monitoring
SSA-9	The system shall remain operational during university network fluctuations	Verified through resilience testing during simulated network issues
SSA-10	The system shall implement automatic failovers for critical services within 30 seconds	Measured during disaster recovery testing

Security

ID	Attribute	Measurement
SSA-11	The system shall prevent unauthorized access to personal and sensitive data	Verified through security testing and penetration tests
SSA-12	All user data shall be encrypted in transit using TLS 1.2 or higher and at rest using AES-256 encryption.	Verified through code review and security scanning
SSA-13	The system shall maintain comprehensive audit logs of all security-relevant events	Inspected through log review and completeness verification
SSA-14	The system shall resist common attack vectors (SQL injection, XSS, CSRF)	Validated through security testing and vulnerability scanning
SSA-15	The system shall implement proper session management with secure timeout handling	Verified through security review and penetration testing
SSA-16	The system shall restrict access based on user roles and permissions	Validated through access control testing
SSA-17	The system shall be free of critical vulnerabilities as identified by OWASP Top 10 during security audits.	Validated through security testing and penetration tests
SSA-18	User authentication shall use MMU SSO exclusively.	Validated through security testing and penetration tests

Maintainability

ID	Attribute	Measurement
SSA-19	The system shall be designed with modular architecture to facilitate component updates	Assessed through architecture review and coupling metrics
SSA-20	The system shall implement comprehensive logging for troubleshooting	Verified through log coverage review and debug testing
SSA-21	The system shall be accompanied by complete technical documentation	Evaluated through documentation review against prescribed standards
SSA-22	The system shall support configuration changes without requiring code modification	Validated through configuration testing
SSA-23	The system shall achieve a maintainability index score of at least 80	Measured through static code analysis tools
SSA-24	Mean Time To Repair (MTTR) for critical bugs shall not exceed 4 hours.	Verified through log coverage review, debug testing and user reported bugs.
SSA-25	Code complexity (e.g., Cyclomatic Complexity) shall be maintained below a threshold of 10 for key modules.	Measured through static code analysis tools

Portability

ID	Attribute	Measurement
SSA-26	The web interface shall function correctly on major browsers (Chrome, Firefox, Safari, Edge)	Verified through cross-browser testing
SSA-27	The mobile application shall be compatible with the current and two previous major versions of iOS and Android operating systems.	Validated through cross-platform testing
SSA-28	The system shall utilize containerization for deployment flexibility	Verified through deployment testing in multiple environments
SSA-29	All front-end components shall adhere to responsive design principles to ensure consistent user experience across various screen sizes.	Validated through multi-device testing
SSA-30	The system database shall be compatible with both Oracle and PostgreSQL	Verified through database adapter testing

Scalability

ID	Attribute	Measurement
SSA-31	The system shall support linear scaling to accommodate up to 20,000 registered users	Validated through load testing and performance monitoring
SSA-32	The system shall handle peak loads of 1,000 concurrent users without performance degradation	Measured through stress testing and response time monitoring
SSA-33	The system shall support horizontal scaling of application servers	Verified through cluster deployment testing
SSA-34	The system shall implement database sharding for future growth	Validated through database performance testing
SSA-35	The system shall maintain response time under load through proper caching strategies	Measured through performance testing under increasing load

Usability

ID	Attribute	Measurement
SSA-36	The system shall achieve a System Usability Scale (SUS) score of at least 80% with user satisfaction rating of 4 out of 5 in usability surveys	Measured through user testing and surveys
SSA-37	First-time users shall complete critical tasks successfully without assistance	Validated through usability testing with new users
SSA-38	The system shall conform to university accessibility standards	Verified through accessibility testing and compliance review
SSA-39	The system shall achieve a task completion rate of at least 95% for common functions	Measured through usability testing

3.8 Supporting Information

This section provides supplemental materials, insights, and artifacts that support the requirements outlined in this SRS. These elements are not mandatory requirements unless otherwise stated but serve as context or guidance for the development and implementation teams.

