Software Requirements Specifications

Campus Parking Management System

(CPMS)

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# 1. Introduction

## 1.1 Purpose

The purpose of the “Campus Ride-Sharing Platform with Parking System Integration”(CRSP) is to integrate a new ride-sharing application with the campus parking management system and digital ID verification. This platform is specifically for university community members, it aims to reduce parking demand and traffic congestion around campus.

This document follows the ISO/IEC/IEEE 29148:2018 standards for Software Requirements Specifications. It is a foundation for system design, development, testing, and validation.

This document is intended for:

* System developer
* Test engineers
* Project manager
* University IT administrators
* Client

## 1.2 Scope

The Campus Ride-Sharing Platform with Parking System(CRSP) Integration is a mobile-based software application and specifically for university community members, including students, faculty, and staff. The platform aims to facilitate carpooling arrangements and integrate with the campus parking management system to reduce traffic congestion and parking demand.

This system will allow users to:

* Coordinate ridesharing with verified university members.
* Set ride preferences.
* View and book available parking spaces in real-time.
* Receive ride and parking notifications via mobile and campus email.
* Authenticate their ID through the university’s Digital ID system.

The system will integrate with existing services including the **Parking Management System**, **Digital ID System**, **Campus Email System**, and the **University Network**.

This system does not include:

* Non-university users.
* External ride-hailing services. (Uber, Grab)

## 1.3 Product Overview

The Campus Ride-Sharing Platform with Parking System Integration(CRSP) is a mobile-based application designed to integrate ridesharing and parking coordination within a university environment. The product supports carpooling among university community members, allowing users to manage rides, set preferences, view available parking, and manage bookings in real-time.

### 1.3.1 Product Perspective

The Campus Ride-Sharing Platform with Parking System Integration (CRSP) integrates with the following systems:

* **Parking Management System:** Provides real-time parking availability data to the platform for display and parking booking by users.
* **Digital ID System:** Authenticates users and verifies user roles.
* **Campus Email System:** Sending and receiving of notifications, alerts, and confirmations related to rides and parking events.

Primary users:

* **University Community Members:** The main users of the system, They interact with the platform to manage rides, view parking availability, and receive notifications.
* **Admin:** An authorized person responsible for managing platform configurations, approving ride and parking data, and ensuring the platform operates within university policy.

A diagram of a system

AI-generated content may be incorrect.

Figure 1.0 CRSP Context Diagram

### 1.3.2 Product Functions

The following table (Table 1.0) shows the list of primary functions to be implemented in CRSP.

|  |  |  |
| --- | --- | --- |
| Function | Description | Accessible Role |
| Rides-Sharing Management | * Allows users to create, join, or manage carpool rides. * Enables setting ride preferences. * Review drivers. | University Community Members, Admin |
| Parking Management | * Displays real-time parking availability. * Enable users to book and manage parking reservations. | University Community Members, Admin |
| Notifications and Alerts | * Sends email and push notifications to users. | University Community Members, Admin |
| User Authentication | * Verifies users using the university’s Digital ID System to ensure access is limited | Admin |
| System Monitoring and Administration | * Allows admins to monitor ride and parking data. | Admin |

Table1.0 CRSP Product Function Table

### 1.3.3 User Characteristics

The following table (Table 1.1) shows the intended user groups and their expected required knowledge in CRSP.

|  |  |  |
| --- | --- | --- |
| User | Description | Required Knowledge |
| University community members | Person related with the university, including students, faculty, and staff, who are eligible to access and use campus-related services. | Basic mobile app usage, university email access, parking and ride-sharing policies rules, university policies. |
| Admin | Authorized person responsible for managing user accounts, managing system functionality, backend settings and monitoring parking data. | Understanding of system backend, parking and ride-sharing rules, university policies, data handling, user role management, basic computer skills. |

Table1.1 CRSP User Characteristics Table

### 1.3.4 Limitations

The Campus Ride-Sharing Platform with Parking System Integration has the following limitations that may affect its functionality or performance:

* Platform Accessibility:
  + The system is designed for mobile platforms only. It is not accessible via desktop browsers or other non-mobile devices.
* User Scope Restriction:
  + Non- university community members are not supported.
* Network Dependency:
  + The application requires a stable internet connection. Network latency may cause delays in real-time parking availability.

