



MIDDLE EAST TECHNICAL UNIVERSITY
DEPARTMENT OF COMPUTER ENGINEERING



SUMMER PRACTICE REPORT
CENG 300

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TOTAL WORKING DAYS

30

STUDENT'S SIGNATURE

ORGANIZATION APPROVAL

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1 Introduction

I have done my first summer practice at OBSS as a software engineer intern for 30 working days between the above dates. Since the intern programs of the OBSS are remote, and my department accepts remote practices, I have done the practice online/remotely.

I had an informative internship and learned much about Java and web development. After learning the basics of Java, Web Development, Spring, and React, our mentor asked us to develop a middle-scaled example project. Since my internship included lots of learning, my report contains two main parts: knowledge sharing and developing a project.

Due to the structure of my internship, I will mention what I learned in the knowledge-sharing part until the Final Project section, and then move into the main project.

2 About Company

OBSS is a company established in 2005 as a software and consulting company, and today, it is one of Turkey's most powerful corporate technology consulting companies. The company has three offices located in İstanbul, Ankara, and Amsterdam. OBSS is the first and the leading Atlassian Partner in Turkey.

From software architecture to coding, from application development to analysis and software testing, the company tries to include all interactive areas of corporate technology in its service range with the aim of providing the most appropriate solutions to its customers.

OBSS has 6+ different internship programs with 100+ interns every year. OBSS shares in 5+ broad expertise sectors with 17+ years of sector experience. 750+ people work at OBSS, and they have built 700+ projects. Additionally, OBSS has several spin-off products and companies. Two of them are Witwiser, which focuses on online assessment solutions and products in international markets, and intouch, a flexible mobile application to meet communities' communication and interaction needs.

3 Orientation

On the first day of my internship, the company introduced itself by 1-hour orientation. The orientation provided general information about the company and internship programs. Information about management systems, personal data protection law (KVKK), and occupational health and safety (OHS) are also given.

After the orientation, I met with my team. Firstly, our mentor introduced himself, and then everyone did so. Our mentor shared the general internship schedule and stated our responsibilities in our internship. Our primary responsibility was to attend the programs/classes on time.

4 Core Java

4.1 Environment Setup and First Program

Since we have been using `Java` during our internship, our mentor introduced necessary development environments and we installed the `JAVA SDK` and `IntelliJ IDEA`.

After we discussed what software is and how it works on a computer and programming languages, we talked about `Java`'s history and working structure. Then, we continued by creating the first project on `IntelliJ IDEA`, and we started learning the core `Java`.

4.2 Introduction to Java

We started with the basics by the standard learning curve of a programming language. The first week's four days were about `Java`'s basics and core concepts. Since syntax and basic concepts of `Java` are pretty similar to `C` and `C++`, understanding the topics was not that hard for me at the beginning of the week.

While learning the concepts and basics, we usually practiced them. The usual process was that after we first coded the exercise, we examined the sample solutions other team members coded. This approach has been constructive for me at times because reviewing other people's codes helps the learning phase.

4.2.1 Basics of Java

While learning the basics, the part that was remarkable to me was the Strings because there are some classes, such as `StringBuffer` and `StringBuilder`, to construct Strings. We also talked about advanced Java IO and the concept of ‘`serialization`’, the conversion of the state of an object into a byte stream, which was new to me.

After these basics, some advanced features such as enumerations, interfaces, abstract, generic classes, and wildcards, which are new to me, are discussed.

4.2.2 Collections and OOP

I knew some data structures from the courses I have taken. Many of these data structures are implemented in Java and called collections. We discussed the collection framework hierarchy of Java and learned these collections. Also, we examined the working ways of `hashCode()` and `equals()`, important methods for these collections to work properly.

Afterward, we covered the basics, such as scopes, constructors, access modifiers, setter and getter methods, method overloading, and principles, such as inheritance, abstraction, encapsulation, and polymorphism, of Object Oriented Programming (OOP). Since I was familiar with concepts from CENG 242: Programming Language Concepts, I did not have a hard time with these concepts.

4.2.3 JavaBeans and JDBC

The last day of the week, when we got out of the basics of Java and learned databases and database connections by using Java, was a day that I learned new information and was challenged for the first time.

We started by talking about the JavaBeans. By learning and reading about JavaBeans, I realized that many things are standardized in Java, and implementations are competed instead of the standards. Additionally, we talked about Maven, a build automation tool, and installed it in addition to MySQL, which was going to be used as a database. After the installations, we dived into the Java Database Connectivity (JDBC), Java API that mainly manages to connect to a database, and sending SQL statements to databases.

4.3 Git & Bitbucket

To our use during the internship, we were provided a Bitbucket account. We were asked to use Git and `push` our codes to Bitbucket. Since we were asked to use Git, the basics and primary usage of Git and Bitbucket were shown.

5 Introduction to Web Development

The first week of my internship was about the Java Core, whereas we focused on the enterprise version of Java, Java EE, or Jakarta EE, and web development in the second week.

5.1 Introduction to Java EE Platform

After learning the Java versions and their primary concern, we discussed enterprise-level applications and their needs. Then, we focused on how Java values developers, vendors, and businesses. Our mentor mentioned that the specifications are determined and defined concurrently, and vendors only compete at their implementation level in the Java world so that developers can use any J2EE implementation for development and deployment.

Additionally, I learned about layers that are the foundation of software architecture (presentation, application/business, data, and service layers) and types of software architectures (one-tier, two-tier, three-tier, and N-tier architectures) and their advantages and disadvantages.

5.2 Introduction to Web Development on Java Platform

After learning what websites and web applications are and their differences, we discussed web servers and installed one of the preferred web servers on Java World: ‘Tomcat’. Then, we focused on the basics, such as HTTP and WWW, Request and Response, DNS, of the web world.

After these basics, we learned the ‘Servlets’, the basic concept and tool for Web development on Java world and JSP, which enables mixing static HTML content with unique code that produces the dynamic content.

5.3 Developing Java Web Applications

We learned the basic anatomy of a web application and web module structure. I believe these topics are pretty beneficial because knowing the web module's structure is essential in portability's development and deployment process. After that, we dived into HTTP and I was mainly surprised when I learned the greatness of the contents carried by a request and response. Then, we focused on Servlets which are the main fragment of Java web development.

Additionally, we discussed the '*Threading Issues*' caused by the multi-threaded approach, which is an approach to solving the problem of how one servlet object serves many clients. In this approach, instead of creating multiple things, the servlet container creates a separate thread for each invocation of `service()` method, and that thread runs all servlet methods.

We also discussed information-sharing techniques among servlets (ServletContext object, HttpSession object, Request attributes). Before learning these techniques, I used incredible nonsensical methods such as different web pages to carry information. However, these techniques are beneficial and make it easier to carry information between servlets.

5.4 More on Java Web Applications

We learned what a developer should do for an exception and error management by configuring a web descriptor, namely `web.xml`. This week, we generally used XML files for configurations; however, following weeks, we used annotation-based configurations.

We focused on session management and filters on the week's last days. We learned session tracking techniques in detail, which of them are tracking via IP address, user authentication, hidden form fields, URL rewriting, and cookies. In the filters part, we learned how filters actually work with other parts of the server. Then, we practiced how requests are used for authentication and security purposes.

Until this week, my knowledge about web development was pretty limited, and I was a novice to the web at this point. Therefore, these topics were confusing but enthusiastic for me.

6 Spring Framework

In web development, our next step was a framework. In the internship program, **Spring**, the world's most popular **Java** framework, is chosen for that purpose. **Spring** is an open-source framework developed for **Java**. Generally, it is used for developing web apps with the **Java** Enterprise platform. For ease of reading, I will dive into the subsections and briefly explain what I learned about **Spring** and what they are.

6.1 Introduction to Spring

By using **Spring initializr**, we created our first spring project. While creating a project, our mentor addressed the features of **Spring initializr** and the dependencies part of it. While discussing the dependencies, we found out a problem with versions; therefore, our mentor talked about the general versioning methods.

