### **Application Engineering Assignment**

VIT '27 Batch Submission at 10:30 PM IST

## Problem Statement

## **Mall Parking System**

A shopping mall requires a **parking management system** that allows **parking operators** to efficiently allocate parking slots, track active sessions, and manage billing. **Visitors will not use the system**; all operations are performed by **parking staff** at entry and exit points. The system must support **hourly billing** and **day pass allocations at entry** to streamline parking operations and maximize revenue.

### **Entities**

**1. Vehicle**

* **Vehicle ID** – Auto-generated for each session.
* **Number Plate** – Unique identifier for the vehicle.
* **Vehicle Type** – Car, Bike, EV, Handicap Accessible.

**2. Parking Slot**

* **Slot ID** – Unique identifier.
* **Slot Number/Location** – E.g., B1-12.
* **Slot Type** – Regular, Compact, EV, Handicap Accessible.
* **Status** – Available, Occupied, Maintenance.

**3. Parking Session**

* **Session ID** – Unique for each parked vehicle.
* **Vehicle Number Plate** – Reference for the session.
* **Slot ID** – Assigned parking slot.
* **Entry Time** – When the vehicle enters.
* **Exit Time** – When the vehicle leaves.
* **Status** – Active, Completed.
* **Billing Type** – Hourly | Day Pass.
* **Billing Amount** –
  + **Hourly:** Calculated on exit based on total duration.
  + **Day Pass:** Fixed rate collected at entry.

\*This is just an example, you are free to change the entities model.

### **Level 0: Core Parking Operations**

**Operator Workflow on Entry:**

1. Operator enters **vehicle number plate & type (Car, Bike, EV, Handicap Accessible)**.
2. **System auto-assigns the nearest available slot** based on the vehicle type:
   * Car → Regular or Compact slot
   * Bike → Bike slot only
   * EV → EV slot with charger availability
   * Handicap Accessible → Reserved accessible slot
3. Operators can **override slot assignment manually** (e.g., for operational convenience).
4. **Dashboard Features:**
   * Shows **Total slots, Free slots, Occupied slots, Maintenance slots**
   * **Filter by type** → Car/Bike/EV/Accessible
   * **Search by number plate** to locate a vehicle quickly
5. **Maintenance Mode**: Operators can mark a slot as **Maintenance**, removing it from auto-assignment temporarily.

### **Level 1: Duration Tracking & Session Management**

**Parking Session Lifecycle:**

1. **Entry Time**: Automatically captured at the moment a parking session begins.  
   This occurs **when the operator assigns a slot to a vehicle in the system**, effectively marking the vehicle as “checked in.”
2. **Exit Time**: Recorded when the **operator checks the vehicle out of the system**. This corresponds to the **actual time the operator marks the vehicle as exited**, officially ending the parking session and freeing the slot.
3. **Slot Auto-Free**: Slot becomes available immediately after checkout.
4. The system should handle overlapping time conflicts and assign the vehicles accordingly.

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### **Level 2: Pricing & Billing**

The system supports **configurable billing** with **two modes**:

#### **Hourly Parking**

* **Charges calculated on exit** based on total duration.
* **Rounding Rules**:
  + Partial hours can be rounded up or follow configurable slab-based pricing.
* **Example Rate Table**:
  + 0–1 hour → ₹50
  + 1–3 hours → ₹100
  + 3–6 hours → ₹150
  + 6+ hours → ₹200 (max cap per day)

#### **Day Pass Parking**

* **Flat Fee (e.g., ₹150) collected at entry**
* **Unlimited duration for that day** until the mall closes.
* Exit does not generate additional charges.
* The system still **tracks duration** for reporting but skips additional billing.

The system should generate the right fee and track duration and billing details for future reference and automatically make the slot available for the next assignment. You can add a simple screen to show the revenue/billing details.

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### **Bonus Level: Automated Session Handling & Analytics**

**1. Automated Session Management**

* **Overstay Detection**: Vehicles exceeding a **configurable maximum duration** (e.g., 6 hours) are flagged for operator attention. Notify the operator

**2. Advanced Reporting & Analytics**

* **Revenue Reports**: Hourly vs Day Pass revenue, daily and monthly totals.
* **Slot Utilization**: Identify peak hours and underused slots for operational efficiency.

## 

## General Notes

**Technology Flexibility**: Utilize any technology stack, library, or framework as we have no specific preferences.

**Mobile App Development**: If you prefer developing a standalone mobile application instead of a web application, please consult with Motorq team for approval.

**Feature Implementation**: Focus on implementing a comprehensive set of features. Focus on completing the Functionalities first and then UI.

**Code Quality**: Ensure high code quality and maintainability with robust error handling and thorough consideration of edge cases.

**Completion**: While completion of all project levels is encouraged, it is acceptable if some remain incomplete. Quality over quantity.

## 

## GUIDELINES FOR SUBMISSION

Create a .zip file of all application related files, upload in a google drive along with your video and send google drive like to ([campus-hiring@motorq.co](mailto:campus-hiring@motorq.co) and cc: [rohit@motorq.com](mailto:rohit@motorq.com), [ketan@motorq.com](mailto:ketan@motorq.com), [vinoj@motorq.com](mailto:vinoj@motorq.com) ) with name and Roll number.

Ensure that a README file is present in the base folder describing steps for any local steps required.

**Imp: Record the working project and add the link of the video in the README file and the email (without demo, project will not be reviewed)**

**Video guidelines are mentioned below.**

VIDEO GUIDELINES

## **To ensure a complete demonstration of your system for review, record a screen capture video (5–10 minutes) showcasing the following:**

### **1. System Overview**

* Show the dashboard with total/free/occupied/maintenance slots.
* Explain the slot auto-assignment logic briefly.

### **2. Core Parking Operations**

* Demonstrate adding a vehicle at entry (check-in).
* Show auto-slot allocation and manual override.
* Display the real-time dashboard updating slot statuses.

### **3. Duration Tracking & Session Management**

* Show Entry Time being recorded automatically on slot assignment.
* Simulate vehicle exit (check-out) and display Exit Time.
* Verify that the slot becomes free immediately.

### **4. Pricing & Billing**

* Demonstrate Hourly Parking billing with an example exit.
* Demonstrate Day Pass selection at entry and show no extra billing on exit.
* Show generated receipt (printed or digital).

### **5. Bonus Features (Optional for Extra Credit)**

* Show Overstay Detection or analytics report (daily revenue or slot utilization).

**Duration: 5–10 minutes  
Format: Screen recording with voice explanation (preferred)  
Show all required features in a single flow without editing out key steps.  
Submit the video file or share a cloud link for review.**