## 1.4 Definitions

**Application**: A campus ride-sharing platform that used to facilitate carpooling and parking coordination among university community members.

**University community members**: Person related with the university, including students, faculty, and staff, who are eligible to access and use campus-related services.

**Student**: A university member who undergraduate or postgraduate studies. A potential ride requester or driver in the system. Also represent the primary users of the ride-sharing and parking platform.

**Faculty**: Academic staff employed by a university. Such as, Lecturers and tutors.

**Staff**: Non-academic university employees, such as administrative or cleaning workers.

**Admin**: Authorized person responsible for managing user accounts, managing system functionality, backend settings and monitoring parking data.

**Carpool**: A ridesharing activity where one or more users share a vehicle.

**Parking Booking**: A system function allowing users to reserve available parking spaces based on real-time data.

# 2. References

IEEE. (2018). ISO/IEC/IEEE 29148:2018 Systems and software engineering—Life cycle processes—Requirements engineering. https://www.iso.org/standard/72089.html

Pohl, K. (2010). Requirements engineering: Fundamentals, principles, and techniques. Springer.(Not Sure)

# 3. Requirements

## 3.1 Functions

A diagram of parking system

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Figure 2.0 CRSP Use Case Diagram

### 3.1.1Manage Rides:

|  |  |  |
| --- | --- | --- |
| Use Case | Manage Rides | |
| Purpose | University community members may manage their own rides. | |
| Actor | University community members | |
| Trigger | User click manage rides button | |
| Precondition | User at the main page. | |
| Main Flow | Step | Description |
| 1 | System will display various button on the screen. Which are, “Join Rides”, “Create Rides”, “Set Preference” and “Review Drivers”. |
| 2 | Users click one of the buttons. |
| 3 | System direct to corresponding page. |

Table 2.0 Use Case Specification – Manage Rides

A diagram of a button

AI-generated content may be incorrect.

Figure 2.1 Activity Diagram – Manage Rides

### 3.1.2 Join Rides

|  |  |  |
| --- | --- | --- |
| Use Case | Join Rides | |
| Purpose | University community members may join others created rides. | |
| Actor | University community members | |
| Trigger | User clicked the “Join Rides” button. | |
| Precondition | User at the Manage Rides page. | |
|  | Step | Description |
| Main Flow | 1 | User is required to enter a destination. |
| 2 | System displays available rides. |
| 3 | Send the information of selected ride. |
| 4 | System direct back to “Manage Rides” page |
| Alternate Flow – Location unavailable | 1-1 | Display a message about location unavailable. |
| Alternate Flow – Rides unavailable | 2-1 | Display a message about rides unavailable. |
| Alternate Flow – Cancel join rides | 3-1 | System direct back to “Manage Rides” page |

Table 2.1 Use Case Specification – Join Rides

A diagram of a flowchart

AI-generated content may be incorrect.

Figure 2.2 Activity Diagram – Join Rides

### 3.1.3 Create Rides

|  |  |  |
| --- | --- | --- |
| Use Case | Create Rides | |
| Purpose | University community members may create a ride for others to join the rides. | |
| Actor | University community members | |
| Trigger | User clicked the “Create Rides” button. | |
| Precondition | User at the Manage Rides page. | |
|  | Step | Description |
| Main Flow | 1 | User is required to enter a location. |
| 2 | User is required to enter a destination. |
| 3 | User is required to select a time. |
| 4 | Store the rides information into system. |
| 5 | System direct back to “Manage Rides” page |
| Alternate Flow – Location unavailable | 1-1 | Display a message about location unavailable. |
| Alternate Flow – Destination unavailable | 2-1 | Display a message about destination unavailable. |
| Alternate Flow – Cancel create rides | 4-1 | System direct back to “Manage Rides” page |

