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SOFTWARE DESIGN DESCRIPTION FOR A PLATFORM FOR MUSIC, BOOK AND MOVIE RECOMMENDATION

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STATEMENT OF NON-PLAGIARISM

I hereby declare that all information in this assignment has been obtained and presented in accordance with academic rules and ethical conduct and the work I am submitting in this document, except where I have indicated, is my own work.

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1. INTRODUCTION

1.1 Purpose

The purpose of this document is to describe the QuiRec system. This platform aims to make recommendations for books to read, movies to watch and music to listen to. This documentation includes detailed information about the designing aspects of the project. It shows the architectural design and the use case realization of the QuiRec system.

1.2 Scope

The QuiRec will be the first recommender system that combines the mostly used recommender systems. The complete design descriptions of the system will be given in this documentation.

1.3 Overview of document

This document consists of 3 chapters. The chapter one gives out the scope and the purpose of the document. Chapter two gives detailed information about the architecture design. The subchapters of chapter two consists of the design approach, used technologies, class diagrams of the system, architecture design of QuiRec and last but not least the activity diagram of the system. Chapter three has further information on the user related design descriptions. User Interface (UI) Design Descriptions and the screen shots of the UI system is given.

2. ARCHITECTURE DESIGN

2.1 Architecture Design Approach

Primary purpose of the QuiRec project is to build a platform which combines recommendations of multiple items and presents them to users. The architecture of the project is designed with the aim of building and developing a system which meets users with maximum capacity and performance and presents them fulfilment recommendations.

Functionality of the system will be conducted with focusing to the user interfaces and focusing to the communication between the client and server. The user interfaces are designed considering the user experiences, simplicity, effectiveness, and comprehensibility. Also, for performance monitoring it is important to understand the user's satisfaction. In further sections, designs are explained in detail.

2.2 Technologies Used

Web application of the QuiRec project will be developed:

- using the Java programming language and Spring Boot framework in the backend part, with using the PostgreSQL for database management and Hibernate for ORM framework.
- using the HTML, CSS, JavaScript programming language and the Vue.JS and Vuetify JS frameworks in the frontend part.
- using the Python programming language and TensorFlow machine learning platform for recommendation models and functions.

Mobile application of the QuiRec project will be developed:

- using the same recommendation models and functions with the web application.
- using the Kotlin for Android development.