3.8.1 Sample Input/Output Information

Ride Request Input


```
{
  "userID": "1211111244",
  "pickupLocation": "MMU Hostel A",
  "destination": "MMU Faculty of Engineering",
  "preferredTime": "08:30 AM"
}
```


Ride Match Output


```
{
  "rideID": "RIDE9832",
  "driverName": "Ali Bin Ahmad",
  "vehicle": "Perodua Myvi (WXD2345)",
  "pickupTime": "08:25 AM",
  "estimatedArrival": "08:45 AM",
  "matchConfidence": "92%"
}
```


CSV Export Format for Admin Reports:


```
userID,role,totalRides,ecoPoints,avgRating
1211109618,Driver,23,150,4.6
1211108820,Passenger,17,98,4.8
```

3.8.2 Supporting & Background Information

Survey Results Summary:

80% of students are open to carpooling if incentives are offered.

65% of staff expressed interest in parking space pre-reservations.

90% of respondents cited ride-sharing as a way to reduce stress and fuel costs.

Cost-Benefit Analysis Snapshot:

Initial Development Cost: RM 75,000 (internal dev team)

Estimated Annual Savings: RM 30,000 from reduced fuel usage and congestion costs.

ROI Timeline: 3 years through operational efficiency, reduced parking infrastructure strain, and eco-initiatives.

Elicitation Techniques Used:

Online questionnaires distributed to MMU students, staff, and faculty.

Stakeholder interviews with campus security and transport administrators.

Comparative analysis of existing ride-sharing platforms like GrabHitch, Waze Carpool.

Description of the Problem to Be Solved:

MMU currently faces:

- Overutilized parking zones, especially during peak hours.
- Inefficient use of commuting resources, with many single-passenger vehicles.
- No centralized platform for secure, institution-backed carpooling coordination.
- Lack of visibility into real-time parking data, causing delays and frustration.

The proposed system solves these issues by offering:

- Verified, secure carpool matching via MMU SSO.
- Real-time parking availability data.
- Eco-incentives to promote sustainable transportation.
- Safety features (e.g., SOS alerts and ride tracking).

Special Packaging Instructions

- The application shall be packaged in the following formats:
    - Android APK and iOS IPA for mobile distribution via internal app stores or test environments.
    - Deployment Archive (ZIP) containing Docker containers for cloud/server deployment.
    - Database Seed File (SQL) with test users, vehicles, and parking data for QA environments.
- All code and packages must:
    - Comply with MMU IT Security Policies.
    - Be digitally signed using MMU's DevOps certificates before deployment.
    - Follow versioning standards (e.g., v1.0.0-beta, v1.1.0-stable).
    - Include user manuals and developer documentation as PDFs in the /docs folder of the deployment archive.

3.8.3 Validation

3.8.3.1 Validation Session

A walkthrough session was conducted on 16 June 2025, where the one of the document author, Ow Ka Sheng, presented the content to the our reviewer team. Some areas of ambiguity and potential defects were identified and commented and to be used in inspection phase.

Afterwards we start the commenting phase, the document was divided and reviewed individually by team members. Comments were made on the SRS documentation. Many potential defects were identified and prepared for formal inspection.

Session ID	Date and Time	Technique	Section Reviewed	Participant & Role	No. of Defect
VS-01	16/6/2025	Inspection	Whole documentation	Chee Rui (Moderator) Lai Zi Xuan (Reviewer) Sow Chien Yee (Reviewer) Teh Li Wei (Reviewer)	10
VS-02	16/6/2026	Inspection	Whole documentation	Sow Chien Yee (Moderator) Lai Zi Xuan (Reviewer) Chee Rui (Reviewer) Teh Li Wei (Reviewer)	7
VS-03	18/6/2027	Inspection	Whole documentation	Teh Li Wei (Moderator) Lai Zi Xuan (Reviewer) Chee Rui (Reviewer) Sow Chien Yee (Reviewer)	5
VS-04	18/6/2028	Inspection	Whole documentation	Lai Zi Xuan (Moderator) Sow Chien Yee (Reviewer) Chee Rui (Reviewer) Teh Li Wei (Reviewer)	7