Table 2.2 Use Case Specification – Create Rides

A diagram of a process

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Figure 2.3 Activity Diagram – Create Rides

### 3.1.4 Set Preference

|  |  |  |
| --- | --- | --- |
| Use Case | Set Preference | |
| Purpose | University community members may customize their preferences such as upload picture, edit names and edit self-description. | |
| Actor | University community members | |
| Trigger | User clicked the “Edit Preference” button. | |
| Precondition | User at the main page. | |
|  | Step | Description |
| Main Flow | 1 | System will display a profile picture and a text box with the user’s current name and user’s current self-description. |
|  | 2 | User may upload a new profile picture |
|  | 3 | User may edit their name. |
|  | 4 | User may edit their self-description |
|  | 5 | Store the user preference information into system |
|  | 6 | System direct back to “Main” page |
| Alternate Flow – Cancel Editing | 5-1 | User cancels the action. System discard changes and direct back to “Main page” |
| Alternate Flow – Upload failed | 2-1 | Display a message if the uploaded picture format is unsupported or upload fails. |
| Alternate Flow – Name field empty | 3-1 | Display a message if the name field is blank. |

Table 2.3 Use Case Specification – Set Preference

A diagram of a software flowchart

AI-generated content may be incorrect.

Figure 2.4 Activity Diagram – Set Preference

### 3.1.5 Review Drivers

|  |  |  |
| --- | --- | --- |
| Use Case | Review Drivers | |
| Purpose | University community members may review drivers after completing a ride. | |
| Actor | University community members | |
| Trigger | User clicked the “Review Drivers” button. | |
| Precondition | User at the Manage Rides page. | |
|  | Step | Description |
| Main Flow | 1 | System displays ride history |
|  | 2 | User selects a completed ride |
|  | 3 | User clicks “Review Driver” |
|  | 4 | System display a review form |
|  | 5 | User fill in review form |
|  | 6 | Store the review information into system |
| Alternate Flow –  No completed ride | 1-1 | Display a message about no completed rides |

Table 2.4 Use Case Specification – Review Drivers

A diagram of a software system

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Figure 2.5 Activity Diagram – Review Drivers

### 3.1.6 View Parking Status

|  |  |  |
| --- | --- | --- |
| Use Case | View Parking Status | |
| Purpose | University community members may check the availability of parking spaces in real time | |
| Actor | University community members | |
| Trigger | User click “View Parking Status” button | |
| Precondition | User at the main page | |
|  | Step | Description |
| Main Flow | 1 | System display parking locations and availability status |
|  | 2 | User select a parking locations |
|  | 3 | System show detailed information about the selected parking location |
|  | 4 | User click “Book parking” button |
|  | 5 | System direct to “Book Parking” page |
| Alternate Flow –  Booking not available | 4-1 | Display a message if the selected parking location is full or not available for booking |
|  | 4-2 | System remains on the “View Parking Status” page |

Table 2.5 Use Case Specification – View Parking Status

A diagram of parking location

AI-generated content may be incorrect.

Figure 2.6 Activity Diagram – View Parking Status

### 3.1.7 Book Parking

|  |  |  |
| --- | --- | --- |
| Use Case | Book Parking | |
| Purpose | University community members may book a parking to join the rides. | |
| Actor | University community members | |
| Trigger | User clicked “Book Now” button while viewing current parking status | |
| Precondition | User views current parking status | |
|  | Step | Description |
| Main Flow | 1 | Redirects to booking form |
|  | 2 | User selects a location and confirms booking |
|  | 3 | System sends the booking request to database to validates |
|  | 4 | User proceeds to the booking payment |
|  | 5 | System sends booking success message |
|  | 6 | System direct back to “Manage Rides” page |
| Alternate Flow - | 2-1 | User selected location is not available and display message about location is not available |
|  | 3-1 | Display the message about validation failed (all parking is occupied) |
|  | 4-1 | Display the message about payment is failed |

