SWENG 837 Final Project

Reat-Time Ride-Sharing Service

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SWENG 837

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Problem Statement and Requirements

Problem statement:

- The main problem the system aims to solve is efficiently connecting passengers to the available drivers to get them to different places within a ride-sharing ecosystem. This is ensuring everyone is being picked up in a timely manner, implementing a dynamic pricing system that responds to fluctuating supply and demand conditions, and optimizing routes to save time for both customers and passengers.

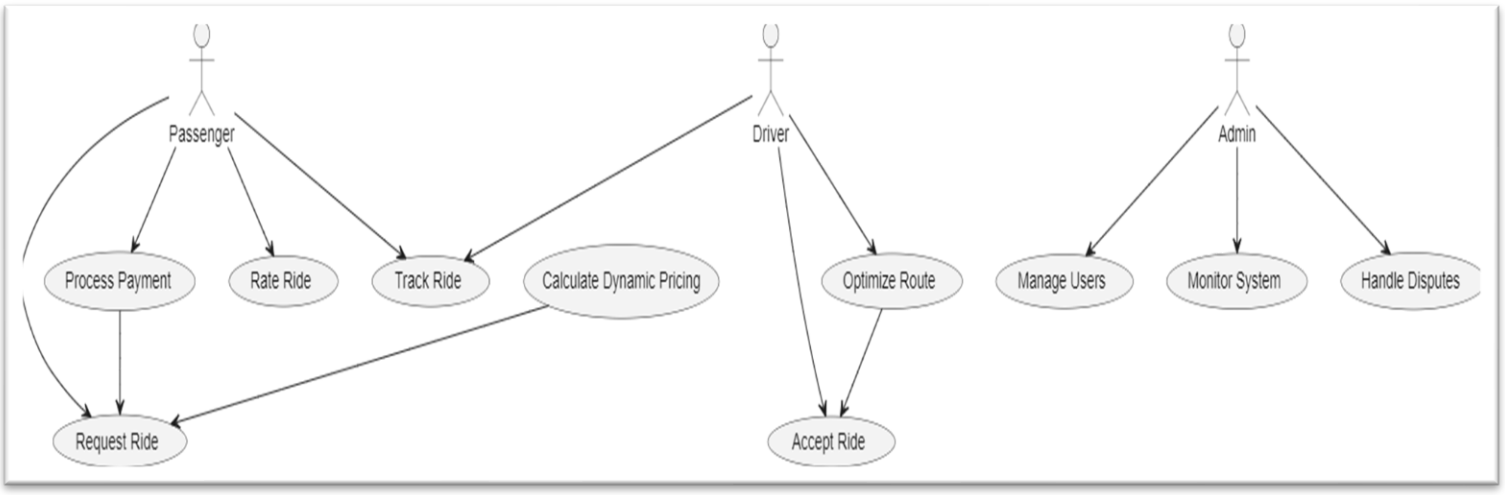
Business and Non-Functional Requirements:

- **Business Goals:**
  - Customer Retention: All the target users should be satisfied with the system
  - Revenue Growth: The system should be able to generate profit through optimizing pricing models
  - Market Expansion: Scales the system so it fits the needs of new geographical areas and user bases.
- **Target Users:**
  - Customers who need reliable transportation between places at fair prices.
  - Drivers who need regular ride request at an optimized route with fair compensation price.
  - Administrators who need tools for managing the system and dealing with any disputes.
- **Functional Requirements:**
  - The system should allow user to create and manage their profiles
  - It should display the drivers within a 10-mile radius so the customers can see their options and pick the one that suites their needs
  - The system should have an option that lets users pick if they want to share the ride with someone or not.
  - The system should let passengers book their rides using their current location and their destination
  - The system should have an option where we can tract the driver's location to see how far they are from the user's current locations
  - The system should offer optimized routes which take traffic, road closures, and accidents into consideration.
  - The system should dynamically calculate ride sharing costs which reflect the current market trends