3.8.3.2 Defect Summary

A. Content Defect

Req ID	Validation and Defect Description	Detected By	Comment/Suggested Fix	Session ID	Severity (1–5)
N/A	1.2.1 Unclear Feature grouping — “Parking Availability & Rewards” merges two different features.	Chee Rui	Split into two sections: “Parking Availability” and “Rewards & Incentives”	VS-01	2
N/A	1.2.1 Wording issue — “Matching is manual” is misleading; it is the accepting requests that is manual.	Chee Rui	"Matching is manual" -> "Acceptance is manual"	VS-01	3
N/A	1.2.1 Incorrect SSO functionality	Lai zi Xuan	Rewrite the sentence on the advantage of Single Sign On	VS-01	2
N/A	1.2.2 Ambigious Phrasing of "Phase 1" and "fallback"	Chee Rui	Define "Phase 1" and "fallback" while rewording the sentence	VS-01	2
N/A	1.2.3 Several points stated are incomplete phrases, vague, or lack clear action	Chee Rui	Rewrite points to be as clear as possible.	VS-01	3
UC-5	No alternate flow or exception when no drivers are available.	Sow Chien Yee	Add alternate flow: If no drivers match the request, system should notify the user and suggest options or waitlist.	VS-02	4
UC-9	No fallback behavior if parking data is unavailable.	Sow Chien Yee	Show last known availability and alert user of sync issue.	VS-02	3
PR-2	Vague "minimum every 2 minutes" wording	Teh Li Wei	Reword to: refreshed at maximum every 2 minutes	VS-03	3
IF-004	Missing details for error handling in Software Interfaces (e.g., timeout, fallback)	Teh Li Wei	Specify how the system handles failures when the Campus Parking API or SSO fails.	VS-03	5

IF-007	“95% accuracy” claim in Operations Interface not supported by measurable criteria	Teh Li Wei	Define how accuracy is measured and validated (e.g., ride-match success rate).	VS-03	3
DB-005	Lack of normalization for the vehicleInfo field in the Driver Table	Chee Rui	Split vehicleInfo into separate fields (e.g., model, year, color， type) to improve data consistency and query ability.	VS-03	4
DB-006	vehicleType stored in Ride Offer Table is a driver-level attribute and violates normalization	Teh Li Wei	Move vehicleType to Driver Table to avoid data duplication and ensure consistent vehicle info per driver.	VS-03	4
N/A	3.6 "Security & Data Protection": Missing specificity for "standard compliances"	Lai Zi Xuan	Explicitly list all relevant standards and regulations the system must comply with. Provide direct references or links to these standards.	VS-04	4
N/A	3.6 "Scalability & Performance Constraints": Vague "Performance thresholds"	Lai Zi Xuan	Quantify performance thresholds with measurable metrics.	VS-04	3
N/A	3.7 Lack of Quantifiable Metrics for some Attributes (Maintainability, Security, Portability)	Sow Chien Yee	Define SMART metrics for each attribute.	VS-04	2
N/A	4.1 Role clarity in verification process	Lai Zi Xuan	Clearly define the roles and responsibilities of different teams and stakeholders in the verification process.	VS-04	3
N/A	4.2 Usability Requirements: Subjectivity in Some Criteria	Lai Zi Xuan	Ensure all verification criteria are quantifiable and objectively measurable. If a requirement is qualitative, define clear, observable indicators that demonstrate its fulfilment	VS-04	2

N/A	5.1 Assumptions & Dependencies: Potential for Unstated Assumptions	Chee Rui	Conduct a comprehensive review with stakeholders to identify and explicitly list all assumptions that the project's success relies upon.	VS-04	4

B. Documentation Defect

Page No.	Validation and Defect Description	Detected By	Comment/Suggested Fix	Session ID	Severity (1–5)
5	1.3.1 Wrongly placed context diagram	Chee Rui	Move the context diagram from page 10 to page 6 to reduce confusion	VS-01	2
8-10	1.3.1.1 Interface requirements is a repeat of 3.4 Interface requirements	Chee Rui	Remove 1.3.1.1 completely as it is a simplified version, with subpar explanations	VS-01	2
34	PR-1 No method specified for measuring performance times	Sow Chien Yee	Add: Performance will be monitored using real device simulations under normal 4G conditions.	VS-02	3
35	PR-5 "Performance metrics" not clearly defined	Sow Chien Yee	Add: metrics include response time, availability, and data accuracy	VS-02	3
51	Data dictionary inconsistent in terminology (e.g., “vechicleType” typo)	Teh Li Wei	Correct the spelling, ensure consistent terminology across tables.	VS-03	2

