Project on

"Railway Reservation System"

Submitted in partial fulfillment of the requirements for the award of degree of

Bachelor of Technology
in
Computer Science & Engineering

UE21CS352B – Object Oriented Analysis & Design using Java

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January - May 2024

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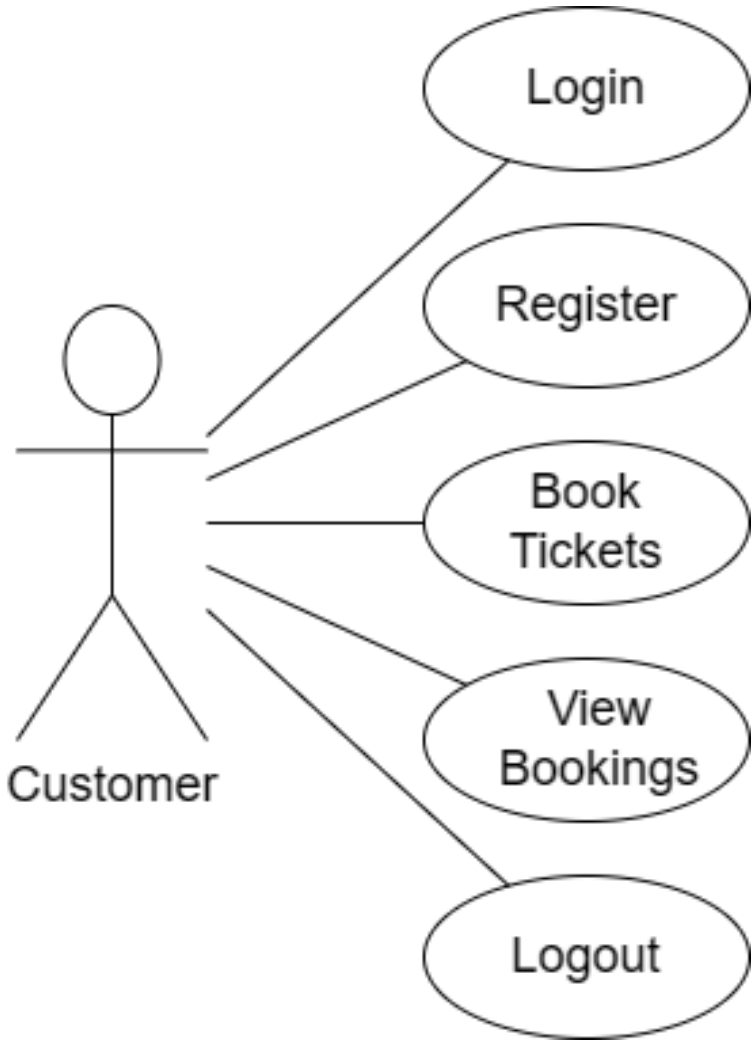
(Established under Karnataka Act No. 16 of 2013)