    - The system should have the capability that lets users pay through the app by using a credit card. This should also consider fair splitting options
    - The system should have the capability where the customer can leave reviews of their rides.
    - The system should also let the target users contact customer support if they have any problems they want to report.
- **Non-Functional Requirements:**
    - Performance Requirements:
        - The system should scale to handle the increasing number of users and demands.
        - The system should be able to handle 1000s of requests per minute especially during peak times.
        - The response time of the should be less than 2 seconds.
    - Maintainability Requirements:
        - The system should have a modular architecture to simplify updated, big fixed, and feature additions.
        - The system should have comprehensive documentation of everything for easy maintenance.
        - The system should have automated testing and CI/CD pipeline to ensure the reliability of code changes.
    - Security Requirements:
        - The system should have mechanisms that verify the identities of all users.
        - The system should make sure all the sensitive data is protected from unauthorized access.
        - The system should have mechanisms that detect fraudulent activities.
        - The system should ensure that the users have only access to the things based on their role.
    - Other Requirements:
        - The system should be user friendly making sure everything is easy for the users to find.
        - The system should have a high availability rate of 99.99% uptime to make sure the users can use it without any problems.
        - The system should be compliant with all the regulatory requirements.

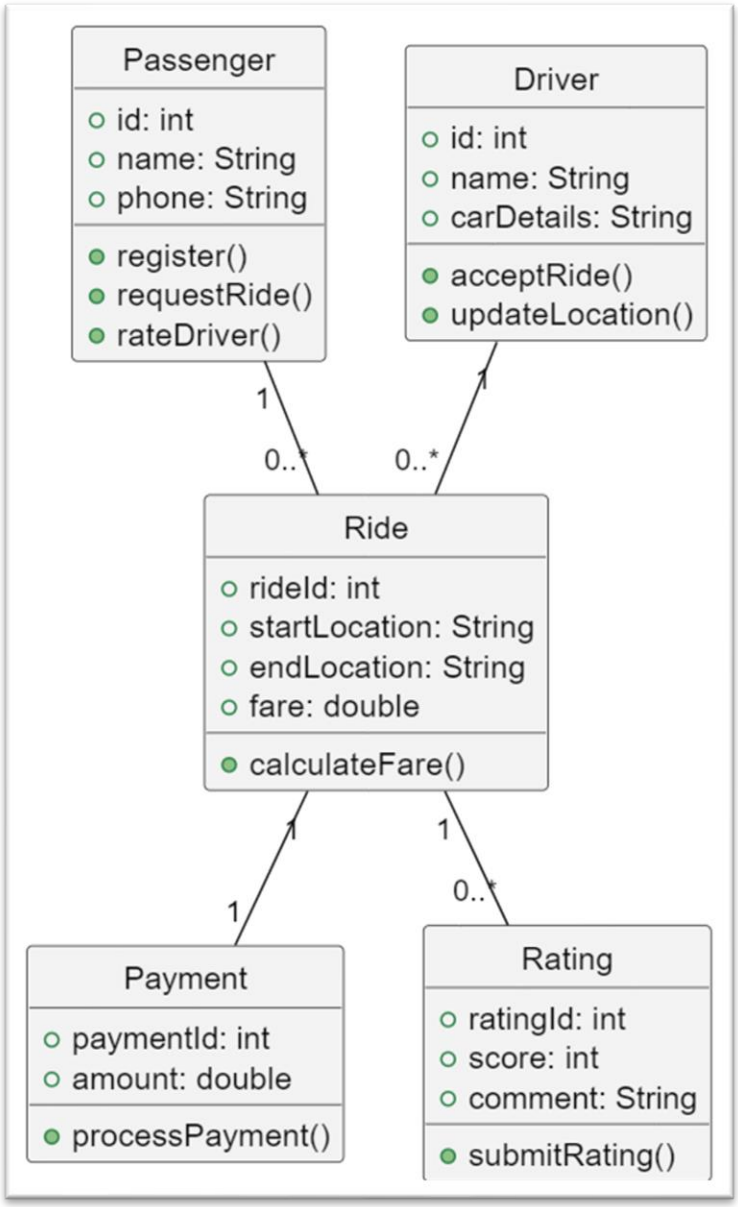
UML Use Case Diagram

This diagrams helps us identify the interactions between all the users. The user can do actions like request a ride, rate one, track the ride, and process the payment after. The driver can track the ride as well and they can accept a ride and get an optimized route. The admin can monitor the system and manager users and any disputes they submit