Table 2.6 Use Case Specification – Book Parking

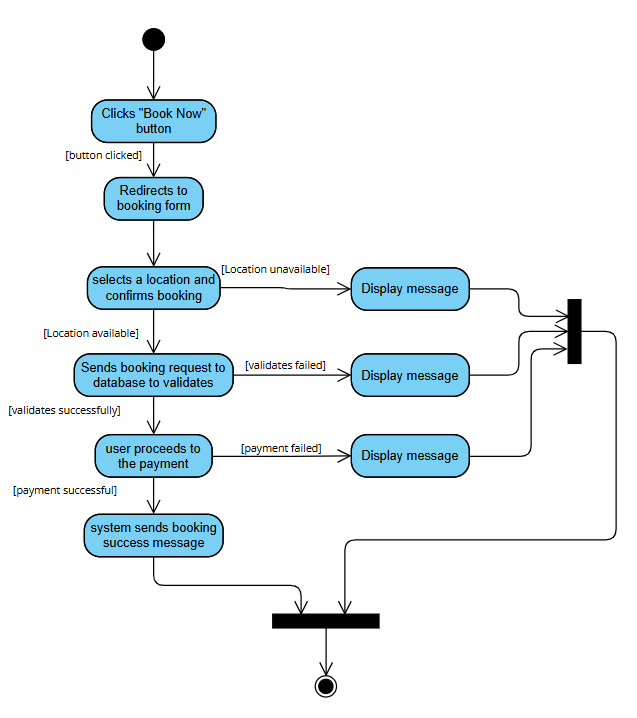


Figure 2.7 Activity Diagram – Book Parking

### 3.1.8 Approve Rides

|  |  |  |
| --- | --- | --- |
| Use Case | Approve Rides | |
| Purpose |  | |
| Actor | Admin | |
| Trigger |  | |
| Precondition |  | |
|  | Step | Description |
| Main Flow | 1 |  |
| Alternate Flow - |  |  |

Table 2.7 Use Case Specification – Approve Rides

Figure 2.8 Activity Diagram – Approve Rides

### 3.1.9 Manage Users

|  |  |  |
| --- | --- | --- |
| Use Case | Manage Users | |
| Purpose |  | |
| Actor | Admin | |
| Trigger |  | |
| Precondition |  | |
|  | Step | Description |
| Main Flow | 1 |  |
| Alternate Flow - |  |  |

Table 2.8 Use Case Specification – Manage Users

Figure 2.9 Activity Diagram – Manage Users

### 3.1.10 Monitoring Parking

|  |  |  |
| --- | --- | --- |
| Use Case | Monitoring Parking | |
| Purpose | Monitor real-time parking space availability and system usage | |
| Actor | Admin | |
| Trigger | Admin clicks a button like “Monitor Parking” on the admin dashboard | |
| Precondition | Admin is logged into the system | |
|  | Step | Description |
| Main Flow | 1 | Request parking data from database when “Monitor Parking” button is clicked |
|  | 2 | Get current parking status from database |
|  | 3 | Return latest parking data from database to admin dashboard |
|  | 4 | Display data on the admin dashboard |
|  | 5 | Show real-time parking info |
| Alternate Flow - | 1.1 | Request failed during data fetching and display message about request failed |
|  | 2.1 | Failed to get data from database and display message about fetching failed |