Problem Statement

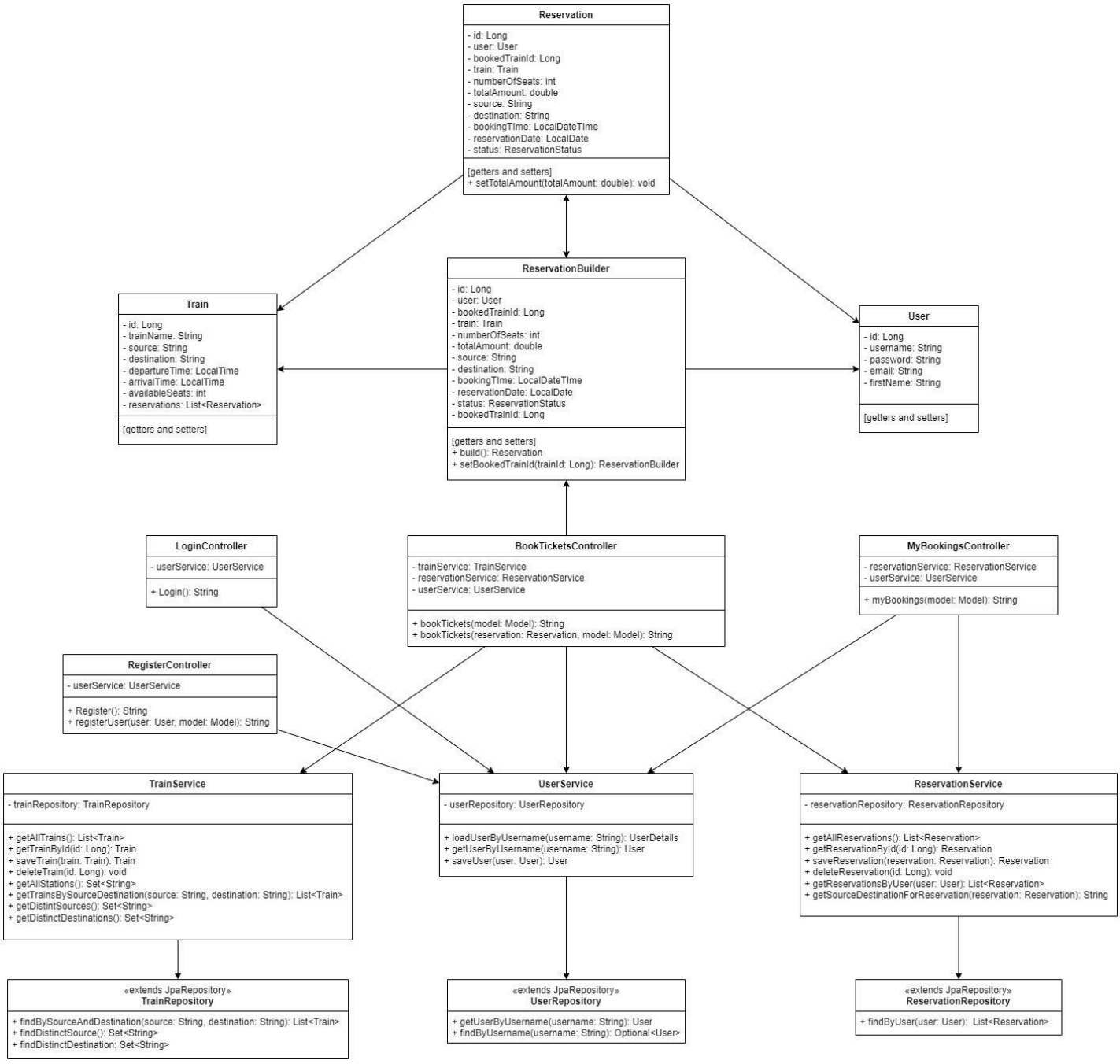
This is a simple Railway Reservation System built using Java Spring Boot Framework and MySQL database. The system allows users to book train tickets and view their bookings.
Features:
User registration and authentication
Book train tickets
View booked tickets