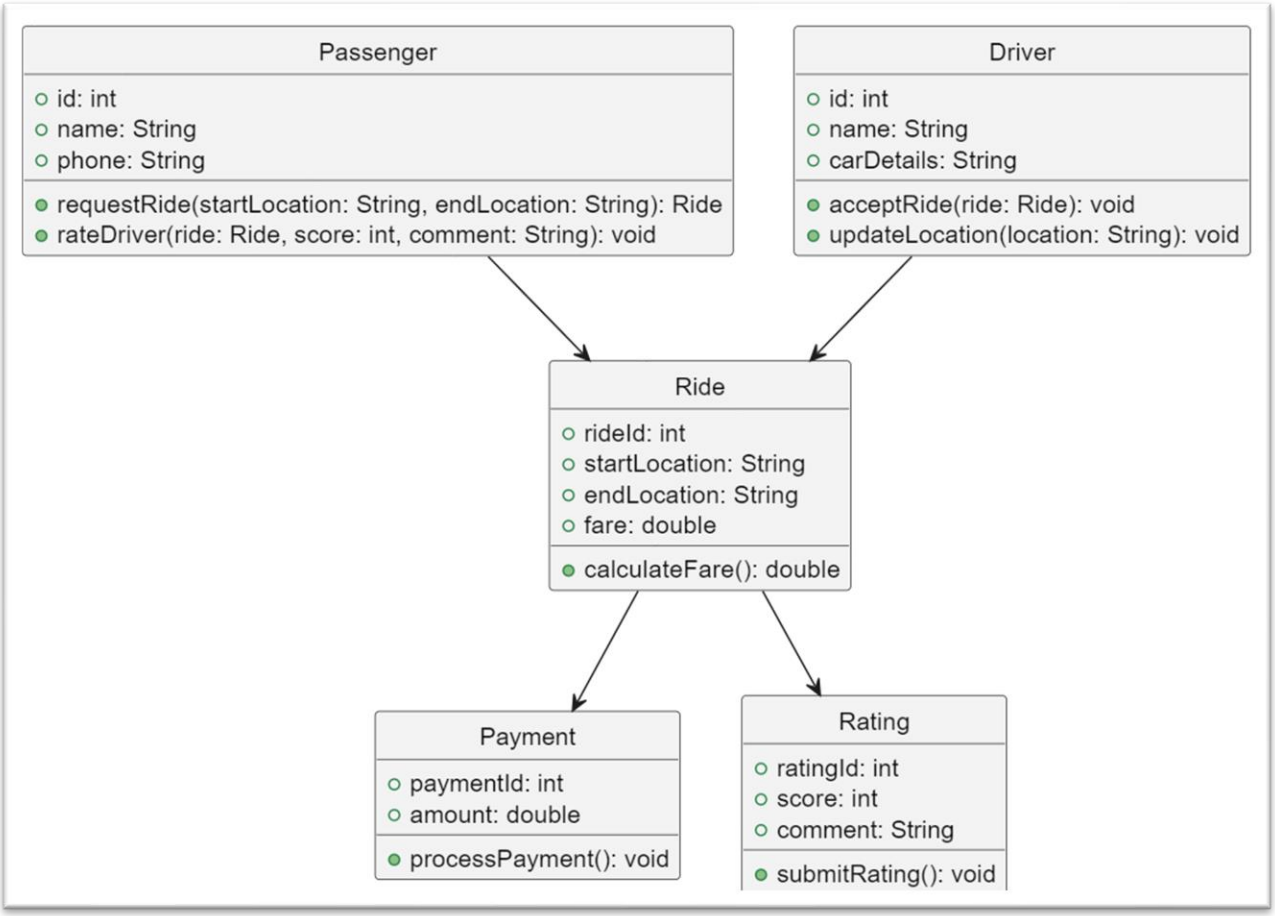
UML Domain Model

The domain model shows the classes and the relationships between them. In this diagram there is a one-to-many relationship between passenger and ride, driver and ride, and ride and rating which means one attribute can belong to multiple classes at a time. There is a one-to-one relationship between ride and payment because one ride can only have one payment attached to it