6.2 Controllers

We started with the controllers. Controllers are part of the Spring Web model-view-controller (MVC) framework and meet the requests. By using the mapping annotations, requests are mapped to related functions inside the controller class. The functions usually return a response after necessary processes are done according to the request. In our projects, we usually used “**ResponseEntity**” classes because we returned an entity.

6.3 Filter and Interceptor

We continued with the filters. The filters are objects used to intercept the HTTP requests and responses of the application. Basically, they are the layer before sending the request to the controller and before sending a response to the client. Some common usages are logging requests and responses, logging request processing time, formatting request body or header, verifying authentication tokens, or compressing responses.

Interceptors are pretty similar to filters, but they act in **Spring Context**, so they are powerful enough to manage HTTP Request and Response but can implement more sophisticated behavior because they can access all **Spring** contexts. In other words, we can not use filters outside the web context, while **Spring** interceptors can be used anywhere because they are defined in the application context.

6.4 Exception

Then we dived into the exceptions. Firstly, we examined the default answer of **Spring** for errors and it can be said that default answer constitutes a security vulnerability because of the information the error provides. For example, someone can tell that this system uses the **Spring** framework by looking the default answer. We discussed how we could handle errors and change the behaviors and messages when an error occurs.

6.5 Model, Entity, and Database

After the error handling, we learned the Data Transfer Objects (DTOs), which are used to encapsulate data and carry this data between processes and their usages. I extensively used models in the final project to transfer data between processes and layers.

Since we will have been using the database, we had to make the database connection. **Spring** provides database connection capability with **Hibernate**, which is integrated inside **Spring** and makes the database connection and necessary database operation.

Hibernate can also create the tables in the database by using entities provided by entity classes. Therefore, we used entity classes to tell the **Hibernate** to create the table in the database.

6.6 Services, Repositories, and Configuration

Services are generally used for business logic, such as creating, storing, or changing data. I extensively used the services in my final project.

Beside, Repositories are the mechanism for encapsulating storage, retrieval, and search behavior that emulates a collection of objects. They are used for the access layer for accessing and making necessary operations in the database. We chose to use **Spring Data JPA** for this purpose. After making the required settings, **Spring** automatically connects itself to the database and gets ready to execute queries with little effort. In repositories, there is almost no need to write SQL queries executed in the database, even if it is allowed. By using the specific combination of some keys in the function names inside the repository interface, we provide necessary information to **Spring** so that **Spring** can create the proper queries and execute them by connecting to the database.

After the basics, we dived into the configuration of our apps, such as security, password encryption, or data loading when it is started.

7 React

On the last day of the third week, we started discussing **React**, a user interface library created by Facebook on **JavaScript**. I had almost no experience with both **React** and **JavaScript**.

7.1 MPA and SPA, and **React** Elements

We started the discussion with MPA (multiple page applications) and SPA (single page applications). **React** helps developers to develop SPA by using **JavaScript** and virtual DOM. Since our primary concern will have been learning **React**, we talked about its advantages and limitations and compared **React** with other frameworks and libraries by looking at the trends to have a better perspective.

We started with the **React** elements and continued with how we could render them. After learning the basics, we talked about JSX, a syntax extension to **JavaScript** that allows **React** elements to be written inside **JavaScript** using HTML tags. Since JSX has many different features, such as styling the elements and inserting **JavaScript** variables, we had to spend much time on it solving mini coding challenges.

7.2 Functional and Class Components

We moved into components. A **React** component can be defined as an independent, reusable component that outputs the **React** element. We compared the class and functional components and discussed their usage differences. I realized that I tended to use class components because of the OOP and class familiarities, although functional components are excessively used in the sector.

7.3 States

Then we discussed a crucial topic and feature of **React**: **States**. We talked about what a state is and how it is used. We then jumped into another critical issue in states: ‘setting/updating the state’. We realized and learned how to fix the different behaviors of setting states.

7.4 Life Cycle Methods

Another essential topic was the life cycle methods of class components. While rendering and mounting the component, **React** runs various methods on the components at multiple phases. Life cycle methods can be used for specific purposes according to phases.

7.5 Event Handlers

We discussed that we could achieve some effects by using event handlers. For example, sending a request when a button is clicked or changing the state of a variable when a key is pressed can be achieved by event handlers.

7.6 Promises, Back-end Requests, and JWT

After the basics and some advanced topics, we moved into the back-end requests. Before talking about them, we discussed the promises, a feature of JavaScript. For back-end requests, we conversed about Axios. Axios provides support to different request types and configs and is easy to use.

8 Final Project

In this part of the report, I will explain the project I developed in detail. I will divide the project into two parts: Back-end and Front-end.

For the final project, we were given some time to develop. We were first given time to develop after the **Spring** framework part. It was for developing the back-end. The second time given was after the **React** part, which was finished on the second day of the fourth week. Since the main internship program was four weeks at OBSS, we were expected to finish the final project by the end of the fourth week. However, I could not complete the project at this time. Since my internship period was six weeks and I could not complete the project, they asked me to complete the project within this period.

In the fifth week of my internship, I decided to start from scratch because I thought that I made mistakes at many points while developing the project and that if I continued to develop on these mistakes, it would harm the development phase. First, I tried to find out where I lacked and made mistakes.

I tried to learn **React** from the beginning for three days because I thought I had problems with the **React** part. As a result of this work, I have come to a position where I can do many things on **React** without difficulty. I spent the next two days thinking about simple things and design. In my last week, I rebuilt and coded the entire project, starting from scratch.

8.1 Project and Requirements

The final project was a basic Book Portal whose requirements were provided. We were provided the document located in the appendices for basic requirements.

In my project, there are two main entities: User and Book. Each user has a role, admin or user role, and book lists for favorite and read books. Each book has many information about itself: name, author, type, publisher, and publication date. Both admins and users can log in to the system. Each admin is also a user and can do everything a user can, such as updating passwords, seeing books, adding books to their read or favorite lists, and searching for a book and its information. Additionally, an admin can add, update, and delete users and books.

8.2 Back-end

As mentioned in the requirements, I used **Spring** for the back-end. The main folder structure can be seen at the appendices. **Spring Security** is active, and JWT tokens, which need to be inside the request's header, are used for authentication. After security is passed, the request is handled by controllers. In the back-end part, there are nine main folders:

- **config**: contains the configurations and data loader.
- **controller**: contains request (Rest) controllers. If the requests are authorized, they are met by the related controller. When a request is met, necessary business logic is run.
- **entity**: contains entity classes. These entity classes are used in the tables of the database.
- **exception**: contains the user-defined exceptions and global exception handler.
- **filter**: contains filter classes. All requests go through the filters.
- **model**: contains model classes. These classes are used for data transfer between client, server, and database.
- **repo**: contains repositories. These interfaces are used to access the database by using **Spring JPA**.
- **service**: contains services. These classes consist of the business layer functions.
- **util**: contains utilities.

These are the main folders consisting of several files; I will explain them in detail. These back-end files are accessible in my GitHub repository of this report.

8.2.1 config

The classes inside this folder are used for the configuration of **Spring** and data loading when **Spring** runs the app. After the app starts running, the data loader is not used, although configurations influence the app's answer.

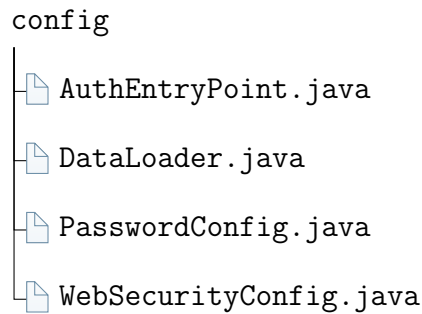


Figure 1: Structure of config folder.

8.2.1.1 AuthEntryPoint.java:

When authorization is failed in **Spring Security**, the function inside this class is called and returns a response with the **UNAUTHORIZED** status code.

8.2.1.2 PasswordConfig.java:

This class indicates the password encoder which is used through the app.

8.2.1.3 WebSecurityConfig.java:

It is configuration of **Spring Web Security** that checks all the requests for authorization and roles. Also, if an exception occurs, it handles the exception with the help of a global exception handler.