Table 2.9 Use Case Specification – Monitoring Parking

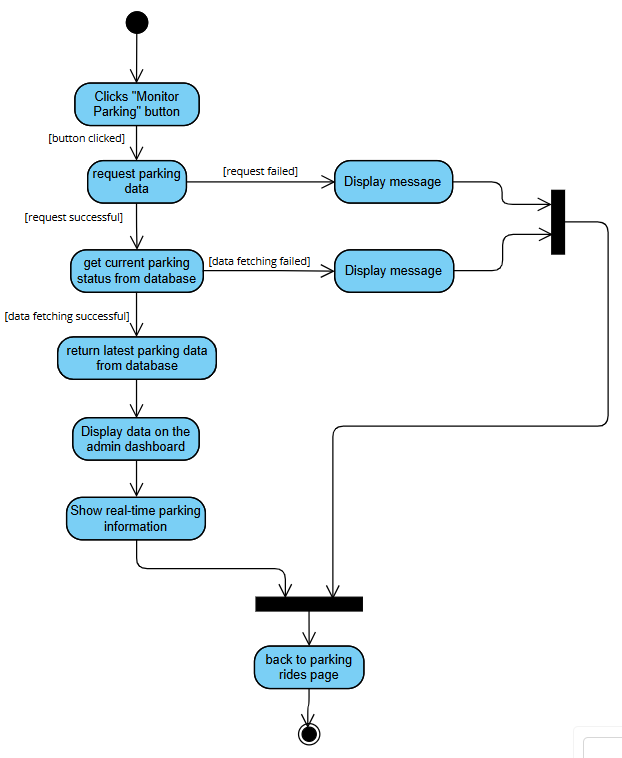


Figure 2.10 Activity Diagram – Monitoring Parking

## Performance Requirements

The CRSP shall meet the following performance requirements:

* Authentication and login processes shall complete within 3 seconds under normal network conditions.
* The system shall respond to user interactions within 2 seconds.
* The platform shall handle at least 100 ride-sharing transactions and 200 parking status queries per minute during peak hours.
* The system shall be scalable to support an increase of up to 200% in user load during semester start and end periods.
* Notifications sent via the Campus Email System shall be delivered within 1 minute after user create or join ride.
* Parking availability data from the Parking Management System shall be updated in the application every 20 seconds.

## 3.3 Usability Requirements

The CRSP shall meet the following usability requirements:

* The user interface shall be intuitive enough that 90% of new users can successfully perform basic tasks (join rides, view parking status) without external help within their first 15 minutes of use.
* The “View Parking Status” actions shall be accessible within 2 clicks from the main screen.
* New users shall be able to learn to use the basic task (join rides, view parking status) with less than 15 minutes of guided interaction.
* A tutorial guide shall be provided for first-time users.
* Admins shall be able to review and approve ride or parking data in under 3 minutes per task.
* Frequent users shall be able to complete a task under 60 seconds.

## 3.4 Interface Requirements

(Mapped to 9.6.11 External Interfaces and 9.6.4 System Interfaces, User Interfaces, Hardware Interfaces, Software Interfaces, Communications Interfaces)

Specify all system interfaces, including external systems, user interfaces, hardware, and communications.

### 3.4.1 System Interfaces:

Interfaces with external systems or hardware.

Example: The system will integrate with the university’s authentication system (LDAP).

### 3.4.2 User Interfaces:

Describe the layout and interaction elements, e.g., navigation, buttons, data entry fields.

Example: The web interface will use a responsive layout with a fixed top navigation bar

for easy access to key features.

### 3.4.3 Hardware Interfaces:

Specify hardware connections, devices, and communication protocols.

Example: The system shall support USB-connected fingerprint readers for user authentication.

### 3.4.4 Software Interfaces:

Describe interactions with other software or APIs.

Example: The system will interact with a third-party cloud service for file storage (e.g.,

Amazon S3).

### 3.4.5 Communications Interfaces:

Specify protocols, message formats, and network requirements.

Example: The system will use HTTPS for secure communication between client and

server.

## 3.5 Logical Database Requirements

(Mapped to 9.6.15 Logical Database Requirements)

Describe key data entities, relationships, and constraints. This could include an EntityRelationship (ER) diagram or class diagram.

Example:

The “Application” entity has attributes such as applicationID, title, and submissionDate, and it is related to the “Reviewer” entity.

## 3.6 Design Constraints

**University Branding Compliance :**

* The user interface must align with the university's official branding guidelines, including colours, fonts, logos, and overall visual identity to ensure consistency and familiarity for users.