Analysis and Design Models

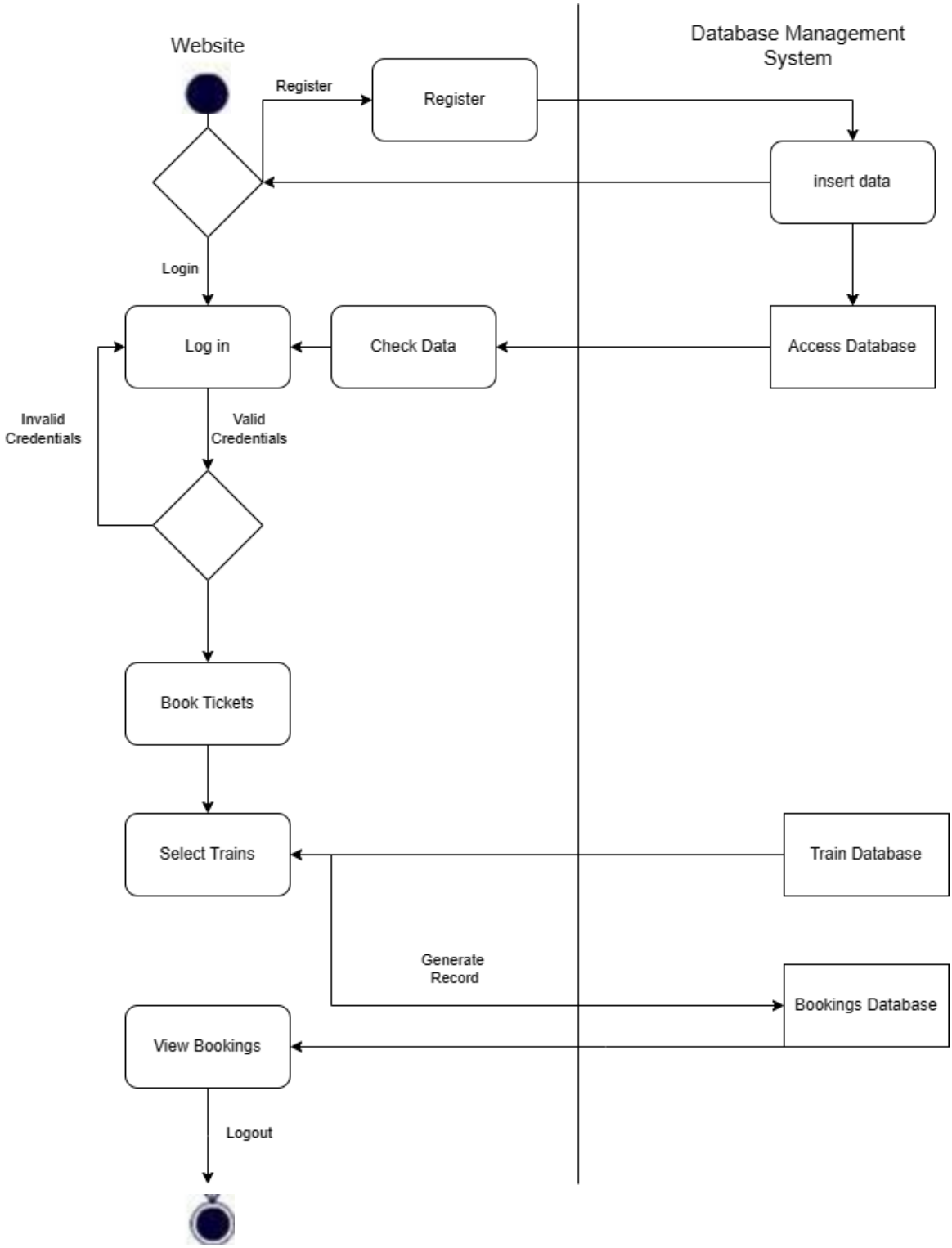
1. Use Case Diagram



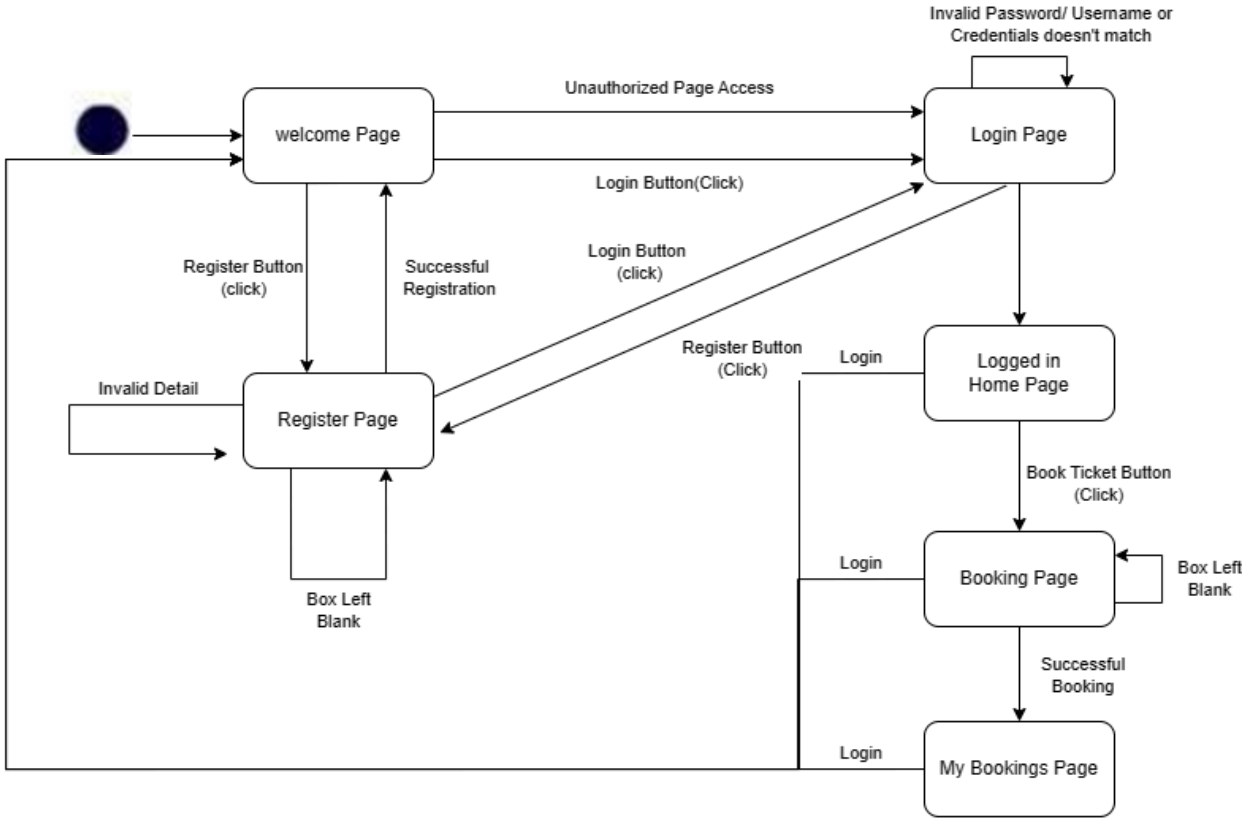
2. Class Diagram



3. Activity Diagram



4. State Diagram



Software Design Principles Followed with screenshots of code

Single Responsibility Principle (SRP):

Each class and component in our system has a single responsibility. For example, controllers handle the user's requests, services contain business logic, repositories handle database operations, etc. This principle helps in making the codebase more modular, maintainable, and testable.