C. Agreement Defect

Req ID	Validation Description/Stakeholder Concern	Mismatch	Detected By	Session ID	Severity (1–5)
N/A	1.3.2 Additional of "voice recording" function	Not stated in functional scope and is a big privacy risk	Chee Rui	VS-01	4
N/A	1.3.2 Missing "Notification" function	Stated in functional scope but not in product functions	Chee Rui	VS-01	4
PR-3	25% performance degradation may not be acceptable	The SRS allows a 25% performance degradation during peak periods, but stakeholders (e.g., users, MMU IT) expect smoother performance and would find this level of slowdown unacceptable.	Sow Chien Yee	VS-02	4

3.8.3.3 Conflict analysis

Conflict ID	Conflict Description	Conflict Analysis	Stakeholders Involved	Session ID
CF-01	Unexpected addition of "voice recording" in 1.3.2	The "voice recording" feature is not present in the Functional Scope. Being a function with significant privacy implications and may not have been reviewed by stakeholders, adding this function without prior agreement could cause legal issues.	IT security team , Student Representive Council and developers	VS-01
CF-02	Missing "Notification" function in Product Functions (1.3.2)	Notifications are clearly stated in Functional Scope but missing from the formal Product Functions. This gap could result in incomplete development and missed user expectations if not corrected.	Project Team, Quality Assurance Team, Developers	VS-01
CF-03	25% performance degradation (PR-3) vs. user expectation of smooth peak-time performance.	Stakeholders felt 25% slowdown was too high and would negatively impact usability during peak hours.	Students, Staff and MMU IT	VS-02

3.8.3.4 Conflict Resolution

Conflict ID	Conflict Resolution Strategy	Resolved (Y/N)	Outcome (If Resolved)	Justification
CF-01	Inquire the Project Team on the implementation and implications of adding "voice recording" function	Y	Voice recording feature is removed.	Privacy and legal implications are too much and it doesn't bring a lot of benefits to the table.
CF-02	Add a new FR to Product Functions table for Notifications, matching the Functional Scope description.	Y	FR added as FR-25 for Notifications.	Clear requirement already agreed in Functional Scope — simple fix by updating Product Functions.
CF-01	Negotiation	Y	Performance degradation limit changed from 25% to 15%	15% was agreed to be a more realistic compromise based on load testing feedback and user experience goals.

3.8.3.5 Change Log

Change ID	Req ID	Summary of Change	Proposed By	Date	Session ID
CL-01	N/A	Split Parking Availability & Rewards into two sections	Chee Rui	17/6/2025	VS-01
CL-02	N/A	Changed “Matching is manual” to “Acceptance is manual”	Chee Rui	17/6/2025	VS-01
CL-03	N/A	Reworded MMU SSO description to prevent multiple logins	Chee Rui	17/6/2025	VS-01
CL-04	N/A	Clarified Phase 1 definition and fallback behavior	Chee Rui	17/6/2025	VS-01
CL-05	N/A	Reworded stakeholder needs for clarity	Chee Rui	17/6/2025	VS-01
CL-06	N/A	Removed FR-17 (record audio)	Chee Rui	17/6/2025	VS-01
CL-07	N/A	Added FR-10 (receive notification)	Chee Rui	17/6/2025	VS-01
CL-08	N/A	Relocated Product Overview section	Chee Rui	17/6/2025	VS-01
CL-09	N/A	Relocated and updated Context Diagram	Chee Rui	17/6/2025	VS-01
CL-10	N/A	Removed duplicated Interface Requirements	Chee Rui	17/6/2025	VS-01
CL-11	UC-5	Added Alternate Flow for “no drivers available”	Sow Chien Yee	18/6/2025	VS-02
CL-12	UC-9	Added Exception Flow for parking data unavailability	Sow Chien Yee	18/6/2025	VS-02
CL-13	PR-2	Reworded parking update rate requirement	Sow Chien Yee	18/6/2025	VS-02
CL-14	PR-3	Revised performance degradation threshold	Sow Chien Yee	18/6/2025	VS-02
CL-15	PR-5	Clarified performance metrics definition	Sow Chien Yee	18/6/2025	VS-02

