

Solution for Exercise 04: E-Scooter Ride-Share System

TU Clausthal | Institut für Software and Systems Engineering

Course: Requirements Engineering | Exercise: 04 (Agent-Oriented Modeling)

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1. Agents and Roles

Based on analysis of the ride-share scenario, three primary agents interact to deliver the service:

Agent	Role	Description
Commuter (Human)	Commuter Role	Handles user-side processes: registration, scooter reservation, riding, and payment authorization
E-Scooter (Hardware)	Fleet Manager Role	Controls physical vehicle state (lock/unlock), reports real-time status and GPS location
Backend System (Software)	Payment Processor Role	Manages account verification, fee computation, and secure financial transactions

2. Goals

Functional Goals

- FG-01 (Registration):** Allow new commuters to register with identity and payment validation
- FG-02 (Reservation):** Enable locating and reserving idle scooters
- FG-03 (Commute):** Allow unlocking and riding the reserved scooter
- FG-04 (End Ride):** Detect ride termination and lock scooter automatically
- FG-05 (Payment):** Calculate and debit fees without manual intervention

Quality Goals

- QG-01 (Data Accuracy):** Real-time scooter status synchronization
- QG-02 (Billing Precision):** Accurate fee calculation based on exact duration
- QG-03 (Security):** Encrypted storage of payment credentials

3. Ride Cost Computation

The system uses a **time-based pricing model**:

$$\text{TotalFee} = \text{UnlockFee} + (\text{Duration}_{\text{minutes}} \times \text{Rate}_{\text{per min}})$$

Variable	Description	Example Value
UnlockFee	Fixed starting fee	€1.00

Variable	Description	Example Value
Duration	Time from unlock to end ride (rounded up)	15 minutes
Rate	Per-minute usage charge	€0.20

Example: A 15-minute ride costs $\text{€}1.00 + (15 \times \text{€}0.20) = \text{€}4.00$

4. Behavioral Interface Model (BIM)

The BIM illustrates the dynamic interaction between roles throughout the ride lifecycle:

Process Flow:

1. **Registration:** Commuter creates account with verified credentials
2. **Reservation:** Commuter selects and reserves an idle scooter
3. **Unlock:** Fleet Manager unlocks the vehicle hardware
4. **Commute:** Commuter travels to destination
5. **End Ride:** Fleet Manager locks vehicle upon session end
6. **Payment:** Payment Processor calculates fee and debits account

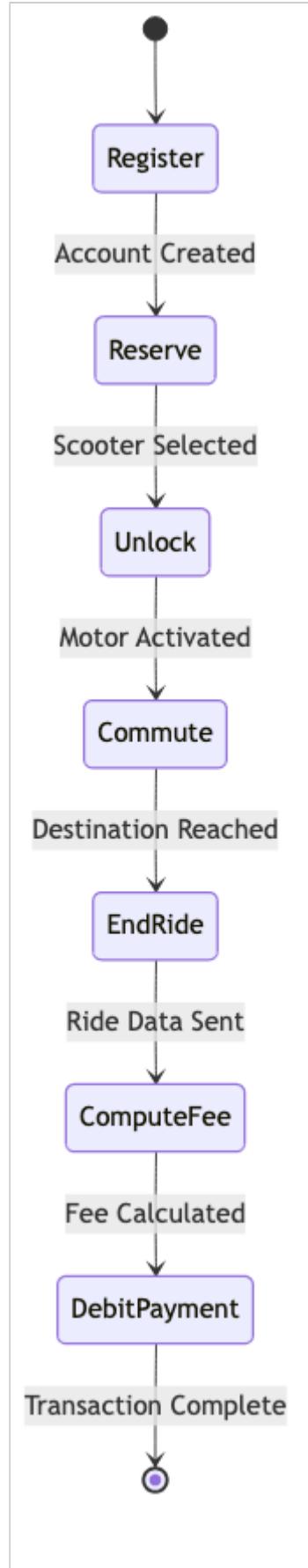


Figure 1: Behavioral Interface Model – State Diagram

5. Goal Hierarchy Diagram (3-Level Tree)

The following diagram shows the hierarchical decomposition of system goals across three levels:

- **Level 1 (Blue):** Main System Goal – Manage E-Scooter Ride Sharing
- **Level 2 (Green):** Sub-Goals – Registration, Ride Operations, Payment Processing
- **Level 3 (Yellow/Light Green):** Leaf Goals – Specific functional and quality objectives

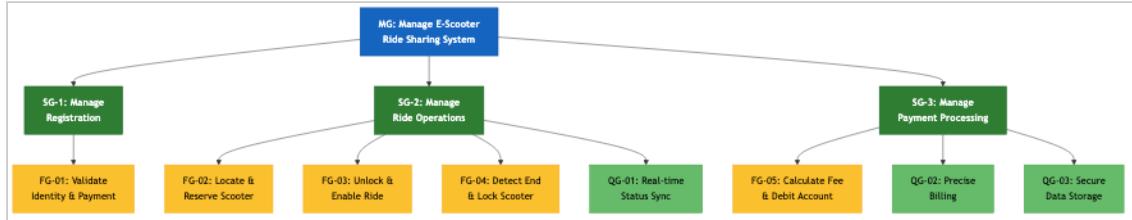


Figure 2: AOM Goal Model – 3-Level Hierarchy