All of our classes are in charge of only one job.

```java
@Table(name = "roles")
public class Role {
    @Id  no usages
    @GeneratedValue(strategy = GenerationType.IDENTITY)
    private Integer id;

    @Getter  2 usages
    @Enumerated(EnumType.STRING)
    @Column(length = 20)
    private ERole name;

    public Role() { this.name = ERole.ROLE_USER; }

    public Role(ERole name) { this.name = name; }
}
```

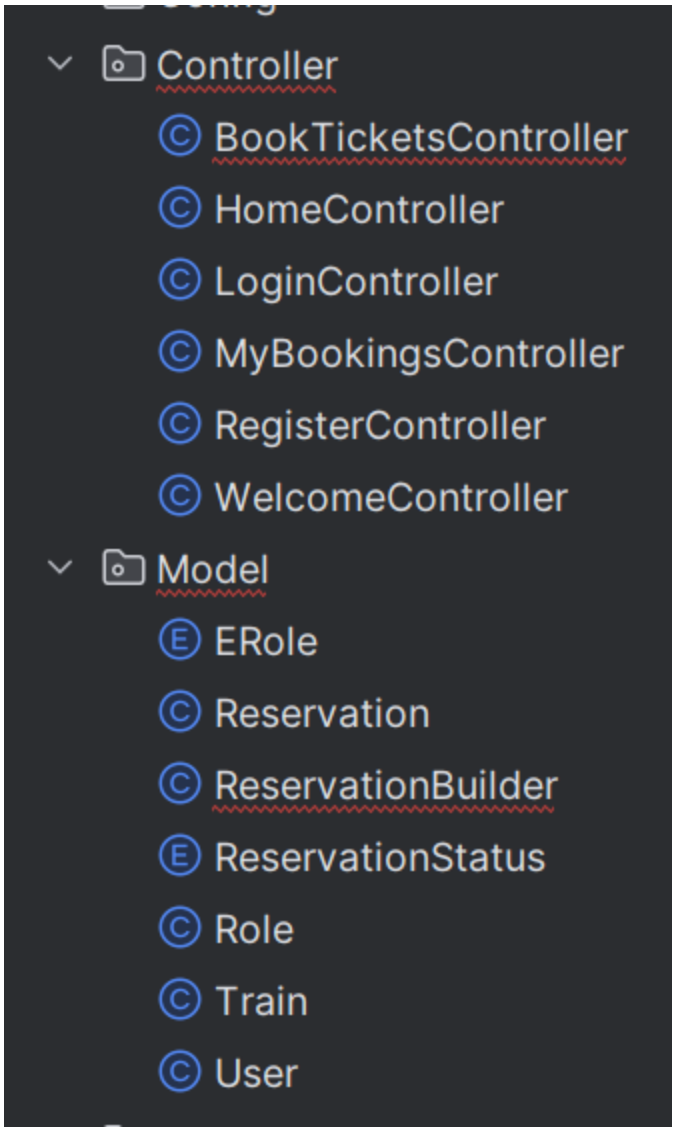
Interface Segregation (IS):

Each interface involves only the function that it needs to. The client isn't exposed to extra functions which could cause errors and make the code messy. So our three different interfaces keep the code clean.

```java
package com.ooadclass.railway_reservation_new.Repository;

import ...

@Repository  2 usages  Srikrishna S Nayak
public interface ReservationRepository extends JpaRepository<Reservation, Long> {
    List<Reservation> findByUser(User user);  1 usage  Srikrishna S Nayak
}
```

Model-View-Controller (MVC) Architecture:

Our project follows the MVC architectural pattern, where models represent data, controllers handle user input and interaction, and views display the user interface. This separation of concerns makes the codebase more organized and easier to maintain.



And the different views come into play on the My bookings page, where the viewer can also view their section of the database which consists of their tickets only.

Open/Closed Principle (OCP):

Our codebase is designed to be open for extension but closed for modification. This means that we can add new features or make changes to existing ones without modifying the existing codebase extensively.

