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1 Introduction

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1.1 Purpose

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3 Requirements

3.1 Functions

3.1.1 Use Case

Use Case Table

|  |  |
| --- | --- |
| Actor | Use Case |
| Driver | Driver Offer Ride |
| Passenger | Passenger Request Ride |
| Passenger Schedule Ride in Advance |
| User (Driver, Passenger) | User View Ride Details |
| User Track Real-Time Ride Location |
| User Send and Receive Messages per Ride |
| User View Notifications |
| User View Real-Time Parking Availability |
| User Sign Up Using MMU Digital ID |
| User Log In |
| User Log Out |
| Admin | Admin Log In |
| Admin Log Out |
| Admin View User Information and Vehicle Details |

Use Case Diagram

A diagram of a system

AI-generated content may be incorrect.

3.1.1.2 Use Case 1: Driver Offer Ride

|  |  |
| --- | --- |
| Use Case Name | Driver Offer Ride |
| Use Case ID | UC-01 |
| Purpose | Allow drivers to offer available seats in a ride. |
| Primary Actor | Driver |
| Secondary Actor | Passenger |
| Preconditions | - Drivers must be logged into the system. |
| Postconditions | - Ride offer is available for system matching. |
| Main Flow | 1. Drivers navigate to “Offer Ride”.  2. Enter the seats available, pickup, and destination.  3. Confirm offer.  4. System matches with passengers’ requests.  5. System notify the user for match success.  6. System display ride details. |
| Alternate Flow | Alternate Flow 1:  1. Drivers navigate to “Offer Ride”.  2. Enter the number of seats available, destination.  3. Confirm offer.  4. System matches with passengers’ requests.  5. Drivers cancel the ride.  6. Enter cancel reason.  7. Confirm cancel.  Alternate Flow 2:  1. Drivers navigate to “Offer Ride”.  2. Enter the number of seats available, destination.  3. Confirm offer.  4. System matches with passengers’ requests.  5. If the passenger cancels the ride, display the cancel reason.  6. System continues to match with passengers’ requests. |
| Special Requirements | - Driver’s account must be verified via MMU ID.  - Drivers must add vehicle details. |

3.1.1.1 Use Case 2: Passenger Request Ride

|  |  |
| --- | --- |
| Use Case Name | Passenger Request Ride |
| Use Case ID | UC-02 |
| Purpose | Allow passengers to request a ride to a specific destination. |
| Primary Actor | Passenger |
| Secondary Actor | Driver |
| Preconditions | - Passengers must be logged into the system. |
| Postconditions | - Ride request is submitted and pending acceptance. |
| Main Flow | 1. Passengers navigate to “Request Ride”.  2. Enter pickup and destination.  3. Confirm request.  4. System matches with the available driver.  5. Send a request to the driver.  6. System notify the passenger for match success.  7. System display ride details. |
| Alternate Flow | Alternate Flow 1:  1. Passengers navigate to “Request Ride”.  2. Enter destination.  3. Confirm request.  4. If there is no available driver, notify the user to try again.  Alternate Flow 2:  1. Passengers navigate to “Request Ride”.  2. Enter pickup and destination.  3. Confirm request.  4. System matches with the available driver.  5. Send a request to the driver.  6. If the driver cancels the ride, display the cancel reason.  7. System notify the passenger to try again.  Alternate Flow 3:  1. Passengers navigate to “Request Ride”.  2. Enter pickup and destination.  3. Confirm request.  4. System matches with the available driver.  5. Send a request to the driver.  6. System notify the passenger for match success.  7. System display ride details.  8. Passengers cancel the ride.  9. Enter cancel reason.  10. Confirm cancel. |
| Special Requirements | - Passenger’s account must be verified via MMU ID. |

3.1.1.3 Use Case 3: Passenger Schedule Ride in Advance

|  |  |
| --- | --- |
| Use Case Name | Passenger Schedule Ride in Advance |
| Use Case ID | UC-03 |
| Purpose | Allow passengers to schedule ride requests in advance. |
| Primary Actor | Passenger |
| Secondary Actor | - |
| Preconditions | - Passenger must be logged into the system. |
| Postconditions | - Ride request is scheduled for future matching. |
| Main Flow | 1. Passengers navigate to “Request Ride > Schedule”.  2. Enter pickup, destination and date/time.  3. Confirm schedule.  4. System matches with the available driver on a specific date/time. |
| Alternate Flow | Alternate Flow 1:  1. Passengers navigate to “Request Ride > Schedule”.  2. Enter pickup, destination and date/time.  3. Confirm schedule.  4. System matches with the available driver on a specific date/time.  5. Passengers cancel the ride schedule.  6. Enter cancel reason.  7. Confirm cancel. |
| Special Requirements | - Passenger’s account must be verified via MMU ID. |