The web security is a little bit confusing and not easy to handle. Especially, **JWT** token-based authentication challenged me. I spent almost one day understanding what **JWT** token and **JWT** token-based authentication are. By reading documents and examining examples, I implemented **JWT** token-based authentication for my security.

8.2.1.4 DataLoader.java:

This class is run when the application is run. It checks the database for the default admin user and roles, called `ROLE_ADMIN` and `ROLE_USER`. If the database is missing, it creates admin user and roles. After learning the `ApplicationRunner` interface, it was easy to implement.

8.2.2 controller

Controllers are the essential elements of back-end development. Controller files are used with `@RestController` annotation, which indicates that the class is a Rest API controller. Each class has `@RequestMapping` annotation that shows the path of the controller; that is, the requests coming to the specified path are handled by that class.

The classes include several mappings for different request types such as `GET`, `POST`, `PUT`, or `DELETE`. When a request is sent to the back-end, `Spring` sends it to a suitable controller according to `@RequestMapping`. When a request arrives at the class, it handles it according to its type.

Since controllers are not tricky, I could easily code and map the requests. The most challenging part of the controllers was the authentication of functions. Since some operations, such as deleting users or books, cannot be done by regular users but admins, I needed to secure the related functions. After researching, I managed to block the regular user using some operations by using `@Secured` annotation. This annotation takes a string which is the privileged role, in my case `ROLE_ADMIN`. When this annotation is used, `Spring Security` checks for the additional role.

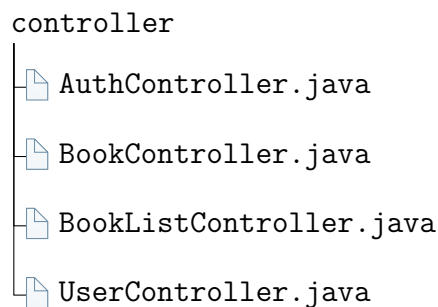


Figure 2: Structure of controller folder.

8.2.2.1 `AuthController.java`:

This class handles the requests coming to the path `‘/auth’` and has two POST mapping.

This class is responsible for authentication operations. It can be used to check the JWT token’s validity or log in. Using the information inside the request body, I checked the necessary information and sent the response to the client. The responses include some required information for the front-end, such as validation information, admin status, or JWT token.

8.2.2.2 `BookController.java`:

This class handles the requests coming to the path `‘/books’`. It has six GET, one POST, one PUT, and one DELETE mapping.

This class handles book operations such as searching, adding, updating, or deleting. I need a particular concern in this class: `Pageable` and `List` data. Since I needed pageable and list data in the front-end while searching the book, I coded two variances of each search function. This class can handle both id and name searches. In name searches, there is no need to provide the full name of the book. Instead, providing a letter or word inside the book name is enough.

8.2.2.3 `BookListController.java`:

This class handles the requests coming to the path `‘/’` and has two PUT. Although the main path is `‘/’`, the two functions inside this class have special path mapping for its PUT mapping. This class is responsible for the favorite and read list operations.

According to the traditional way, updating something is done with PUT request. Since adding or removing a book from read or favorite lists is updating the list, I decided to use PUT requests. However, there were four operations: adding or removing from the read list and adding or removing from the favorite list. Therefore, I decided to have two main functions and paths for read and favorite lists. In main paths `‘/read’` and `‘/fav’`, I handled read and favorite list operations, respectively. A request parameter is needed as well as the book and user ids to acquire the necessary information, which book will be added or removed.

8.2.2.4 UserController.java:

This class handles the requests coming to the path `‘/users’`. It has six GET, one POST, one PUT, and one DELETE mapping.

This class is similar to the book controller and is responsible for user operations such as searching, adding, updating, or deleting. Like in the book controller, I also need a particular concern, `Pageable` and `List` data, and I solve this problem the same way in the book controller.

8.2.3 entity

Entities are my main data classes. Thanks to `Hibernate`, I was also able to create the database tables by using `@Table` annotations, so the tables were created automatically. Around the back-end, such as between data and business layers, I used these entity classes; however, I used models while sharing and transmitting information between the client and server.

The main problem with entity classes was the mutual data types. A `User` includes `Set<Book>` inside it, and a `Book` includes `Set<User>` inside it. This was a problem when this information was sent to the client side due to this mutuality. For example, when a `User` is sent to the client, its read list is also sent. However, inside the read list, there are books that contain the `User` that is being sent to the client. Therefore, there was an infinite loop while parsing the data. I solved it by using `@ManyToMany`, and `@JsonManagedReference` annotations.

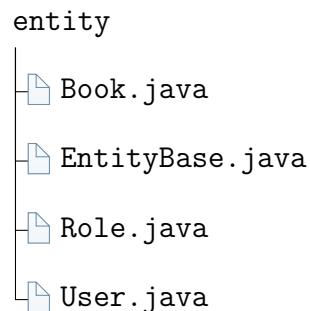


Figure 3: Structure of entity folder.

8.2.3.1 **Book.java:**

This is an entity class that extends `EntityBase` for a `Book` and is responsible for holding information of a book. It has ‘name’, ‘author’, ‘page count’, ‘type’, ‘publisher’, and ‘publication date’ fields as well as the data fields in `EntityBase`. Also, it has many-to-many relations with `User` class.

8.2.3.2 **User.java:**

This is an entity class that extends `EntityBase` for a `User` and is responsible for holding information of an user. It has ‘username’, ‘password’, ‘read list’, ‘favorite list’, and ‘roles’ fields as well as the data fields in `EntityBase`. Also, it has many-to-many relations with `Book` and `Role` classes.

8.2.3.3 **Role.java:**

This is an entity class that extends `EntityBase` for a `User` and is responsible for holding information of a role. It has the ‘name’ field and the data fields in `EntityBase`. Also, it has many-to-many relations with `User` class.

8.2.3.4 **EntityBase.java:**

This is an entity class that is the base of other entities. This holds the general information such as ‘id’, ‘creation date’, ‘update date’, or ‘activity’.

8.2.4 **exception**

Exceptions are used at several points to provide information to the exception handler. The exception handler catches the exceptions and sends a response to the client. The primary purpose of the exception handler is security because default `Spring` errors exploit some system information. Therefore, I used special exceptions and an exception handler to provide necessary but unimportant information outside.

Creating new exception classes was not hard. However, adjusting the exception handler is a little tough because the order of the functions can be a problem. I solved this problem using `@Order` annotations and attention.



Figure 4: Structure of exception folder.

The names of the files explain what the classes are for and what they do. These are used for specified exceptions in related positions.

8.2.5 filter

My app contains only one filter, which is checking the JWT token. I use JWT token for authentication purpose because transmitting username and password in all request is hard and can cause security vulnerabilities. If the JWT token does not exist in the header or it is expired, `BadRequestException` is thrown, and a response is returned with `BAD_REQUEST` status code.

This part challenged me because I did not know JWT and how to check it, and I spent almost one day for this authentication system. However, the main problem was not that the subject was difficult but that I misunderstood some concepts and topics and needed to change the security configuration quite a bit.

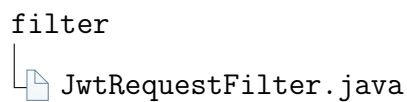


Figure 5: Structure of filter folder.

8.2.6 model

Models are mainly used to transmit data between client and server sides. There were two reasons. The first one is that client does not know some information, such as the creation date while the latter is that the client should not need to see some information, such as the user's password or the object's update date. Therefore, I used DTOs for any information transfer between the client and server sides.

One class, called `MyUserDetails`, is not used for information transfer. It was needed for the authentication system. It helps by indicating how the necessary information is extracted from the `User` entity.