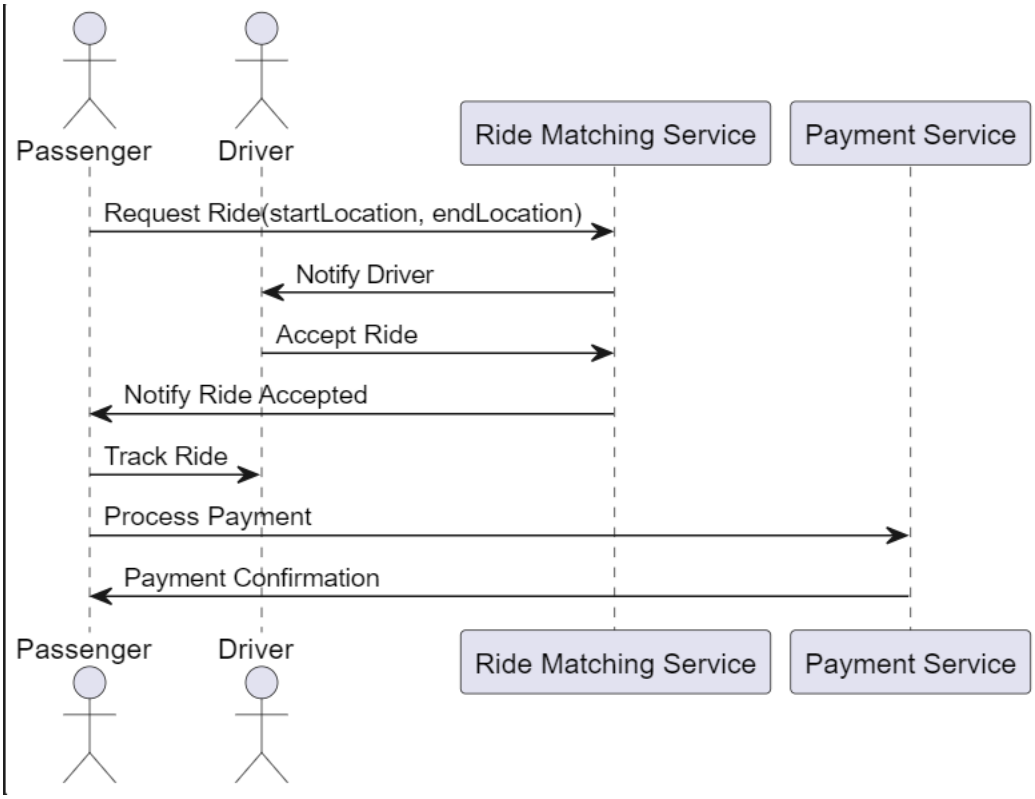
UML Class Diagram

The class diagram shows how multiple classes work together to make the system functional. In this case the passenger requests a ride, the driver accepts it, once the ride is done the ride can calculate the fare and then the user can make the payment and submit the rating.



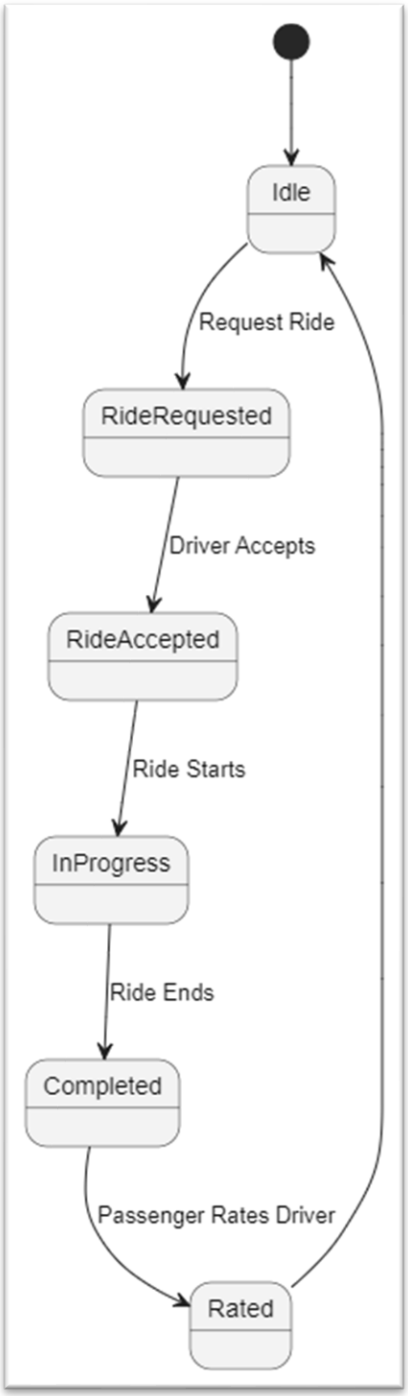
UML Sequence Diagram

The sequence diagram shows the exact step by step process of what happens when the user requests a ride. The information above the arrow in this diagram shows this information and where the arrow is pointing towards is the stage of the system.