3.1.1.4 Use Case 4: User View Ride Details

|  |  |
| --- | --- |
| Use Case Name | User View Ride Details |
| Use Case ID | UC-04 |
| Purpose | Allow users to view active ride session details like destination, date/time, user and vehicle info etc. |
| Primary Actor | User |
| Secondary Actor | - |
| Preconditions | - Users must be logged into the system.  - Users have upcoming or past rides. |
| Postconditions | - Ride details are displayed. |
| Main Flow | 1. Users navigate to “My Rides”.  2. System loads all ride sessions if any.  3. Users select a ride.  4. System displays ride details like date/time, destination etc. |
| Alternate Flow | Alternate Flow 1:  1. Users navigate to “My Rides”.  2. If there’s no upcoming or past ride, show “no available details”. |
| Special Requirements | - |

3.1.1.5 Use Case 5: User Track Real-Time Ride Location

|  |  |
| --- | --- |
| Use Case Name | User Track Real-Time Ride Location |
| Use Case ID | UC-05 |
| Purpose | Allow users to track the location of the current active ride session. |
| Primary Actor | User |
| Secondary Actor | - |
| Preconditions | - Users must be logged into the system.  - Users must be in an active ride session. |
| Postconditions | - Location is continuously updated. |
| Main Flow | 1. Users navigate to “My Rides”.  2. System displays a list of ride sessions if any.  3. Users select the current active ride.  4. System displays ride details.  5. Users click “Track Ride”.  6. System displays the live location on the map. |
| Alternate Flow | Alternate Flow 1:  1. Users navigate to “My Rides”.  2. If there’s no upcoming or past ride, show “no available details”.  Alternate Flow 2:  1. Users navigate to “My Rides”.  2. System displays a list of ride sessions if any.  3. Users select the current active ride.  4. System displays ride details.  5. Users click “Track Ride”.  6. If the location service is off, display the last known location.  7. Display message “Turn on location to track ride”. |
| Special Requirements | - User’s device must turn on location service. |

3.1.1.6 Use Case 6: User Send and Receive Messages per Ride

|  |  |
| --- | --- |
| Use Case Name | User Send and Receive Messages per Ride |
| Use Case ID | UC-06 |
| Purpose | Allow drivers and passengers in a shared ride to communicate. Once ride session ends, |
| Primary Actor | User |
| Secondary Actor | - |
| Preconditions | - Users must be logged into the system.  - Users must be in an active ride session.  - Both users (driver, passenger) must be matched for the same ride. |
| Postconditions | - Messages are exchanged and stored temporarily for each ride session. |
| Main Flow | 1. Users navigate to “My Rides”.  2. System displays a list of ride sessions if any.  3. Users select the current active ride.  4. System displays ride details.  5. Users click the chat button.  6. System loads the message if any.  7. Users type and send a message.  8. Recipients view and respond to the message.  9. Conversation continues until the ride ends or the user closes the session. |
| Alternate Flow | Alternate Flow 1:  1. Users navigate to “My Rides”.  2. If there’s no upcoming or past ride, show “no available details”.  Alternate Flow 2:  1. Users navigate to “My Rides”.  2. System displays a list of ride sessions if any.  3. Users select the current active ride.  4. System displays ride details.  5. Users click the chat button.  6. If the ride session is canceled or ends, system disables the messaging functionality.  7. System loads the message if any. |
| Special Requirements | - Messaging is only accessible during an active ride session.  - Messages are automatically archived once the ride ends and deleted after 7 days. Users are informed within the interface. |

3.1.1.7 Use Case 7: User View Notifications

|  |  |
| --- | --- |
| Use Case Name | User View Notifications |
| Use Case ID | UC-07 |
| Purpose | Allow users to view ride and system-related notifications. |
| Primary Actor | User |
| Secondary Actor | - |
| Preconditions | - Users must be logged into the system. |
| Postconditions | - Notifications are read. |
| Main Flow | 1. Users navigate to “Notification”.  2. System displays a list of notifications if any.  3. Users select a notification.  4. System displays the notification. |
| Alternate Flow | Alternate Flow 1:  1. Users navigate to “Notification”.  2. If there’s no notification, show “no notifications”. |
| Special Requirements | - Notifications must be time-stamped and clearly categorized (e.g., Ride, Parking, System). |