2.3 Class diagram

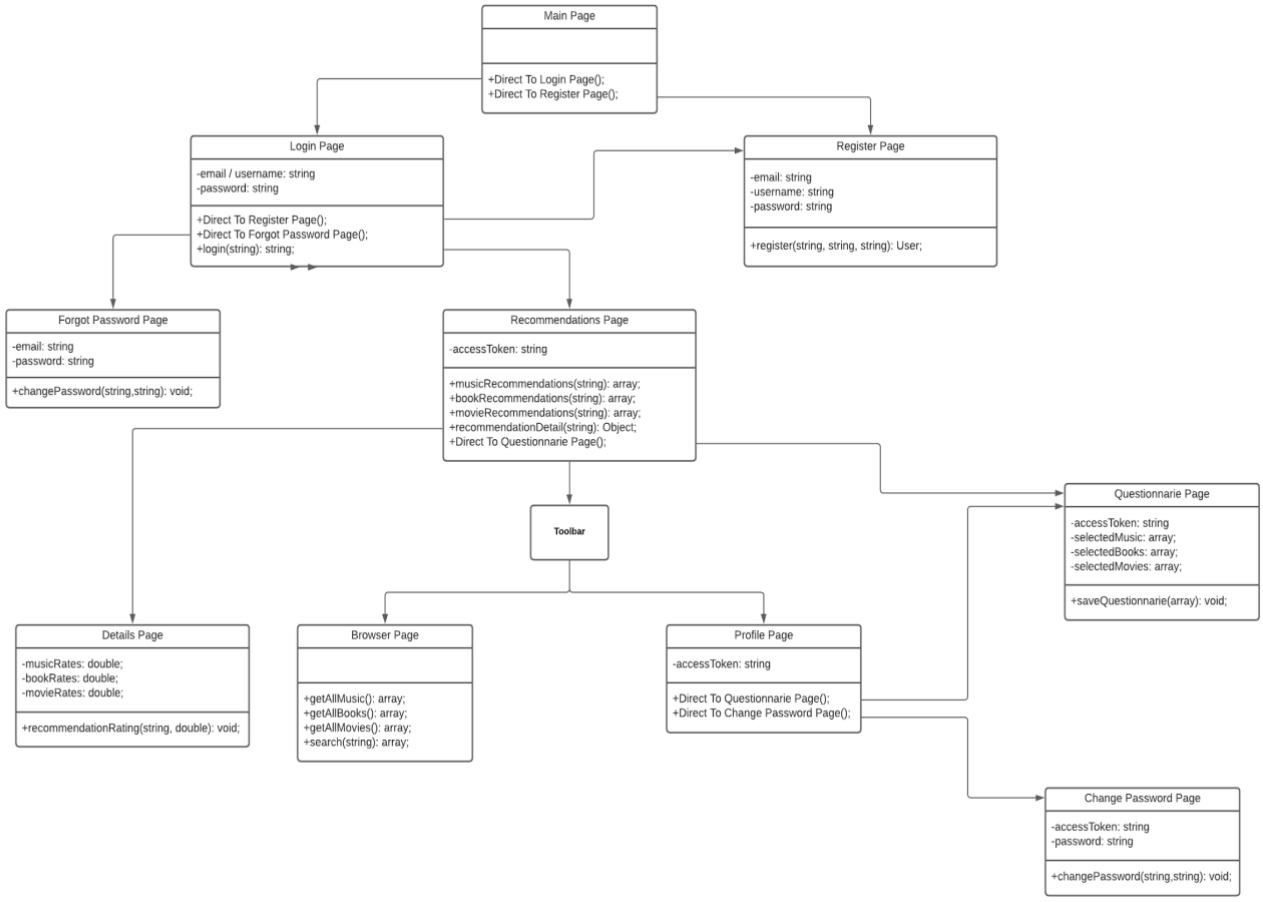

Figure 1 Class Diagram of The User

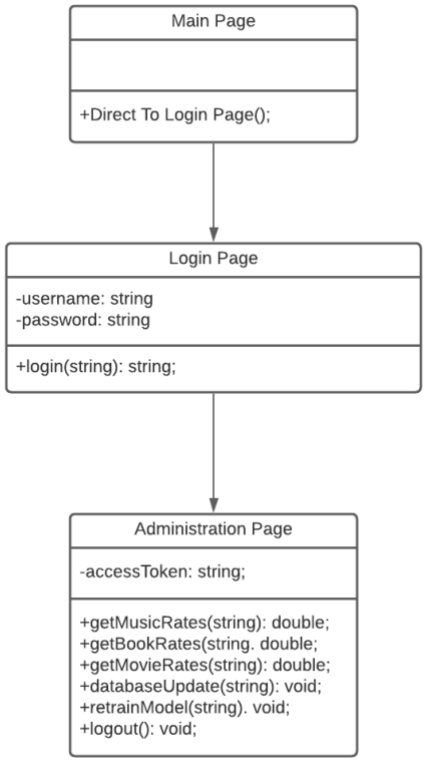

Figure 2: Class Diagram of The Admin

2.4 Architecture Design of QuiRec System

The QuiRec platform will serve up to users and admins. The main purpose of the system is to recommend their favorite genre of movie, books and music to users. The admin will use the system for monitoring the effectiveness of the recommendation model and making necessary updates on the database and recommendation model.

Users can register and login to the system; select or change genre preferences, receive recommendations, see recommendations in detail and rate the recommendations from 1 to 5 (1->Not related, 5-> Highly related compared to user preferences), which will be used for measuring the recommendation performance, change password information in the system, and logout from the system. Using the system, users can also see all movies, books and music which the system has, and perform a search operation without changing their preferences.