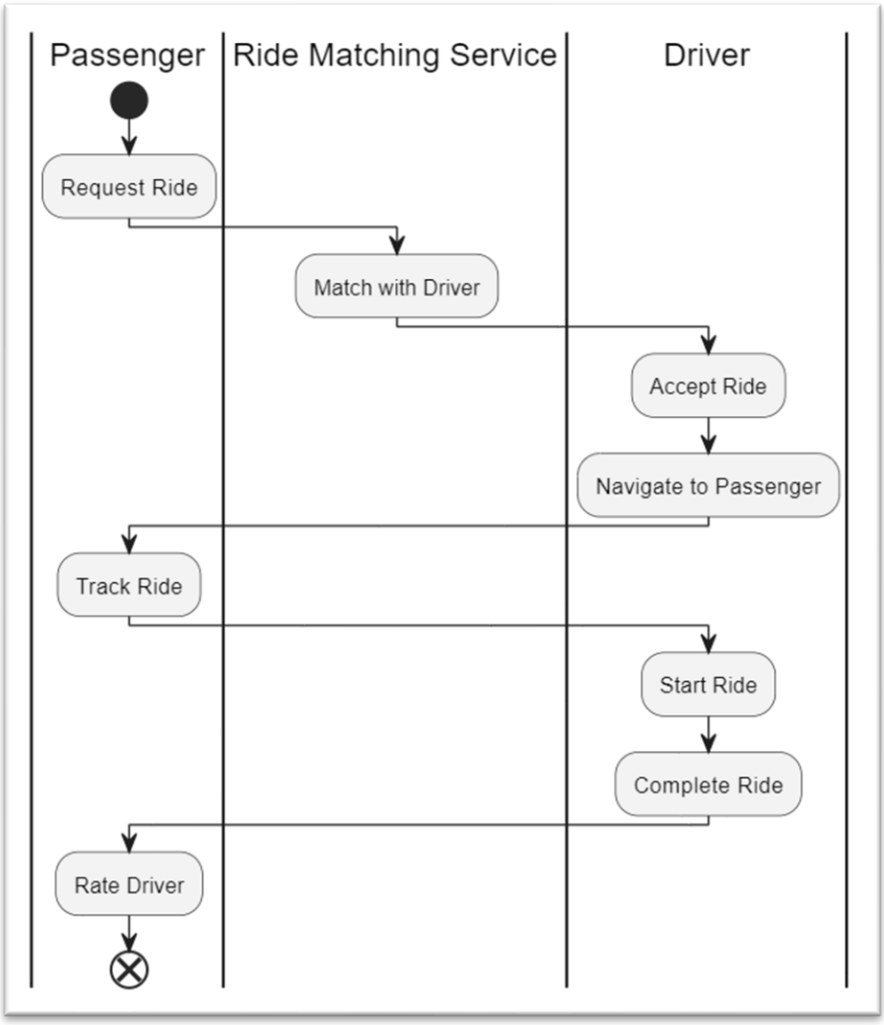
UML State Diagram

The state diagram shows the state of the system and which level each step is at and it also shows which actions led to that state.