CL-16	PR-1	Added monitoring method for PR-1 responsiveness	Sow Chien Yee	18/6/2025	VS-02
CL-17	IF-004	Added fallback mechanism for Parking API and SSO	Teh Li Wei	19/6/2025	VS-03
CL-18	IF-007	Reworded accuracy requirement with calculation method	Teh Li Wei	19/6/2025	VS-03
CL-19	DB-005	Normalized vehicleInfo fields in Driver Table	Teh Li Wei	19/6/2025	VS-03
CL-20	DB-006	Moved vehicleType to Driver Table	Teh Li Wei	19/6/2025	VS-03
CL-21	Pg 52	Corrected vehicleType typo and field separation	Teh Li Wei	19/6/2025	VS-03
CL-22	N/A	Added details to Scalability & Performance Constraints	Lai Zi Xuan	21/6/2025	VS-04
CL-23	N/A	Added PDPA, ISO 27001, WCAG compliance in Security	Lai Zi Xuan	21/6/2025	VS-04
CL-24	N/A	Clarified encryption requirements in SSA-12	Lai Zi Xuan	21/6/2025	VS-04
CL-25	N/A	Added SSA-17 and SSA-18 (OWASP, SSO auth)	Lai Zi Xuan	21/6/2025	VS-04
CL-26	N/A	Added SSA-24, SSA-25 (MTTR, code complexity)	Lai Zi Xuan	21/6/2025	VS-04
CL-27	N/A	Updated usability targets in SSA-36	Lai Zi Xuan	21/6/2025	VS-04
CL-28	N/A	Clarified verification responsibilities in 4.1	Lai Zi Xuan	21/6/2025	VS-04
CL-29	N/A	Clarified usability verification criteria in 4.2	Lai Zi Xuan	21/6/2025	VS-04
CL-30	N/A	Added assumptions for network and API dependencies	Lai Zi Xuan	21/6/2025	VS-04

3.8.3.6 Requirements Traceability Matrix

All goals in the project are identified and assigned an ID to be used in the Requirements traceability Matrix below.

Goal ID	Goal Description
G1	Ensure system reliability and performance for campus-wide usage
G2	Provide fast and secure user authentication and profile management
G3	Enable efficient and flexible ride-sharing services
G4	Promote user safety and emergency handling
G5	Provide accurate real-time parking availability
G6	Encourage eco-friendly commuting through rewards and incentives
G7	Support administrative reporting and monitoring of system usage

Performance Requirements

Req ID	Requirement Description	Linked Goal(s)	Feature(s)	Use Case(s)	Traceability Score (1-4)
PR-1	UI responsiveness: dashboard <3s, forms <2s	G1	All features	All Use Cases	4
PR-2	Parking data refresh ≤ 2 min, queries <3s, reservations <10s	G5	FR-11, FR-12, FR-13	UC-9	4
PR-3	Support 500–1000 concurrent users, peak degradation ≤ 15%	G1	All features	All Use Cases	4
PR-4	Process up to 100 ride requests, 50 matches, 200 parking queries per min	G3	FR-4, FR-5, FR-6, FR-8, FR-11	UC-4, UC-5, UC-6, UC-9	4
PR-5	Support 50% user base growth without perf degradation	G1	All features	All Use Cases	4
PR-6	Support feature expansion via API versioning	G1	All features	All Use Cases	4
PR-7	Store ride history (12 months), profiles indefinitely	G6	FR-2, FR-18, FR-21	UC-3, UC-11, UC-13	4
PR-8	Mobile data ≤ 5MB/hr, backend up to 50Mbps	G1	All features	All Use Cases	4

PR-9	Uptime ≥ 99.5%, downtime ≤ 1 hr/month	G1	All features	All Use Cases	4
PR-10	Crash recovery <2 min, preserve session & ride data	G1, G4	FR-4, FR-5, FR-6, FR-14, FR-16	UC-4, UC-5, UC-6, UC-12	4