3.1.1.8 Use Case 8: User View Real-Time Parking Availability

|  |  |
| --- | --- |
| Use Case Name | User View Real-Time Parking Availability |
| Use Case ID | UC-08 |
| Purpose | Show users available parking spots in real time. |
| Primary Actor | User |
| Secondary Actor | Parking Management System |
| Preconditions | - Users must be logged into the system.  - Parking availability data is available in the system. |
| Postconditions | - Users view updated parking availability. |
| Main Flow | 1. Users navigate to “Parking”.  2. System requests real-time parking data.  3. Parking Management System provides the latest data.  4. System loads the campus interactive map and displays available parking locations to the user. |
| Alternate Flow | Alternate Flow 1:  1. Users navigate to “Parking”.  2. System requests real-time parking data.  3. If the Parking Management System fails to respond, show message "parking data is currently unavailable". |
| Special Requirements | - |

3.1.1.9 Use Case 9: User Sign Up Using MMU Digital ID

|  |  |
| --- | --- |
| Use Case Name | User Sign Up Using MMU Digital ID |
| Use Case ID | UC-09 |
| Purpose | Allows users to sign up with their MMU Digital ID. |
| Primary Actor | User |
| Secondary Actor | MMU Digital ID Database |
| Preconditions | - User/Driver must have a valid MMU Digital ID.  - MMU Digital ID Database must be accessible. |
| Postconditions | - New account is created. |
| Main Flow | 1. User navigates to the sign-up screen.  2. User enters their details and credentials.  3. System validates the fields and credentials with the MMU Digital ID Database.  4. A new account is created. |
| Alternate Flow | Alternate Flow 1:  1. User navigates to the sign-up screen.  2. User enters their details and credentials.  3. System validates the fields and credentials with the MMU Digital ID Database.  4. The validation process failed. An error message is shown. |
| Special Requirements | - |

3.1.1.10 Use Case 10: User Log In with MMU Digital ID

|  |  |
| --- | --- |
| Use Case Name | User Log In with MMU Digital ID |
| Use Case ID | UC-10 |
| Purpose | Allow users to log into the system with their MMU Digital ID. |
| Primary Actor | User |
| Secondary Actor | MMU Digital ID Database |
| Preconditions | - User/Driver must have a valid MMU Digital ID  - MMU Digital ID Database must be accessible |
| Postconditions | - User is logged in. |
| Main Flow | 1. User navigates to the login page.  2. User enters their credentials.  3. System validates the credentials.  4. User is logged in. |
| Alternate Flow | Alternate Flow 1:  1. User navigates to the log-in page.  2. User enters the wrong credentials.  3. System validates the credentials.  4. System shows an error message. |
| Special Requirements | - |

3.1.1.11 Use Case 11: User Log Out

|  |  |
| --- | --- |
| Use Case Name | User Log Out |
| Use Case ID | UC-11 |
| Purpose | Allow users to log out of the session. |
| Primary Actor | User |
| Secondary Actor | - |
| Preconditions | - Users must be logged into the system. |
| Postconditions | - Session is deleted. |
| Main Flow | 1. User clicks the “Logout” button.  2. System logs the user out and deletes session objects related to the user. |
| Alternate Flow | - |
| Special Requirements | - |

3.1.1.12 Use Case 12: Admin Log In

|  |  |
| --- | --- |
| Use Case Name | Admin Log In |
| Use Case ID | UC-12 |
| Purpose | Allow admins to log in. |
| Primary Actor | Admin |
| Secondary Actor | - |
| Preconditions | - Admin must have a valid account. |
| Postconditions | - Admin is logged in. |
| Main Flow | 1. Admin navigates to the admin login page.  2. Admin enters their credentials.  3. System validates the credentials and logs admin in. |
| Alternate Flow | Alternate Flow 1:  1. Admin navigates to the admin login page.  2. Admin enters the wrong credentials.  3. System validates the credentials.  4. Validation process failed. System shows an error message. |
| Special Requirements | - |

3.1.1.13 Use Case 13: Admin Log Out

|  |  |
| --- | --- |
| Use Case Name | Admin Log Out |
| Use Case ID | UC-13 |
| Purpose | Allows admin to log out of the session. |
| Primary Actor | Admin |
| Secondary Actor | - |
| Preconditions | - Admin must be logged into the system. |
| Postconditions | - Admin is logged out and related session objects are deleted. |
| Main Flow | 1. Admin clicks the “Logout” button.  2. System logs admin out and deletes related session objects. |
| Alternate Flow | - |
| Special Requirements | - |