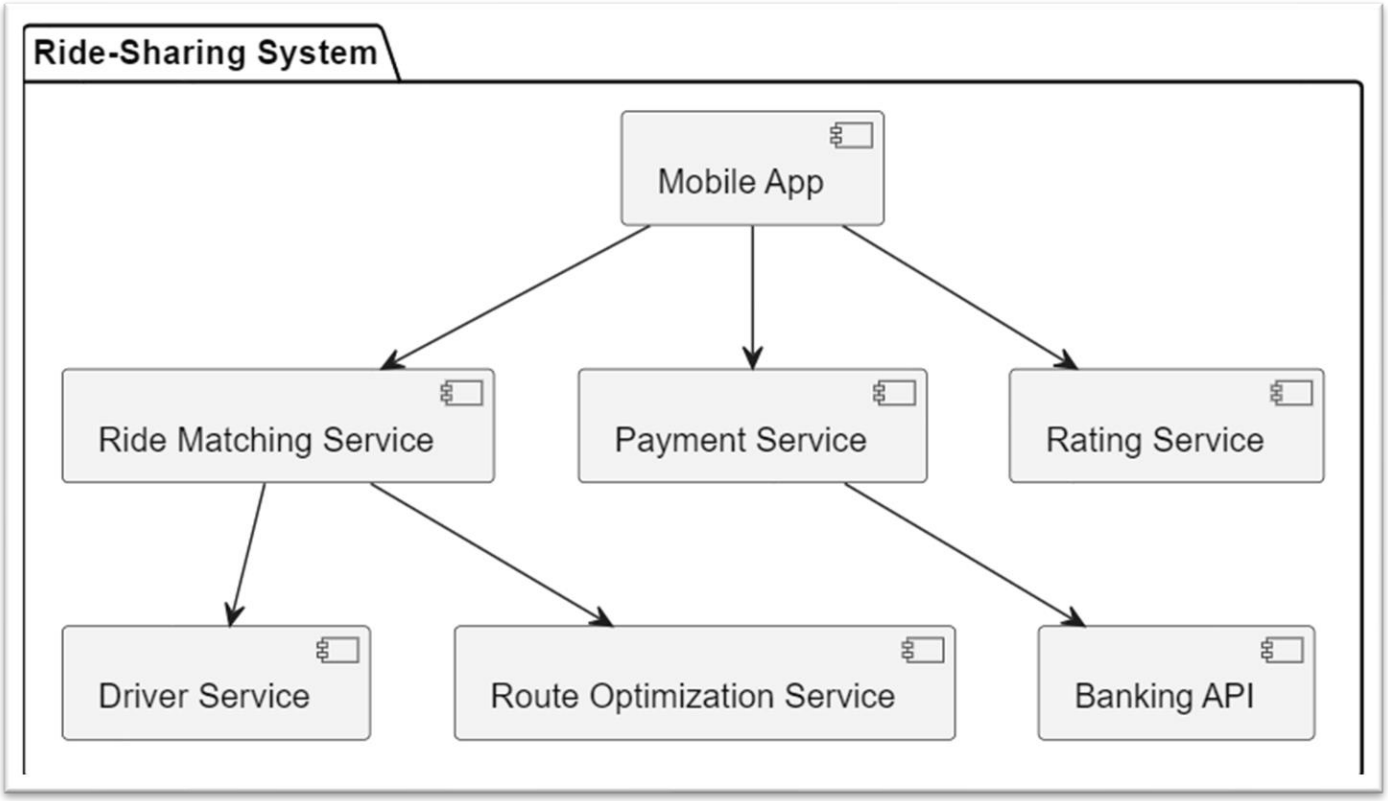
UML Activity Diagram

The activity diagram shows all the steps taken by the user in a chronological order.