**Authentication Integration :**

* The platform must support integration with the university’s digital ID verification system for secure access by students, faculty, and staff.

**Platform Accessibility :**

* The system must comply with common web accessibility standards (e.g., WCAG 2.1) to ensure usability for users with disabilities.

**Technology Stack :**

* The design should be compatible with frameworks such as Django (Python), Java, and SQLite or similar relational databases to ensure ease of development, maintenance, and integration.

**Data Privacy Regulations :**

* The system must adhere to institutional and legal data protection regulations (e.g., GDPR-like rules for user consent and personal data handling) since it involves sensitive personal data and location tracking.

**Network Dependency :**

* Real-time parking data and ride-matching features must rely on stable internet connectivity. Offline functionality is limited and should be clearly documented.

**Deployment Environment :**

* The software must be deployable on university-managed Linux and Windows servers without requiring extensive custom configuration.

**Cross-Platform Support**

* The application should be designed to operate on both desktop and mobile platforms, including web browsers and Android/iOS devices, without requiring separate codebases.

## 3.7 Software System Attributes

* **Reliability**:  
  The system should deliver reliable updates of parking availability and ride-matching. In the event of a crash, it should recover in under 1 minute to not cause service disruption.
* **Availability**:  
  The platform should maintain at least 99.9% uptime between peak campus times (Monday to Friday, 7:00 AM – 10:00 PM), which encompasses students' and employees' primary use times.
* **Security**:  
  The system will implement role-based access control (RBAC) to restrict user permissions. All user sensitive data, personal data, and location history shall be encrypted using industry best practices protocols.
* **Maintainability**:  
  Software shall be coded with best coding practices using modular architecture. This will make it easier to do future upgrades, debugging, and scalability.
* **Portability**:  
  The application should run smoothly on both Linux and Windows server environments. No major reconfiguration should be required for deployment across different operating systems.

## 3.8 Supporting Information

**a) Sample Input/Output Formats**:

* Input: User login credentials (e.g., campus email and password).
* Output: List of available ride-sharing options, parking lot availability in JSON or tabular format.
* Export Format: Data logs can be exported in CSV format for administrative review.

**b) Supporting/Background Information**:  
The project responds to growing parking space deficits and campus transportation inefficiency by encouraging ride-sharing and integrating digital ID verification for secure entry.

**c) Problem Description**:  
Parking and traffic limitations exist in campus populations. The goal is to provide a shared solution that enables easy sharing of rides and optimal parking space utilization.

**d) Special Packaging Instructions**:  
Deployment packages must include a README that includes setup instructions, secure API key configurations, and permissions. Deployment packages should be signed and verified prior to being installed on university servers to protect the installation package.

**Note**: These supporting information items are **not considered binding requirements** unless explicitly marked as such during the development phase.

# 4. Verification

## 4.1 Verification Approach

* How:
  + Unit testing for individual features such as join ride, parking booking and create ride.
  + Manual functional testing by group members to ensure the system behaves as expected.
  + User simulation by group members acting as end users.
* Who:
  + All verification will be done by the project group members.
* When:
  + After completing each major feature
  + Before submitting the project
* Where:
  + Testing will be conducted on group members personal machines.

## 4.2 Verification Criteria

* All system functions must perform as described in the functional requirements
* User actions like creating a ride, booking a parking must complete without errors.
* System should display accurate parking availability.
* All data must be saved and retrieved correctly.

# 5. Appendices

## 5.1 Assumptions and Dependencies

(Mapped to 9.6.8 Assumptions and Dependencies)

List any assumptions and dependencies that impact the software development process or its requirements.

Example:

The system depends on the availability of the university's student database for user authentication.

## 5.2 Acronyms and Abbreviations

CRSP – Campus Ride-Sharing Platform with Parking System Integration

SRS – System Requirement Specification

IEEE – Institute of Electrical and Electronics Engineers

API - Application Programming Interface