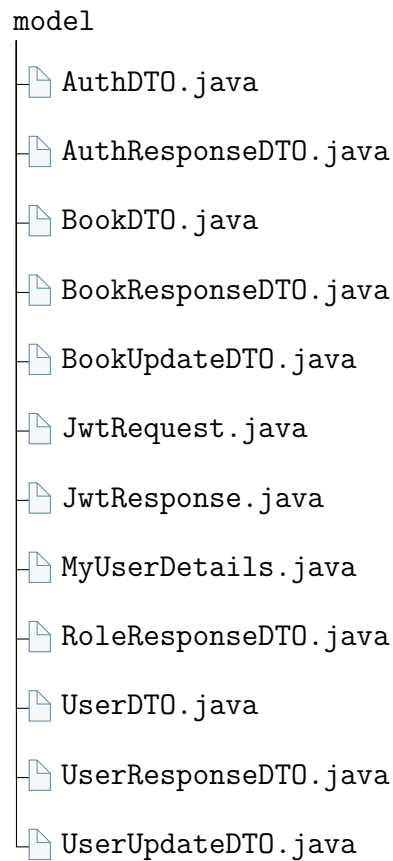


Figure 6: Structure of model folder.

8.2.7 repo

Repositories are used to access the databases, and they make use of the **Spring JPA** by extending **JpaRepository**. Some essential operation, such as directly adding or finding by id, is inside the **JpaRepository** but if I want to add something special, I write the function name by using keywords, such as **findBy**, or **All**, and **Spring** generates the necessary queries in the background. This is so easy to use and increases the speed of development.

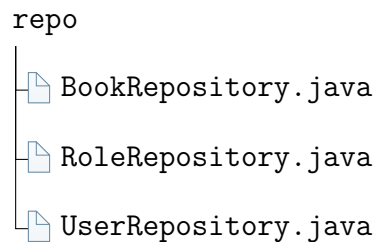


Figure 7: Structure of repo folder.

There is one for each main entity. **BookRepository** is used for operations on books, **UserRepository** is used for operations on users, and **RoleRepository** is used for operations on roles.

8.2.8 service

Services are the business layer of my app. All the operations, such as adding or removing the books or users, and logic are done in this layer. Controllers use the services for related operations; therefore, it can be said that there is one service for each controller.

Inside services, other services or necessary repositories are used. Accessing the database is done inside services with the help of repositories that contain several different implementations of the same operation for different needs. For example, several search functions exist for pageable and list data.

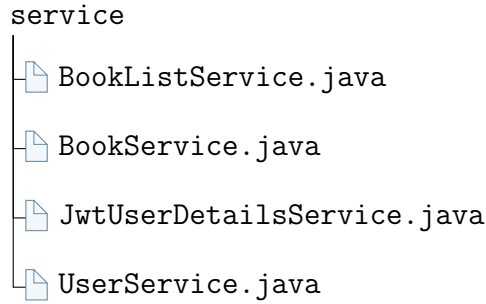


Figure 8: Structure of service folder.

8.2.9 util

This folder contains only one class, called `JwtTokenUtil`. This class contains several functions applicable to the JWT token, such as getting the username or expiration date from the token. Also, it can generate a new JWT token. JWT filter and `AuthController` excessively used this class.



Figure 9: Structure of util folder.

8.3 Front-end

As mentioned in the requirements, I used `React` for the front-end. The main folder structure can be seen in the appendices front-end-tree. I used `antd`, an enterprise-class UI design language and React UI library, for the user interface, Node.js, a JavaScript runtime built on Chrome's V8 JavaScript engine, and npm, packages manager.

The front-end part has two main folders: `public` and `src`. The folder 'public' contains the default `public.html`, and `public.html` contains only one div whose id is 'root' and which will be modified through entire app by using `React`.

8.3.1 Folder Structure

The main project files are inside the `src` folder.

- **globals**: It is a folder containing the app's global variables.
- **pages**: It is a folder containing the pages called `auth`, `book`, and `user`, as well as the main homepage of the app.
- **service**: It is a folder containing the front-end service layer. Files inside this folder include functions to connect the back-end.
- **App.js**: It is a file and is responsible for rendering the pages and providing the main/top navigations around the app. Also, it checks the authorization token and its validation.
- **index.js**: It is a file and responsible for rendering **App.js** by using `ReactDOM`.

I will briefly explain the folder and files. These front-end files are accessible in my GitHub repository of this report.

8.3.1.1 globals

This folder contains just a file called `GlobalVariables`. That file includes two global variables, called `BOOK_COLUMNS` and `PAGINATION`, which are used for tables around the app.

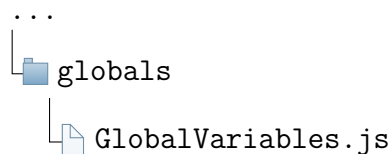


Figure 10: Structue of globals folder.

8.3.1.2 pages

This folder contains the whole pages, which means users mainly see the files inside this folder. I will explain the pages in detail later.

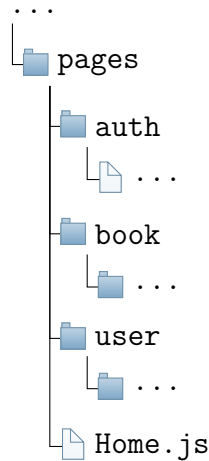


Figure 11: Structue of pages folder.

- **Home.js**: This is the app's homepage and contains the user's general information. It can be accessed by clicking the **Home** from the top navigation.
- **auth**: This folder contains just a file called **Login**, which is responsible for the login page.
- **book**: This is the page of books. It contains five folders and one file inside it and is responsible for the operations of adding, deleting, updating, and adding/removing books to/from favorite/read lists. It uses a switch for rendering the right page of the operation.
- **user**: This is the page of users. It contains four folders and one file inside it and is responsible for adding, deleting, and updating operations. It uses a switch for rendering the right page of the operation.

8.3.1.3 service

This folder contains the services to access the back-end. The functions inside the service files handle the returned response and return a new object with the data inside the response. Additionally, thanks to Axios interceptor, the authorization token, which is saved to **Session Storage** or **Local Storage** while logging in, is added to the header of all requests.

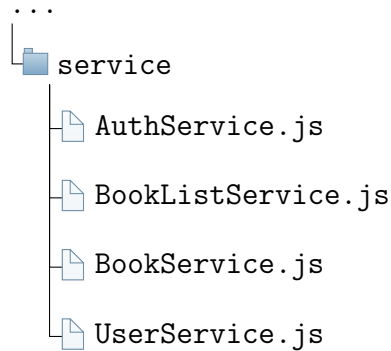


Figure 12: Structue of service folder.

- **AuthService:** Responsible for authentication and login process.
- **BookListService:** Responsible for adding/removing books to/from read/favorite lists.
- **BookService:** Responsible for book operations such as searching, adding, removing, and updating.
- **UserService:** Responsible for user operations such as searching, adding, removing, and updating.

8.3.2 Pages

When the app is run, firstly `index.js` renders the `App.js`. `App.js` firstly checks the authorization token and its validation. If the token is valid, it directs the user to the homepage, rendering (`Home.js`). If the token is not valid, it directs the user to the login page, rendering (`Login.js`).

8.3.2.1 Login and Logout

This page contains a basic login form. While the login page is done by **antd** form, the logout item is constructed by 'Popconfirm' of **antd**. If the 'Remember me' option is chosen, authorization token is saved into both **Session Storage** and **Local Storage**. However, if it is not chosen, the token is only saved into **Session Storage**.

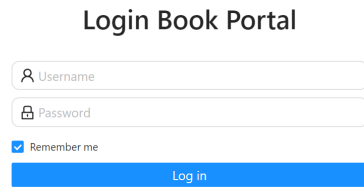


Figure 13: Login Page

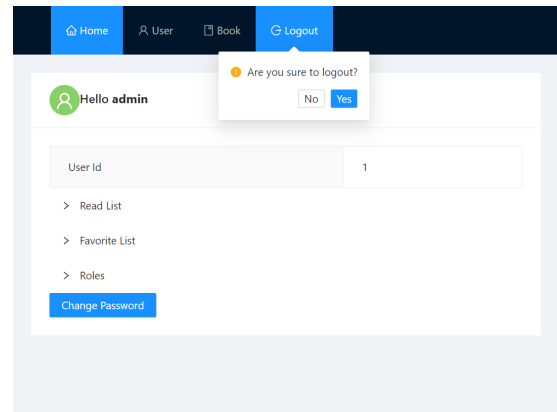


Figure 14: Logout

After logging in, users are directed to the homepage. At the top of the screen, there are four different menu items, called **Home**, **User**, **Book** and **Logout**. Home is firstly rendered, and using these navigations page can be changed.

