

Project Documentation

Assignment Overview by Asiamah Emmanuel Donkor

This project implements an **Advanced Vehicle Rental Management System** that adheres to the principles of Object-Oriented Programming (OOP), including:

- **Encapsulation**
- **Inheritance**
- **Polymorphism**
- **Abstraction**
- **Composition**

The system is designed to manage vehicle rentals efficiently and provides a real-world demonstration of advanced OOP concepts.

Objectives

The primary objective is to create a comprehensive rental management system that:

1. Implements all OOP principles.
2. Demonstrates best practices in software design.
3. Simulates real-world rental operations with extensibility and flexibility.

Core System Components

1. Abstraction

- **Vehicle:**
 - An abstract base class with the following abstract methods:
 - `calculateRentalCost(int days)`
 - `isAvailableForRental()`
 - Encapsulates common attributes for all vehicles, such as:
 - Vehicle ID
 - Model name

- Base rental rate
- Availability status

2. Inheritance

- **Vehicle Subclasses:**
 - Car, Motorcycle, and Truck extend the Vehicle class.
 - Each subclass provides:
 - Custom rental cost calculation.
 - Specific availability rules.
 - Unique characteristics tailored to the vehicle type.

3. Encapsulation

- All classes enforce strict encapsulation by:
 - Using private fields.
 - Providing public getters and setters with validation.
 - Ensuring sensitive data is not directly modifiable.

4. Polymorphism

- **Interfaces:**
 - A Rentable interface is implemented by all vehicle classes, defining:
 - rent(Customer customer, int days)
 - returnVehicle()
- **Method Overriding:**
 - Each vehicle class overrides calculateRentalCost and isAvailableForRental to provide type-specific functionality.
- **Method Overloading:**
 - Demonstrated in the handling of rental transactions.

5. Composition

- Supporting classes are designed to compose the system:

- **Customer:**
 - Tracks rental history and eligibility.
- **RentalAgency:**
 - Manages the vehicle fleet and rental transactions.
- **RentalTransaction:**
 - Encapsulates details of individual rentals.