3.1.1.14 Use Case 14: Admin View User Information and Vehicle Details

|  |  |
| --- | --- |
| Use Case Name | Admin View User Information and Vehicle Details |
| Use Case ID | UC-14 |
| Purpose | Allows admin to view users’ personal details and vehicle details |
| Primary Actor | Admin |
| Secondary Actor | - |
| Preconditions | - Admin must be logged into the system. |
| Postconditions | - System shows user information and vehicle details. |
| Main Flow | 1. Admin navigates to the “View user information and vehicle details” page.  2. Admin enters the user’s ID or car plate number to filter the search result.  3. Admin views the user information or vehicle details. |
| Alternate Flow | Alternate Flow 1:  1. Admin navigates to the “View user information and vehicle details” page.  2. Admin enters the user’s ID or car plate number to filter the search result.  3. If there is no result, system will show a “no result” message. |
| Special Requirements | - |

3.1.2 Activity Diagram

3.2 Performance Requirements

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3.3 Usability Requirements

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3.4 Interface Requirements

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3.4.1 System Interfaces

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3.4.2 User Interfaces

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3.4.3 Hardware Interfaces

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3.4.4 Software Interfaces

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3.4.5 Communication Interfaces

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3.5 Logical Database Requirements

A diagram of a computer

AI-generated content may be incorrect.

Below are the attributes exist in each entity:

|  |  |
| --- | --- |
| ENTITY | ATTRIBUTES |
| USER | MMU\_ID (PK)  NAME  EMAIL  PHONE\_NUMBER |
| RIDE | RIDE\_ID (PK)  VEHICLE\_ID (FK)  DRIVER\_ID (FK reference USER.MMU\_ID)  DESTINATION (FK reference LOCATION.LOCATION\_ID)  PICKUP (FK reference LOCATION.LOCATION\_ID)  DATE  TIME  AVAILABLE\_SEATS  STATUS  CANCEL\_REASON |
| REQUEST | REQUEST\_ID (PK)  PASSENGER\_ID (FK reference USER.MMU\_ID)  DESTINATION (FK reference LOCATION.LOCATION\_ID)  PICKUP (FK reference LOCATION.LOCATION\_ID)  DATE  TIME  STATUS  CANCEL\_REASON  RIDE\_ID (FK) |
| VEHICLE | VEHICLE\_ID (PK)  MMU\_ID (FK)  PLATE\_NUMBER  BRAND  MODEL  COLOUR |
| LOCATION | LOC\_ID (PK)  LOC\_LONGITUDE  LOC\_LATITUDE  LOC\_ADDRESS  AREA |
| NOTIFICATION | NOTIFICATION\_ID (PK)  MMU\_ID (FK)  SENT\_AT |
| CHAT | CHAT\_ID (PK)  RIDE\_ID (FK)  DRIVER\_ID (FK reference USER.MMU\_ID)  PASSENGER\_ID (FK reference USER.MMU\_ID) |

|  |  |
| --- | --- |
| MESSAGE | MESSAGE\_ID (PK)  CHAT\_ID (FK)  SENDER\_ID (FK reference USER.MMU\_ID)  CONTENT  SENT\_AT |

**Entity Relationship**

|  |  |  |  |
| --- | --- | --- | --- |
| USER | — | RIDE | 1:M |
| USER | — | REQUEST | 1:M |
| USER | — | VEHICLE | 1:M |
| USER | — | NOTIFICATION | 1:M |
| USER | — | CHAT | 1:M |
| USER | — | MESSAGE | 1:M |
| RIDE | — | VEHICLE | 1:1 |
| RIDE | — | REQUEST | 1:M |
| RIDE | — | CHAT | 1:1 |
| RIDE | — | LOCATION | 1:1 |
| REQUEST | — | LOCATION | 1:1 |
| CHAT | — | MESSAGE | 1:M |

**Entity Creation**

* When a user signup, a USER entity is being created.
* A VEHICLE entity is created after the user adds the vehicle information into the system.
* When driver offers a ride, a RIDE entity will be created, status will be PENDING. Status will change to MATCHED after match success.
* When passenger requests a ride, a REQUEST entity will be created, date/time will be filled automatically, status will be PENDING. After match success, status will change to MATCHED, RIDE\_ID (FK) will be filled, and a CHAT entity will be created.
* When passenger schedules a ride, a REQUEST entity will be created, date/time need to be filled manually, status will be PENDING. System will start matching at the scheduled date/time. After match success, status will change to MATCHED, RIDE\_ID (FK) will be filled, and a CHAT entity will be created.
* A MESSAGE entity is created for each message sent in a chat.
* Notification is generated dynamically using existing data in the database. A NOTIFICATION entity is created whenever a user receives a notification.