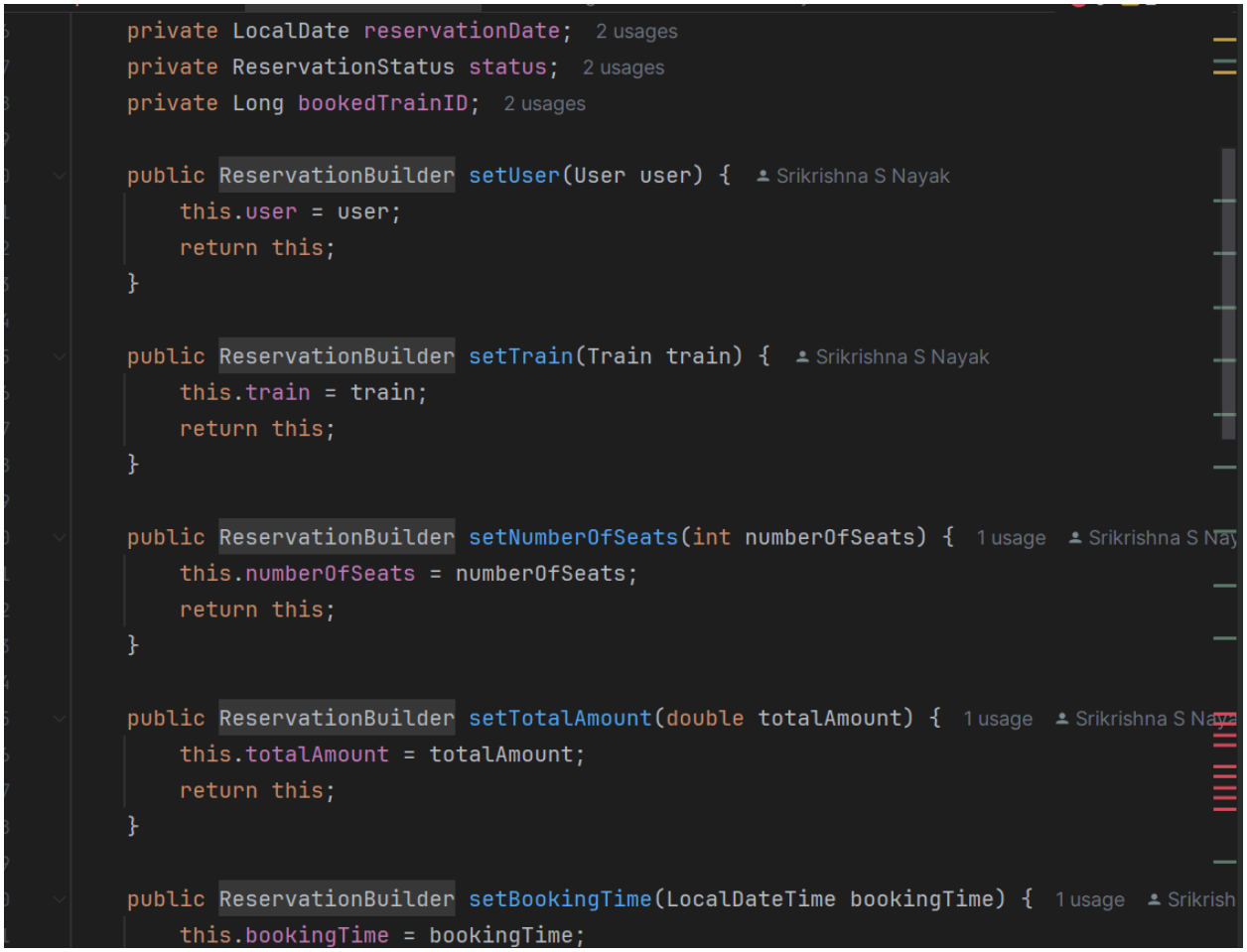
Hence you can make children out of our classes and extend, but we don't have too much code within the class itself which modifies a lot.

```
@Service  2 usages  Srikrishna S Nayak
public class TrainService {
    @Autowired  8 usages
    private TrainRepository trainRepository;

    public List<Train> getAllTrains() { return trainRepository.findAll(); }

    public Train getTrainById(Long id) { return trainRepository.findById(id).orElse( oth

    public Train saveTrain(Train train) { return trainRepository.save(train); }

    public void deleteTrain(Long id) { trainRepository.deleteById(id); }

    public Set<String> getAllStations() {  no usages  Srikrishna S Nayak
        List<Train> trains = trainRepository.findAll();
        return trains.stream()  Stream<Train>
                .flatMap(train -> Stream.of(train.getSource(), train.getDestination()))
                .distinct()
                .collect(Collectors.toSet());
    }
```

Software Design Patterns Used with screenshots of code

Builder Pattern:

The Builder pattern is implemented with the ReservationBuilder class. This pattern is used to construct a complex object step by step. In our railway ticket booking system, the ReservationBuilder is used to create reservation objects by setting various attributes of the reservation in a step-by-step manner.



```
    private LocalDate reservationDate;  2 usages
    private ReservationStatus status;  2 usages
    private Long bookedTrainID;  2 usages

    public ReservationBuilder setUser(User user) {  Srikrishna S Nayak
        this.user = user;
        return this;
    }

    public ReservationBuilder setTrain(Train train) {  Srikrishna S Nayak
        this.train = train;
        return this;
    }

    public ReservationBuilder setNumberOfSeats(int numberOfSeats) {  1 usage  Srikrishna S Nay
        this.numberOfSeats = numberOfSeats;
        return this;
    }

    public ReservationBuilder setTotalAmount(double totalAmount) {  1 usage  Srikrishna S Nay
        this.totalAmount = totalAmount;
        return this;
    }

    public ReservationBuilder setBookingTime(LocalDateTime bookingTime) {  1 usage  Srikrish
        this.bookingTime = bookingTime;
```