Usability Requirements

Req ID	Requirement Description	Linked Goal(s)	Feature(s)	Use Case(s)	Traceability Score (1-4)
UR-1	Intuitive Interface (registration < 5 min, tutorial < 3 min)	G2	FR-1, FR-2, FR-3	UC-2, UC-3	4
UR-2	Help & Documentation (context help, searchable, video tutorials)	G2	All features	All Use Cases	3
UR-3	Task completion (rides < 45 sec, parking < 15 sec)	G2, G3, G5	FR-4, FR-5, FR-6, FR-11	UC-5, UC-6, UC-9	4
UR-4	Navigation efficiency (2 taps to primary functions)	G2	All features	All Use Cases	3
UR-5	User satisfaction (survey rating ≥ 4.0, app store ≥ 4.2)	G2	All features	All Use Cases	3
UR-6	Visual design (branding, consistency, UX)	G2	All features	All Use Cases	3
UR-7	Accessibility (WCAG 2.1 AA, adjustable text, contrast)	G2	All features	All Use Cases	3
UR-8	Device compatibility (iOS/Android, screen sizes)	G2	All features	All Use Cases	3
UR-9	Error prevention	G2	FR-2, FR-4, FR-5, FR-10	UC-3, UC-4, UC-5, UC-10	4
UR-10	Recovery options (cancel rides, reset defaults, preserve input)	G2, G3	FR-5, FR-7, FR-2	UC-3, UC-5, UC-6	4
UR-11	Student-specific features (cost savings, campus routes)	G6	FR-4, FR-5, FR-18, FR-19	UC-4, UC-5, UC-11	4
UR-12	Faculty/Staff features (calendar sync, networking)	G6	FR-4, FR-5, FR-20	UC-4, UC-5, UC-11	4

3.8.3.7 Role in Requirements Validation, Negotiation & Management

Student Name	Primary Responsibility	No. of Session Participated
Chee Rui	Main Inspector and modifier for Section 1 - 3.1.4 Main Compiler	6
Sow Chien Yee	Main Inspector and modifier for Section 3.1.5 - 3.3	6
Teh Li Wei	Main Inspector and modifier for Section 3.4-3.5	6
Lai Zi Xuan	Main Inspector and modifier for Section 3.6-5.3	6

3.8.3.8 Version Control & Configuration Summary

Google Sheets was selected as the version control tool for this validation process (see link below).
https://docs.google.com/spreadsheets/d/1OgdQcZSB6BbzL9wj-b-jzcQtMLWHHEID4M5g3wA0I78/edit?usp=sharing

Configuration and modifications were documented individually in Microsoft Word files. Each inspector was responsible for a section of the SRS, with identified defects and corresponding changes recorded in the sheet named after each inspector. Finally, the main compiler compiles all changes and added them into the SRS documentation.

4.0 Verification

4.1 Verification Approach

The verification approach defines how the requirements specified in this document will be validated to ensure the system meets stakeholder needs:

Verification Methods

Method	Description	Application
Inspection	Systematic examination of requirements through reviews, walkthroughs, and audits	Used for verifying documentation completeness, consistency, and adherence to standards
Analysis	Evaluation of requirements through models, simulations, or theoretical analysis	Used for verifying system architecture, data models, and logical requirements
Demonstration	Showing that requirements are satisfied through prototype operation	Used for verifying user interface requirements and workflow functionality
Testing	Systematic operation of the system under control conditions to evaluate behavior	Used for verifying functional and performance requirements
Certification	Verification by an independent authority	Used for verifying compliance with external standards and regulations

Verification Process

1. **Requirements Review**: All requirements will undergo peer review by stakeholders to ensure clarity, testability, and relevance
2. **Traceability Matrix**: A traceability matrix will be developed to link each requirement to its corresponding verification method and test case
3. **Prototyping and User Testing**: Key functional and usability requirements will be validated through prototype development and user testing
4. **Functional Testing**: Comprehensive test cases will be developed to verify functional requirements through black-box and white-box testing approaches
5. **Performance Testing**: Load testing, stress testing, and capacity testing will be conducted to verify performance requirements
6. **Security Assessment**: Security requirements will be verified through vulnerability scanning, penetration testing, and code review
7. **User Acceptance Testing**: End-users will validate that the system meets their needs through structured acceptance testing
8. **Compliance Verification**: External audits will verify compliance with applicable regulations and standards
9. **Role clarity**: The Development Team is responsible for Unit and Integration Testing. The Quality Assurance (QA) Team is responsible for System, Performance, and Security Testing. User Acceptance Testing (UAT) will be facilitated by the Business Analyst and conducted by selected end-users (drivers and passengers).