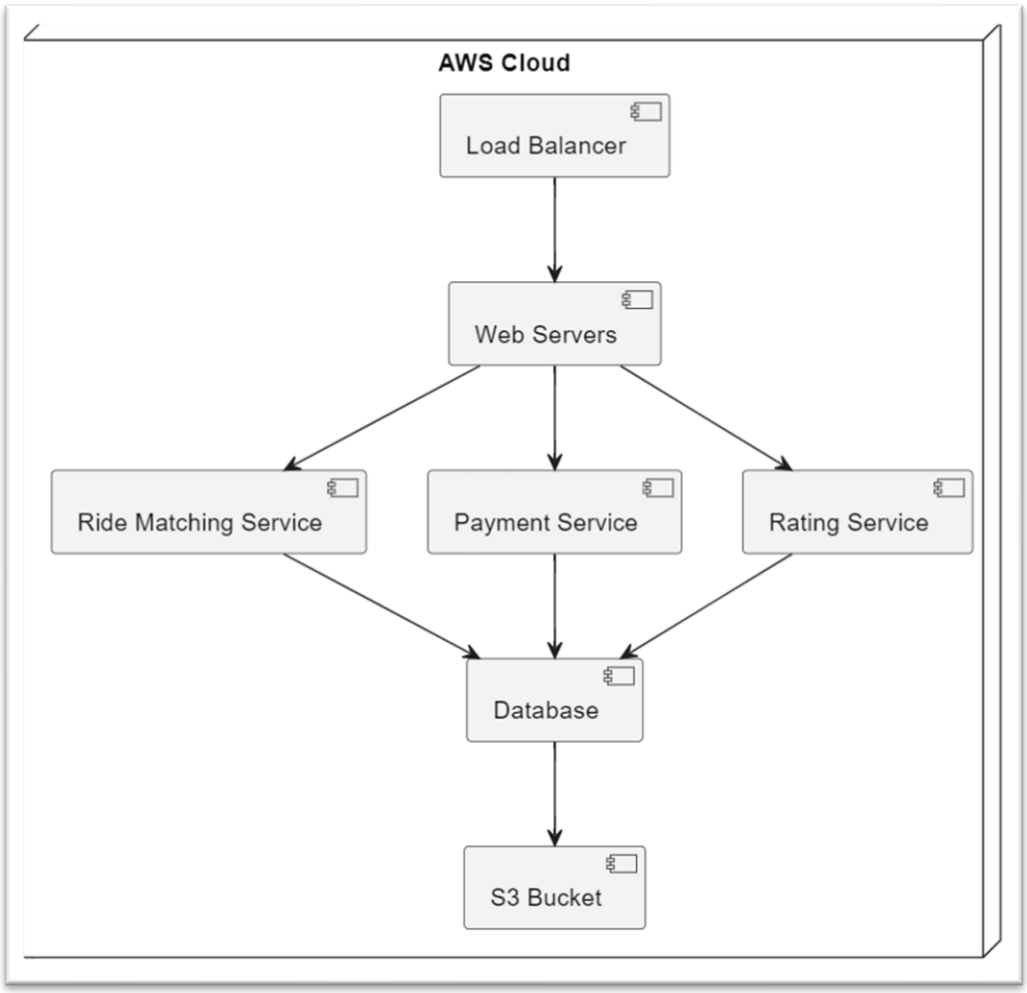
UML Component Diagram

The component diagram shows all the major components needed for the system to function appropriately.



Cloud Deployment Diagram

The deployment diagram shows how the system is divided into smaller, individual services



Skeleton Classes and Table Definition

- User
    - Attributes:
        - user_id: Integer
        - name: String
        - email: String
        - password_hash: String
        - phone_number: String
        - address: String
        - user_type: Enum (Passenger, Driver)
    - Methods:
        - register()
        - login()
        - updateProfile()
        - viewProfile()
        - deleteAccount()
- Ride
    - Attributes:
        - ride_id: Integer
        - passenger_id: Integer (foreign key to User)
        - driver_id: Integer (foreign key to User)
        - pickup_location: String
        - dropoff_location: String
        - status: Enum (Pending, Accepted, In-Progress, Completed, Canceled)
        - fare: Float
        - timestamp: DateTime

    - Methods:
        - requestRide()
        - updateRideStatus()
        - calculateFare()
        - cancelRide()
        - completeRide()
- Driver
    - Attributes:
        - driver_id: Integer (foreign key to User)
        - vehicle_type: String
        - license_plate: String
        - rating: Float
        - availability_status: Enum (Available, Unavailable)
    - Methods:
        - updateAvailability()
        - viewCurrentRides()
        - updateRating()
- RideRequest
    - Attributes:
        - request_id: Integer
        - passenger_id: Integer (foreign key to User)
        - pickup_location: String
        - dropoff_location: String
        - request_time: DateTime
        - status: Enum (Pending, Accepted, Rejected)
    - Methods:

- createRequest()
- updateRequestStatus()

Design Patterns

Some of the principles I have used for this are:

- Single Responsibility from SOLID. This means each class has its own responsibility
- Interface Segregation Rule which means each user will have their own interface
- Dependency Inversion Rule which means high level modules don't depend on low level modules.
- Strategy Pattern from GOF will be applied for dynamic pricing. We can use various strategies to implement this.
- It also uses API gateways and Service Separations which means each functionality has its own service and the gateway handles all the requests and routes them to appropriate service.