When users click to **Logout**, a warning, which asks whether they are sure to log out, pops up. If yes is clicked, users are directed to the login page.

8.3.2.2 Home

On the homepage, user information is provided. This page makes use of ‘**Card**’, ‘**Descriptions**’, ‘**Collapse**’, and ‘**Panel**’ of **antd** to show the information. Users can see their user ids, read lists, favorite lists, and roles on this screen. This information is acquired by sending back-end a request by username and setting the information state. By using the button ‘**Change Password**’, they can also access the update form and change their passwords.

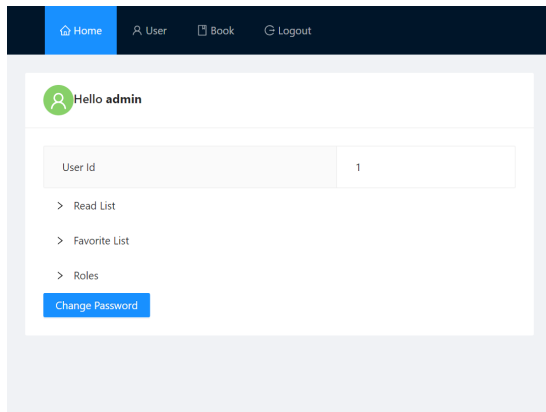


Figure 15: Home Page

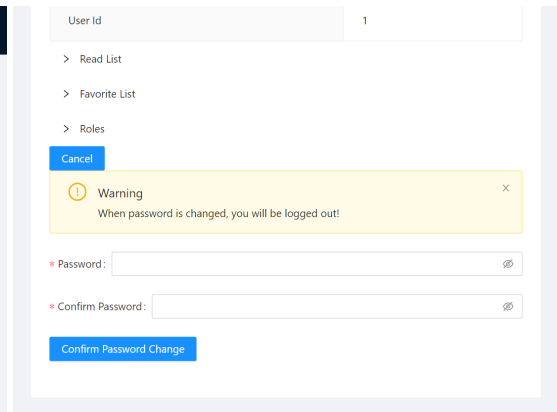


Figure 16: Password Change

Since regular users are not allowed to do user operations such as adding, deleting, or updating, **User** page is unique to admins. Therefore, **User** item is not seen when the user does not have admin roles.

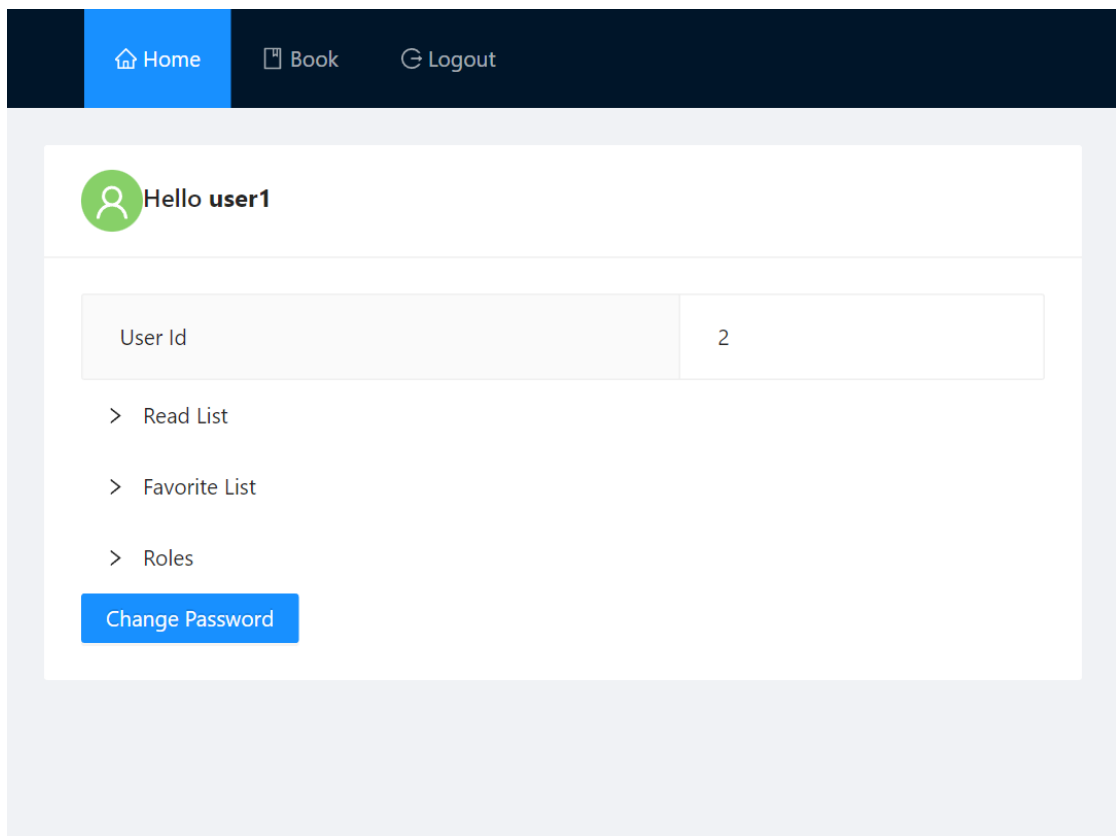


Figure 17: User Home Page

8.3.2.3 User

When **User** is clicked from top navigation, **User** page is rendered. On this page, there are three operations: adding, deleting, and updating users. This page is special to admins because users are not allowed to add, delete, or update users. Therefore, this page is only accessible when the user does have the admin role.

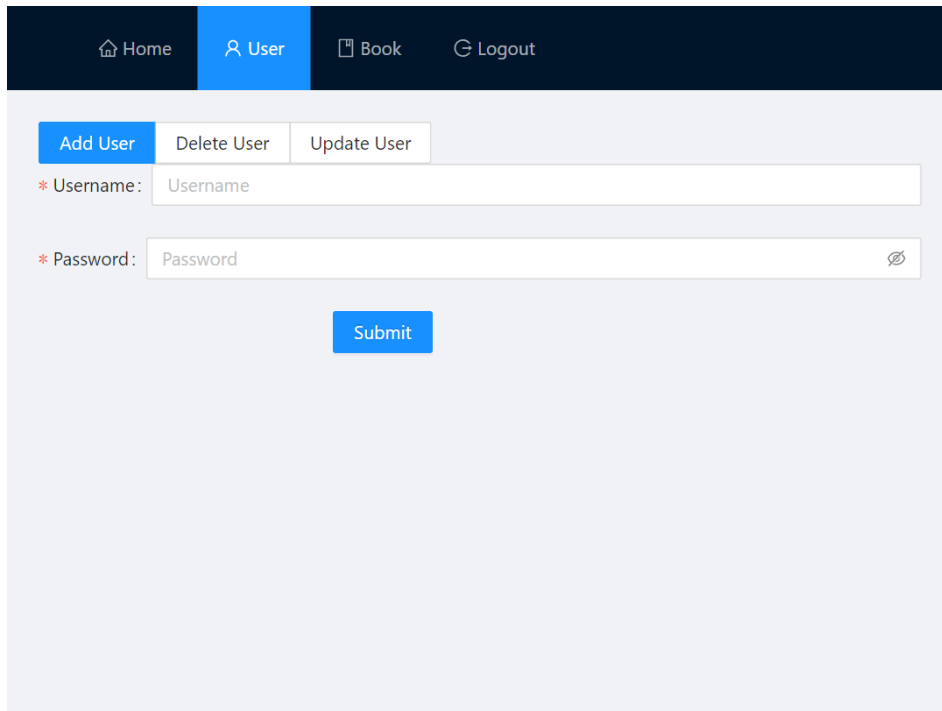


Figure 18: User Page

■ **Add User** By default **Add User** is rendered when **User** menu item is clicked. This page is for adding a user to the database and is unique to admins. When the page is rendered, an **antd** form, which includes username and password, appears.