4.2 Verification Criteria

Each requirement category will be verified according to the following criteria:

Functional Requirements

- Each function operates as specified
- Functions handle both valid and invalid inputs appropriately
- Functions properly integrate with other system components
- User workflows complete successfully
- All business rules are enforced correctly

Performance Requirements

- Response times meet specified targets under normal and peak loads
- System handles concurrent user limits
- Resource utilization remains within specified boundaries
- System remains stable during extended operation periods
- Recovery procedures function as expected after failures

Usability Requirements

- User tasks are completed within specified time frames
- Error rates fall below acceptable thresholds
- User satisfaction shall be verified by achieving an average score of 4 out of 5 in post-UAT surveys regarding system usability and functionality.
- Learning curve metrics match or exceeds expectations
- Accessibility compliance is verified

Interface Requirements

- All specified interfaces function correctly
- Data exchanges with external systems operate as expected
- User interfaces display correctly across specified devices
- Error handling protocols function properly at interface boundaries
- Interface performance meets specified targets

Security Requirements

- Authentication mechanisms function as specified
- Authorization controls properly restrict access
- Data encryption functions correctly
- Audit logging captures required information
- System resists penetration testing attempts

5.0 Appendices

5.1 Assumptions and Dependencies

This section outlines the assumptions and dependencies that influence the Campus Ride-Sharing Platform with Parking System Integration.

Assumptions

- The MMU Single Sign-On (SSO) system will remain operational and accessible.
- Campus Wi-Fi and cellular coverage will provide reliable connectivity across parking zones.
- University-affiliated users (students, faculty, and staff) will have smartphones capable of running the app.
- The carpool reward system will remain viable under university policies.
- Parking occupancy data updates will be accurate and timely.
- Consistent availability and performance of MMU's network infrastructure
- Third-party mapping service APIs (e.g., Google Maps API) remain stable and accessible within service level agreements.

Dependencies

- **MMU IT Security Policies**: Affect user authentication and data management.
- **Campus Parking System**: Must provide real-time availability and enforce priority zones.
- **Notification Services**: Cloud-based push notifications depend on third-party providers.

5.2 Acronyms and Abbreviations

AES	Advanced Encryption Standard
API	Application Programming Interface
CSV	Comma-Separated Values
GIS	Geographic Information System
GPS	Global Positioning System
HTML	HyperText Markup Language
HTTPS	Hypertext Transfer Protocol Secure
ID	Identification
IEEE	Institute of Electrical and Electronics Engineers
JSON	JavaScript Object Notation
KPIs	Key Performance Indicators
MMU	Multimedia University
PDF	Portable Document Format
REST API	Representational State Transfer API
SOS	Safe Operating Stop
SSO	Single Sign- On
SRC	Student Representative Council
SRS	System Requirements Specification
TLS	Transport Layer Security
UI	User Interface
XML	Extensible Markup Language

5.3 Glossary

API (Application Programming Interface)	A set of protocols that allows different software components to communicate effectively.
Authentication	The process of verifying a user's identity using **MMU SSO** credentials.
Carpool Matching Engine	The module responsible for pairing drivers and passengers based on route compatibility.
Database	A structured repository for storing and managing user profiles, ride history, and parking occupancy data.
Eco-Points	Reward points earned by users for ride-sharing participation, redeemable for rewards like priority parking or vouchers.
Emergency Alert (SOS)	A feature that allows users to notify campus security and selected emergency contacts in critical situations.
GPS (Global Positioning System)	A technology used for location tracking and ride validation.
HTTPS (Hypertext Transfer Protocol Secure)	A secure communication protocol ensuring encrypted data transmission.
MMU SSO (Multimedia University Single Sign-On)	A system used for authenticating users using university-issued credentials.
Notification System	A module responsible for sending alerts related to ride confirmations, parking availability, rewards, and emergencies.
Passenger	A registered user who requests a ride through the platform.
Priority Parking	Reserved parking spots allocated for verified carpools as an incentive for shared commuting.
Push Notifications	Instant messages sent to users via the platform's mobile application to provide timely updates.

Ride History	A record of past rides taken or offered by a user, including details of trip durations and participants.
Ride Offer	A submission by a driver specifying available seats, origin, destination, and trip timing.
Ride Request	A submission by a passenger specifying pickup location, destination, and preferred time.
Security Protocols	Measures implemented to ensure data encryption, user authentication, and privacy compliance.
User Interface (UI)	The visual elements of the platform that facilitate interaction with ride-matching and parking lookup features.
Verification Criteria	Standards used to confirm the system meets specified functional, security, and usability requirements.