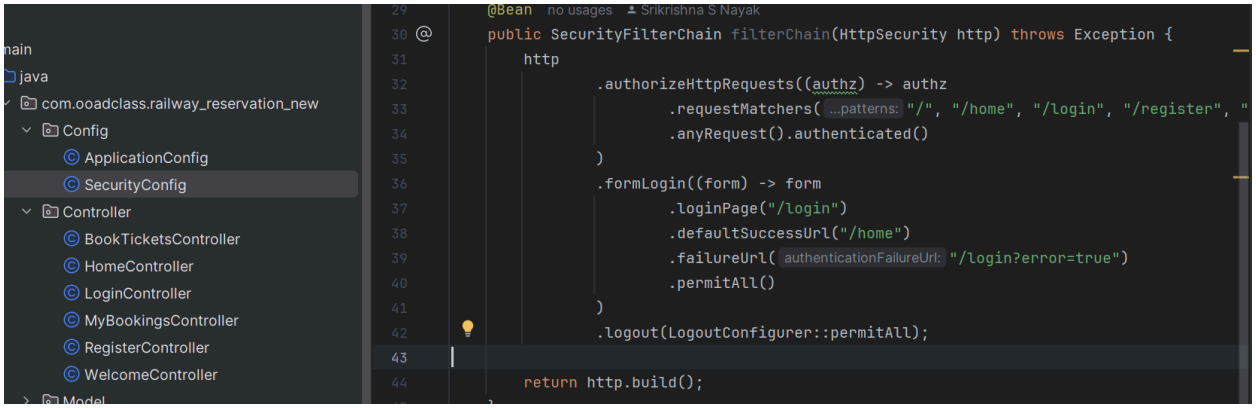
Facade Pattern:

Our services (ReservationService, TrainService, UserService) act as facades. The Facade pattern provides a simplified interface to a complex system of classes, making it easier to interact with. Each service encapsulates a part of the functionality related to reservations, trains, and users respectively, providing a simplified interface for the controllers to interact with the underlying business logic.

```java
@Override  5 usages  Srikrishna S Nayak
@Transactional
public UserDetails loadUserByUsername(String username) throws UsernameNotFoundExcept
    User user = userRepository.findByUsername(username)
            .orElseThrow(() -> new UsernameNotFoundException("User Not Found with us

    return UserPrincipal.build(user);
}

public User getUserByUsername(String username) {  2 usages  Srikrishna S Nayak
    return userRepository.findByUsername(username).orElseThrow(() -> new UsernameNot
}

public User saveUser(User user) {  1 usage  Srikrishna S Nayak
    String encodedPassword = passwordEncoder.encode(user.getPassword());
    user.setPassword(encodedPassword);
    user.setEnabled(true); // Set the user as enabled by default
    return userRepository.save(user);
}
```

Chain of Responsibility Pattern:

Spring Security is configured to enforce authentication for accessing all pages, which resembles the Chain of Responsibility pattern. In this pattern, a request is passed through a chain of handlers until it is handled by the appropriate handler. Similarly, in our application, each page request goes through Spring Security's filter chain, and if the user is not authenticated, they are redirected to the login page. Once authenticated, they gain access to the requested page.



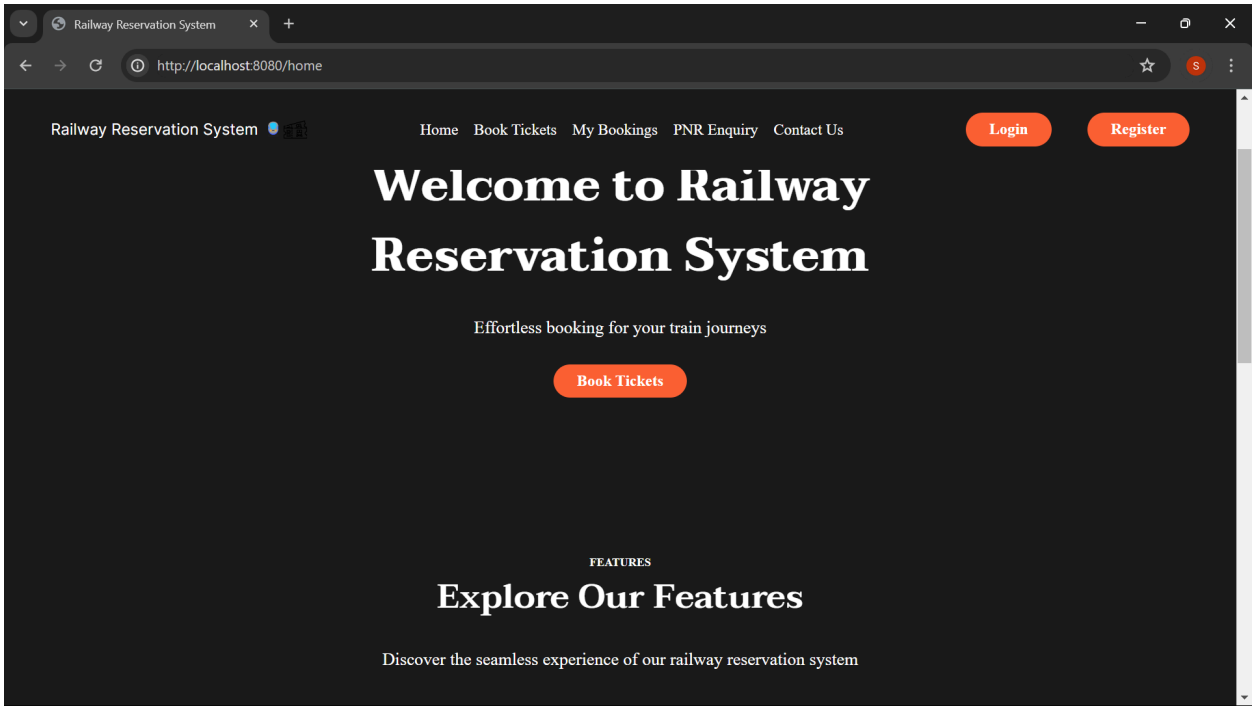
Repository Pattern:

The Repository pattern is used with the repository classes (ReservationRepository, TrainRepository, UserRepository). This pattern provides a way to encapsulate data access

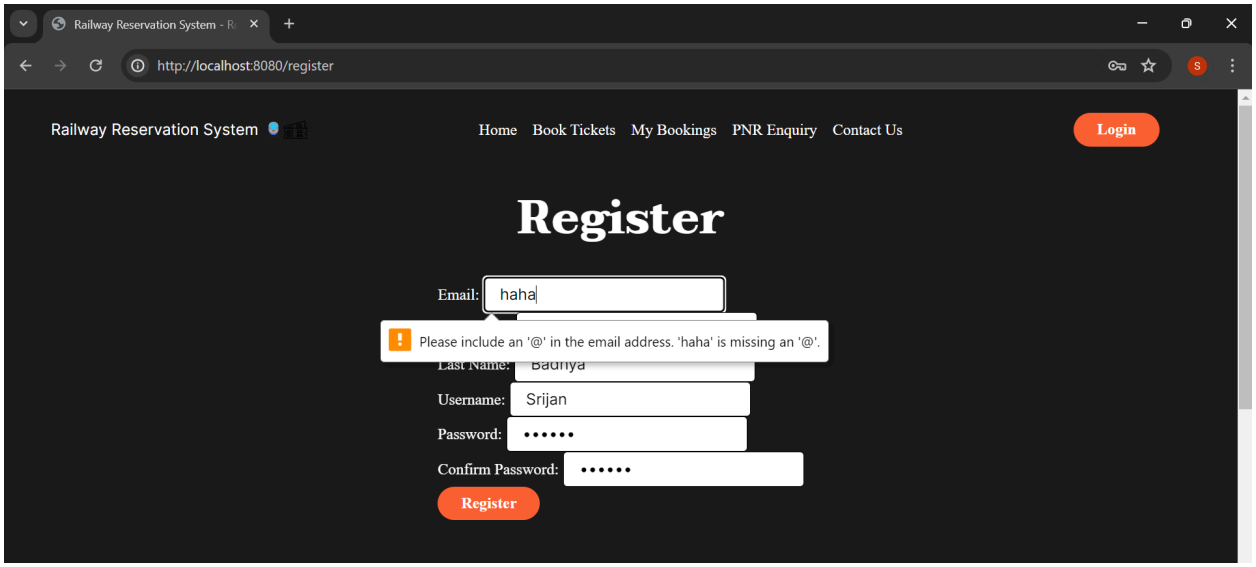
logic, allowing the rest of the application to interact with the database without exposing the underlying database implementation details. Each repository is responsible for CRUD (Create, Read, Update, Delete) operations related to its corresponding entity (reservation, train, user).

User Interface Screenshots

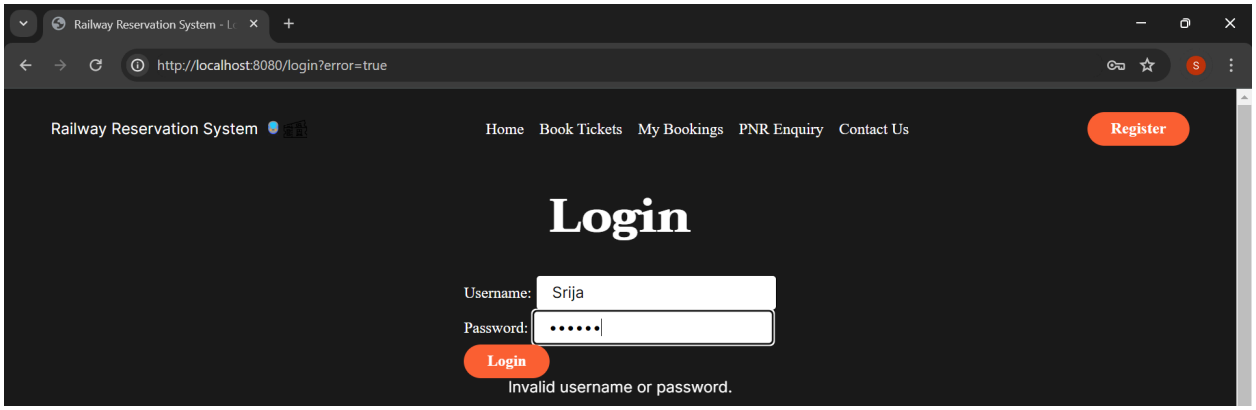
Home Page, loaded when you access localhost8080