■ **Delete and Update User** **Delete User** and **Update User** contains more advanced components. When **Delete User** and **Update User** are firstly rendered, a request is sent to database to acquire users and their information by using **useEffect** of **React**. These pages also utilize pagination and utilities located in the **util** folder of the user.

Delete User and **Update User** are pretty similar to each other. Both pages support searching users by both id and username, and the searching option can be changed by using the radio buttons. When an id or username is provided and clicked the search button, a request is sent to the back-end through **UserService**. When the input area is cleared, the page is updated, and user data is reset. Both pages also support the pagination and pagination setting changes. Admin can change the pagination setting by using the navigation below. When pagination is changed, a new request is sent to the back-end. Additionally, the admin can see the users' information on both pages.

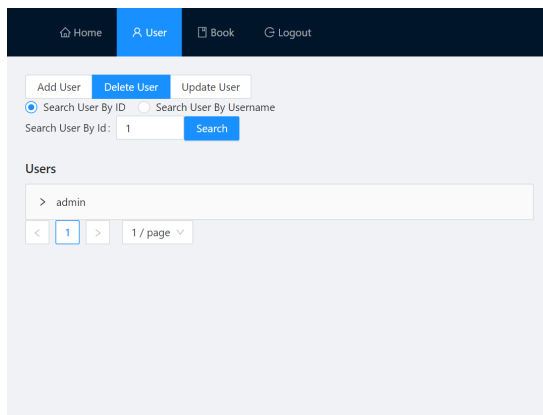


Figure 19: Searching by ID

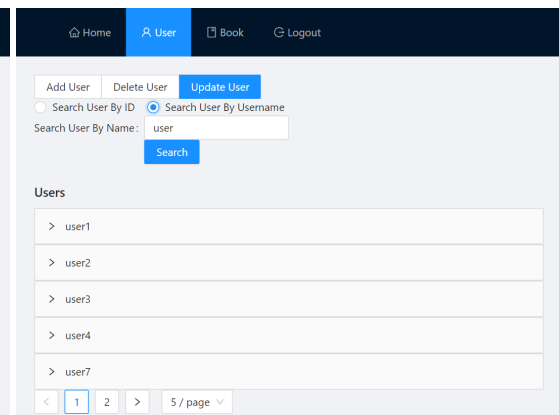


Figure 20: Searching by Name

Pagination and visualizing the data was the most challenging part for me because there were several aspects I needed to consider. I changed my visualizing method third time for the convenience of development. Because of these changes, I had to change the back-end at some points. This situation causes the so much loss of time for visualizing decisions. However, my job was not done after visualizing the decision because pagination was more challenging than expected. Due to misunderstanding of some parts of pagination, I had to spend a couple of hours searching and reading the **antd** documentation.

The difference between **Delete** and **Update User** is the buttons found in all users. In **Delete User**, the name of the button is '**Delete User**', and it is used for deleting the user. In **Update User**, the name of the button is '**Update User**', and when it is clicked password update form appears.

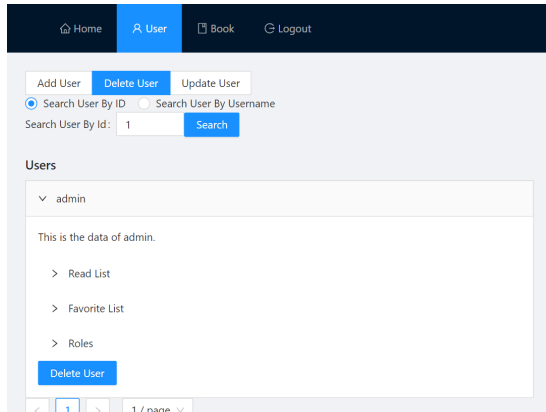


Figure 21: Delete User

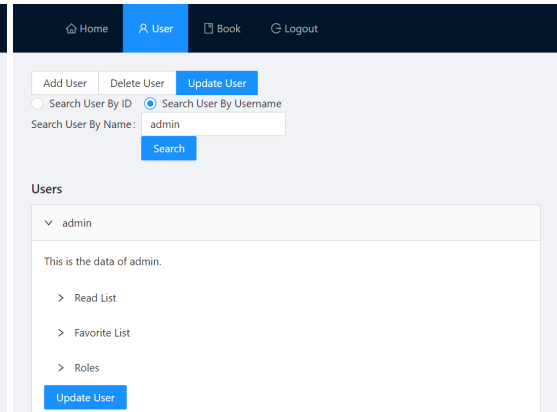


Figure 22: Update User

8.3.2.4 Book

When **Book** is clicked from top navigation, **Book** page is rendered. On this page, there are three operations: adding, deleting, updating, and listing books. By default **Book List** is rendered. Although this page is not special, some operations are not allowed to normal users. Therefore, normal users can list books and add/remove these books to/from their lists.

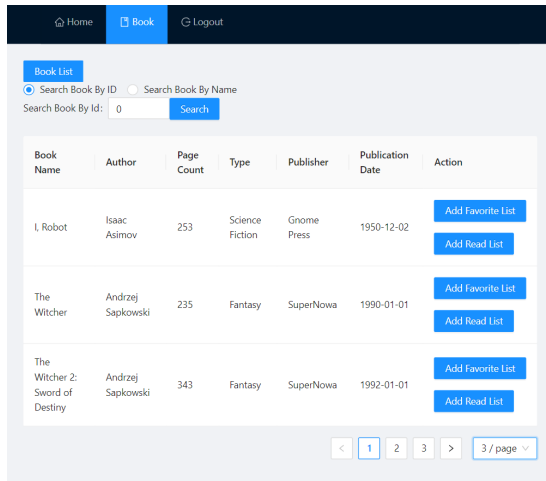


Figure 23: Book Page for Normal User

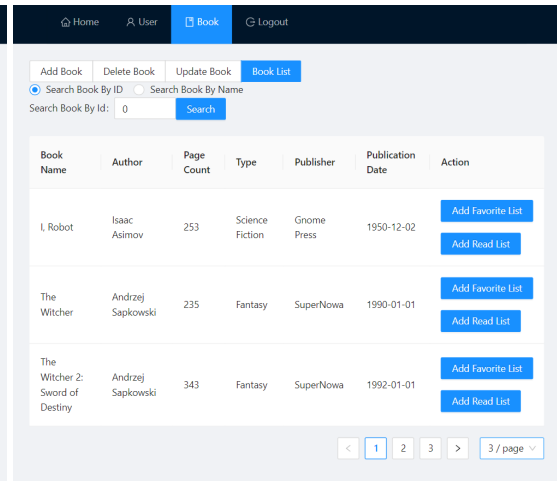


Figure 24: Book Page for Admins

■ **Add Book** This page is for adding a book to the database and is unique to admins. When the option is chosen, **Add Book** is rendered and provides a form to add a book. The fields of **Book** entity: name, author, page count, type, publisher, and publication date. All the fields are required, and the date can be chosen from the calendar. When the book is submitted, a request is sent to the back-end with the help of **BookService**. When the book is saved, the saved book's information is shown below the form. Additionally, the size of the form can be changed by using the 'Form Size' radio buttons.

Figure 25: Book Adding Form

Book Info					
Book ID	11	Book Name	Dune	Author	Frank Herbert
Page Count	412	Type	Science Fiction	Publisher	Chilton Books
Publication Date	1965-08-01				

Figure 26: Book Added to Database

■ **Delete and Update Book** The **Delete** and **Update** pages of the book are similar to user's and special to admins. Both pages support searching books by both id and username, and the searching option can be changed by using the radio buttons. Again, when the input area is cleared, the page is updated, and user data is reset. Both pages also support the pagination and pagination setting changes. Admin can change the pagination setting by using the navigation below. Additionally, the admin can see the books' information on both pages.

The only difference between **Delete Book** and **Delete User** is the visualizing data. I preferred the 'Descriptions' of **antd** to visualize the data of a book. The differences between **Update Book** and **Update User** are the visualizing method and updating form. Only the page count, publisher, or publication date of a book can be updated.

