Parking Lot Management System

Overview

This Parking Lot Management System is a simple Java application designed to manage parking spaces and vehicles. It allows users to park and release vehicles, track parking durations, and calculate parking fees. The system supports different types of vehicles, including motorcycles, cars, and buses.

Features

- **Parking Space Management**: Allocates parking spaces based on vehicle type and availability.
- **Vehicle Management**: Registers vehicles entering the parking lot and tracks their parking duration.
- **Fee Calculation**: Calculates parking fees based on the duration of stay, with a base fee for the first hour and additional fees for every hour or part thereof.
- **Concurrency Handling**: Uses a ReentrantLock to ensure thread safety during vehicle parking and releasing operations.

Technologies Used

- Java 11 or higher
- Java Collections Framework
- Java Concurrency

Class Structure

- **Vehicle**: Abstract class representing a vehicle with attributes like license plate and entry time.
- **Subclasses of vehicle :** Motorcycle, Car, and Bus.
- **ParkingSpace**: Represents a parking space with attributes like ID, type, and availability.
- **ParkingTicket**: Represents a parking ticket issued when a vehicle is parked, including entry and exit times.
- **ParkingLot**: Manages parking spaces and handles parking and releasing vehicles.
- **ParkingLotCLI**: Command-line interface for user interaction with the parking lot system.

Installation

1. Clone the repository or download the source code files and open them in java ide project.
2. Navigate to the project directory.
3. Compile the Java files using a Java compiler (e.g., javac ParkingLotCLI.java).
4. Run the application using the Java Runtime Environment (e.g., java ParkingLotCLI).

Usage

1. Start the application.
2. You will be presented with options to park a vehicle, release a vehicle, display the parking status, or exit the application.
3. Follow the prompts to interact with the system.

Example Commands

- To park a vehicle:
    - Select option 1, enter the vehicle type (MOTORCYCLE, CAR, BUS), and provide the license plate.
- To release a vehicle:
    - Select option 2 and enter the license plate of the vehicle you wish to release.
- To display the current parking status:
    - Select option 3.
- To exit the application:
    - Select option 4.

Design Choices

- **Encapsulation**: All attributes of classes are kept private and accessed through public methods.
- **Inheritance**: The Vehicle class is abstract, and specific vehicle types extend it, allowing for polymorphism.
- **Thread Safety**: The use of ReentrantLock ensures that concurrent modifications to parking spaces and tickets are handled correctly.

Bonus: Test Cases

As a bonus, several test cases have been provided in the **tests** folder. These tests are designed to verify the core functionality of the Parking Lot Management System, such as parking a vehicle, releasing a vehicle, and fee calculation.

How to Use the Tests:

1. Move the files from the tests folder into the ParkingSystem folder.
2. Compile the test files along with the main application.
3. Run the test cases to ensure that all core functionalities work as expected.