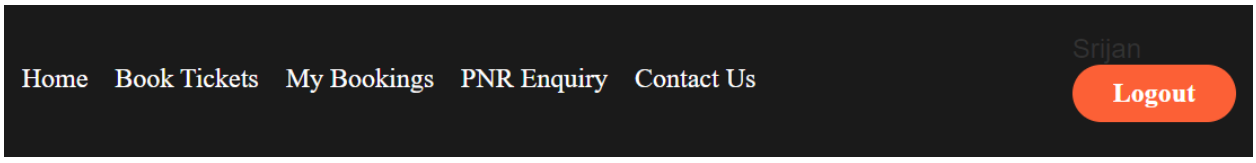
After clicking the register button, you are taken to the register page. The screenshot is an example of the register page not proceeding when you enter invalid information. The password entered by the user is hashed and stored in the database.



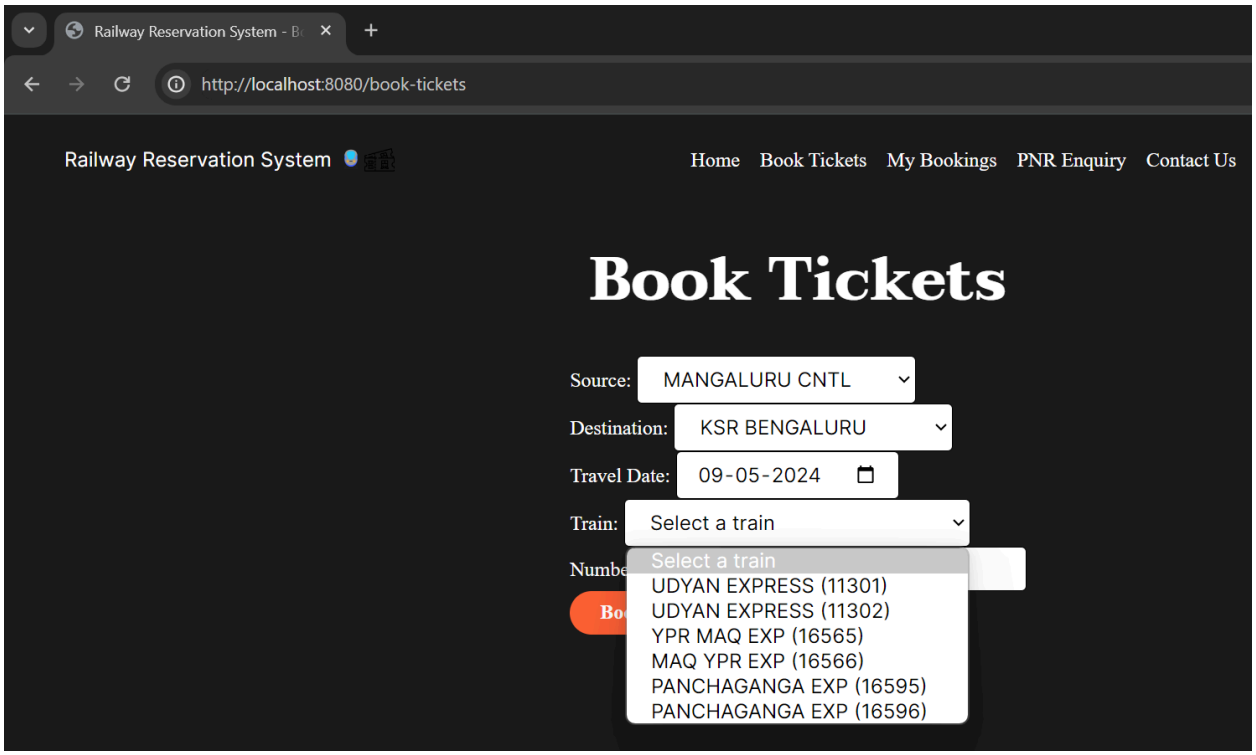
When you go to the login page and you enter information not in the database, you remain at the login page.



Once you successfully log in, your username appears in the top right corner of the page.



These are the options when you visit the booking page after logging in.



After you are done booking a ticket, you are taken to a page which displays the details of all your bookings.