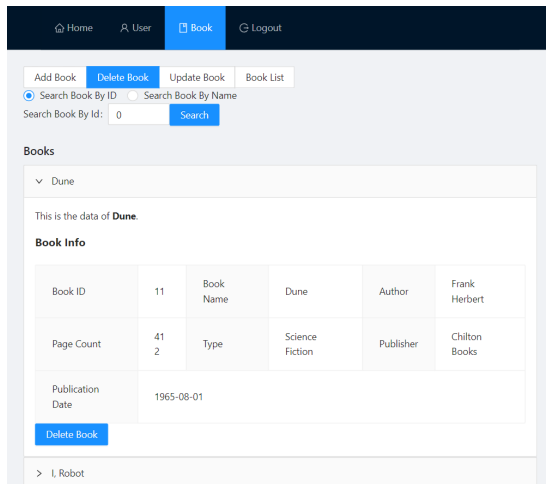


Figure 27: Book Delete

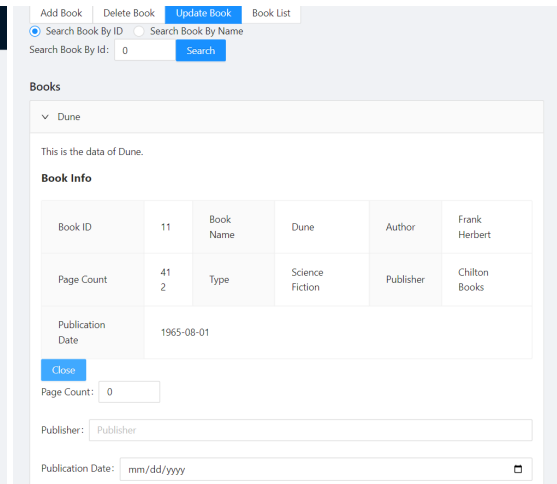


Figure 28: Book Update

■ **Book List** This page is accessible by all users and the default rendered page of Book item. ‘Table’ and ‘Pagination’ from **antd** are used on this page. It lists all the books in the database and provides searching by both id and name. Information about each book is provided in each row, and the actions operate on the book in that row. Users can add or remove the book to/from their read or favorite lists.

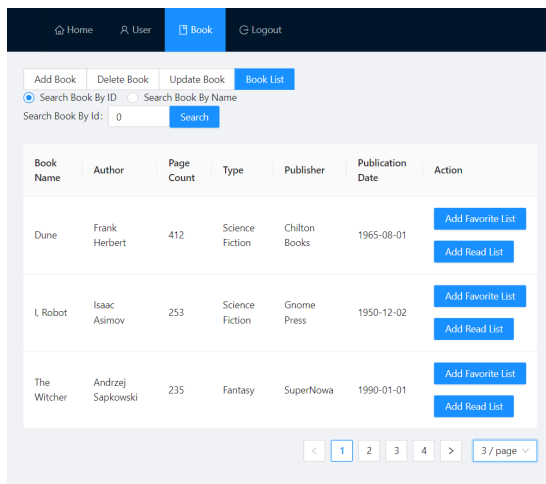


Figure 29: Book List

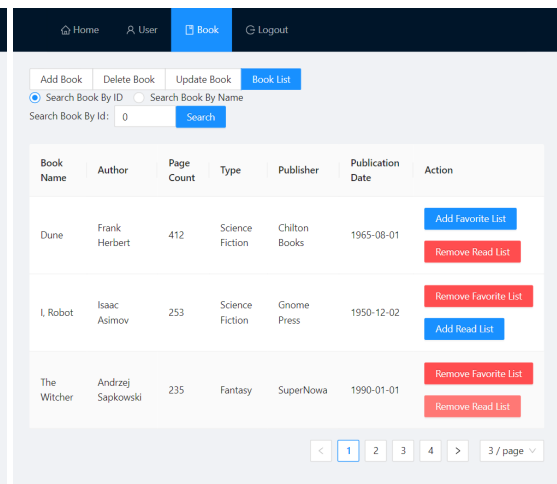


Figure 30: Book List Example

If the book is not added to the related list, the action button is blue, and the text of it specifies the adding operation. However, if the book is already added to the corresponding list, the action button is red, and the text of it specifies the removing operation. When the button is clicked, a request is sent to the database, and the book data is updated. As a result, the page is re-rendered with the new state.

This part was hard to code. Putting the action buttons and performing their operations were more complex, aside from the force of the table. It was easy to send a request and save the book to the user's list in the database; however, it was hard to update and re-render the book data and the state of the book. I thought to do this task without getting requests because of the complexity. Also, in the first place, the book information had a problem when the pagination was updated. To solve these problems, I spent several hours.

9 Conclusion

This summer practice was my first practice and the first experience in **Java** web development. The first part of my internship consisted of knowledge sharing. That part taught me so much about **Java**, Web Development, and **Spring**. This knowledge sharing was quite intense and sometimes hard to follow, and the last part of it was not beneficial for me due to the intensity. I had hard times about **React** and I had to spend time and efforts to learn and straighten the information that I misunderstood. I believe information sharing part may be planned better by spreading the program for at least one week more, five weeks at total.

The second part of the practice consisted of developing a project from scratch. The project part was pretty beneficial because before this project, I didn't have to set up the general structure for my projects and assignments at school. I was trying to do something that needed to be done, like implementing a function or data structure class, and was trying to fix bugs if they came up. Therefore, although I did not have much difficulty in my experience until this project, I can say that I had a lot of difficulty in this project, especially in the design part. The probable reason for this is that I have not been involved in a project of this scale before.

Although the requirements were given in the project, we were asked to think and develop many things such as thinking the design of the general flow. Until the end of the fourth week (last week of the normal internship program), we were asked to finish this project. Due to my limited time, I did not have time to think much, so I started developing it after a short thought process. This short-term thinking and inexperience made my job very difficult. I couldn't complete the project in the expected time due to the long time I wasted on unfocused parts such as design.

In short, I tried to do everything in the best way and move on to the next stage, instead of revealing something tangible on a part and then continuing to develop on it. But I realized too late that this wouldn't work in this type of development. Therefore, I was not able to finish my project at the end of the fourth week. However, I managed to finish my project with decent planning and developing until the end of the my internship.

In conclusion, in addition to many things I learned about **Java** and web development, I learned how not to develop a project from scratch and possible mistakes in a four-week period. In the last two weeks of my internship, I understood how a project should be developed and what needs to be done before it starts. Additionally, I do think I would choose to continue on web development even though I had hard time at some points.

10 Appendices

Final Project:

Implement a small web application using Spring MVC framework (Spring Boot 2.5.0+ is also acceptable), Spring Security 5 and ReactJS. Use Spring MVC 5.3.0+ framework while building your application. Use Hibernate with JPA annotations in database operations. Use Spring Security 5.5.0+ while building security parts of the application. Divide the project into parts explicitly such as DAO, Model, Service, Controller etc.