**Frequency of Use**

|  |  |  |
| --- | --- | --- |
| Entity | Frequency | Justification |
| RIDE | High | Created for every offered ride, frequently queried for matching and tracking. |
| REQUEST | High | Created for every passenger ride request or scheduled ride, status updated dynamically. |
| MESSAGE | High | Created every time a user sends a message during a ride. |
| NOTIFICATION | High | Generated dynamically, created frequently upon new system events. |
| CHAT | Medium | Created after a match, updated during communication. |
| USER | Medium | Created once per signup, referenced frequently during login, requests, and rides. |
| LOCATION | Medium | Referenced frequently for pickup/destination coordinates. |
| VEHICLE | Low | Typically created once by each driver, only updated when vehicle info changes. |

**Accessing Capabilities**

|  |  |  |
| --- | --- | --- |
| Role | Accessible Entities | Access Type |
| Passenger | USER, REQUEST, RIDE, CHAT, MESSAGE, NOTIFICATION, LOCATION | View, Create, Cancel |
| Driver | USER, VEHICLE, RIDE, CHAT, MESSAGE, NOTIFICATION, LOCATION | View, Create, Cancel, Update |
| System | All entities | Full read and write access for automation and matching. |
| Admin | All entities | View only for audit and reporting. |

* Access to CHAT and MESSAGE is restricted to matched users only.
* Only the system can link REQUEST to RIDE after matching.

**Integrity Constraints**

|  |  |
| --- | --- |
| Constraints Type | Explanation |
| NOT NULL | Ensures that a column cannot have a NULL value. DESTINATION must be filled in every time passengers request a ride; thus, the system is able to match with available ride offers. CANCEL\_REASON is NOT NULL if STATUS = ‘CANCELED’. |
| UNIQUE | Ensures that all values in a column are different. The record of each PLATE\_NUMBER must be unique in order to identify and track vehicles precisely. |
| PRIMARY KEY | A combination of NOT NULL and UNIQUE. Uniquely identifies each row in a table. Each entity has a primary key (eg. USER.MMU\_ID, RIDE.RIDE\_ID, REQUEST.REQUEST\_ID). |
| FOREIGN KEY | Prevents actions that would destroy links between tables. All foreign key are enforced (eg. RIDE.DRIVER\_ID reference USER.MMU\_ID, DESTINATION reference LOCATION.LOCATION\_ID). |
| CHECK | Ensures that the values in a column satisfies a specific condition. Only REQUESTs with status = ‘MATCHED’ may be assigned a RIDE\_ID. CANCEL\_REASON is NOT NULL if STATUS = ‘CANCELED’. |
| DEFAULT | Sets a default value for a column if no value is specified. When a RIDE or REQUEST entity is created, the default status is ‘PENDING’. |

**Security**

|  |  |
| --- | --- |
| Security Area | Measures Implementation |
| Authentication | Users log in using their verified MMU Digital ID. |
| Authorization | Role-based access ensures users can only view/edit their own data. |
| Message Access | CHAT and MESSAGE access is restricted to users in that ride session only. |
| Data Encryption | Sensitive data (e.g., user credentials, messages) are encrypted in transit and at rest. |
| Audit Logging | System maintains logs of login/logout and key ride operations (matching, cancellations). |

**Data Retention Requirements**

|  |  |
| --- | --- |
| Entity | Retention Requirements |
| USER | Retained indefinitely unless account deletion is requested. |
| VEHICLE | Retained until user removes vehicle or account is deleted. |
| RIDE | Retained for 1 year for audit and usage analysis. |
| REQUEST | Retained for 1 year for audit and usage analysis. |
| LOCATION | Permanent record as it is static reference data. |
| CHAT | Retained for 7 days after ride completion. |
| MESSAGE | Retained for 7 days, after which it is automatically deleted. |
| NOTIFICATION | Retained for 30 days or until manually cleared by the user. |

3.6 Design Constraints

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3.7 Software System Attributes

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3.8 Supporting Information

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4 Verification

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4.1 Verification Approach

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4.2 Verification Criteria

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5 Appendices

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5.1 Assumptions and Dependencies

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5.2 Acronyms and Abbreviations

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