There will be two types of users in the system: Admin and User. The roles and users will be stored in database. In addition to users and roles, there will be books, read_list and favorite_list (additional tables can be added in accordance with your design) tables in DB. Main requirements of the project (Book Portal) are stated below:

Book Portal:

Requirements:

○ Functional:

- Admins/users can login to system
- Admin should be able to:
 - Add/delete/update books, users, authors etc. to/from system
 - Search for book and users
- Users should be able to:
 - See list of books
 - Add/remove books to/from read list
 - Add/remove books to/from favorite list
 - Search book by name (Optional: you can search by other information too)

○ Technical:

- There should be two different users: Admin & End-user
- Use Spring Security for authentication/authorization
- Use Hibernate with JPA annotations in database operations
- DB information should be read from properties file
- Use ReactJS for frontend

Figure 31: Requirements of Book Portal

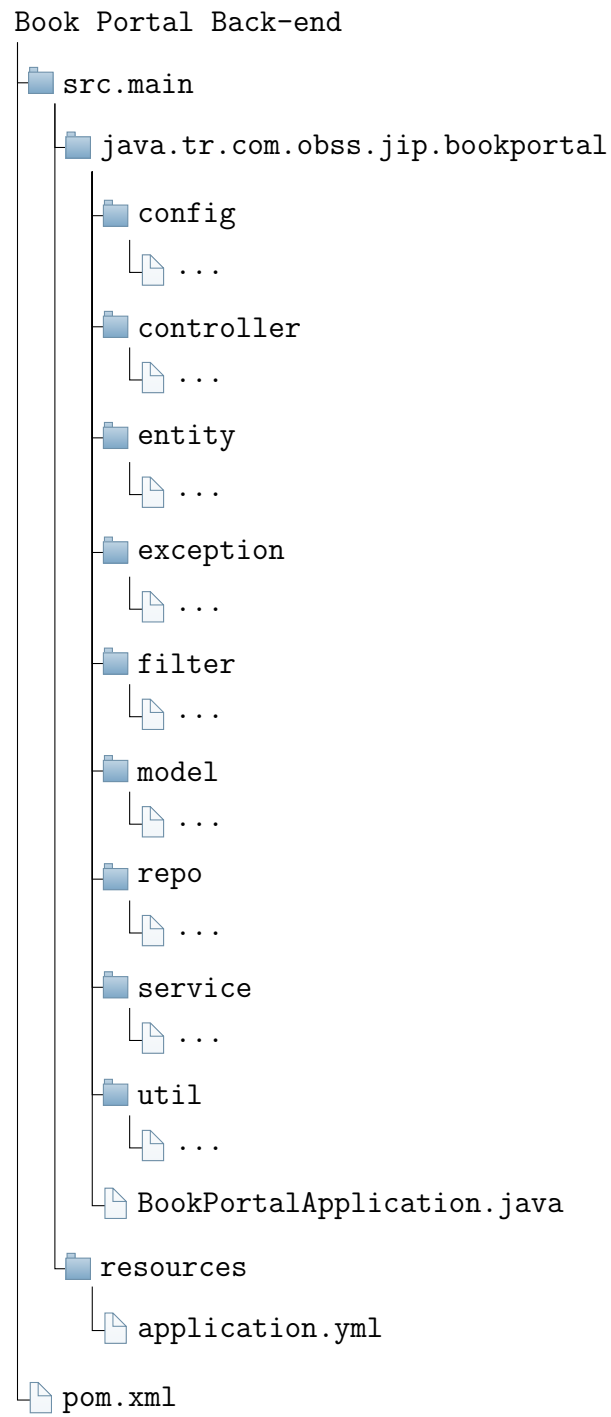


Figure 32: General Back-end Directory Tree of Book Portal

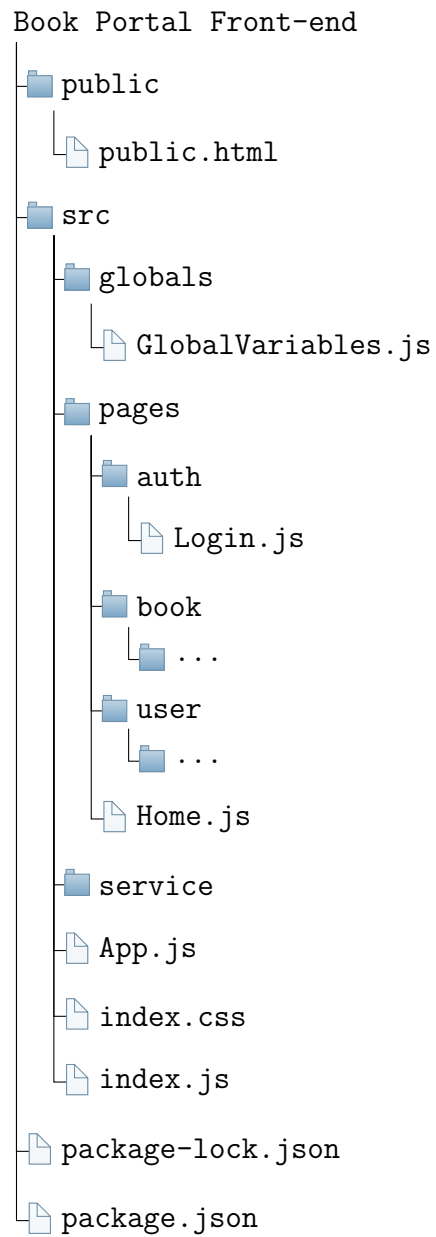


Figure 33: Front-end Directory Tree of Book Portal

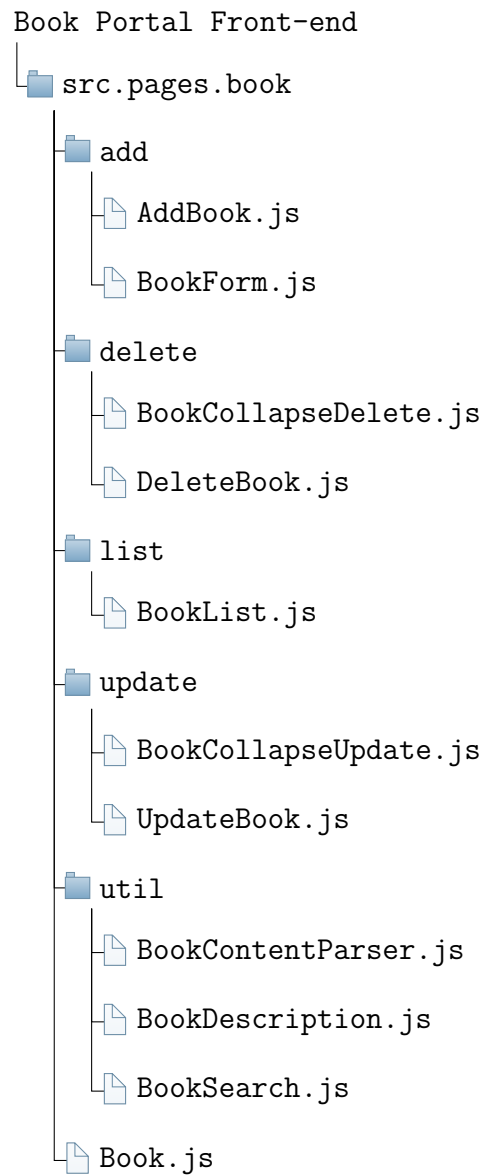


Figure 34: Directory Tree of Front-end Book

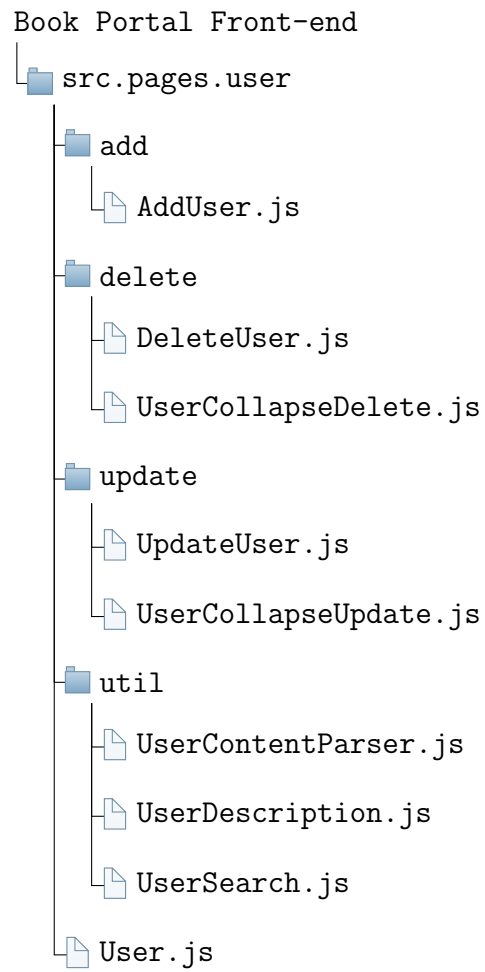


Figure 35: Directory Tree of Front-end User