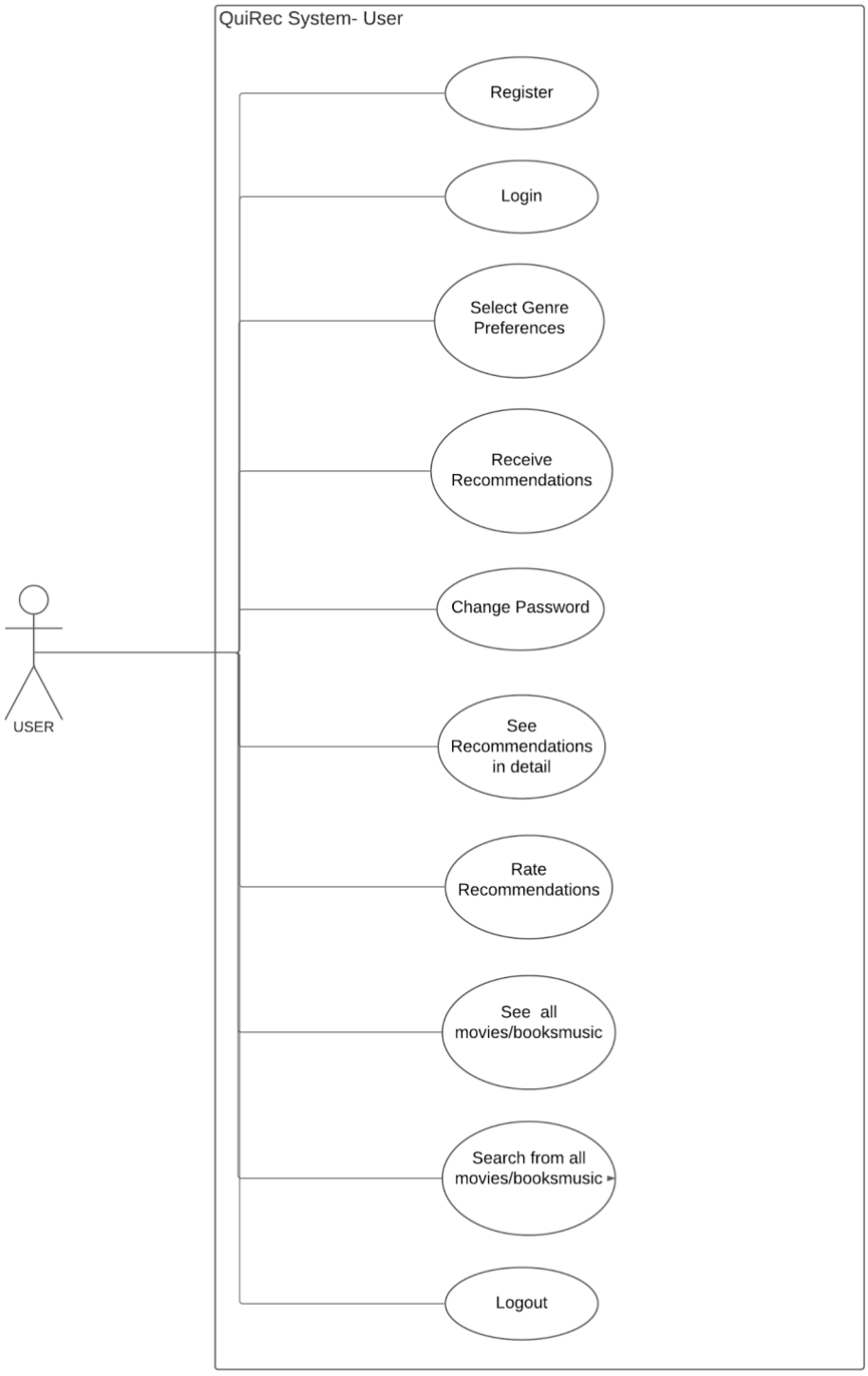

Figure 3: Use Case of the User

Table 1: The Position-Action Diagram for User

User Position	**Action**
Main page	The user can go to the login page.
Main page	The user can go to the registration page.
Login Page	The user can log into the system.
Registration Page	The user can register to the system.
Forgot Password Page	If the user forgets their account password, they can change it.
Change Password Page	The user can change the password of his/her account.
Questionnaire Page	The user selects genre preferences by answering the questions of the system to be used for recommendations.
Recommendations Page	The user can receive the movies, books or music recommended by the system.
Browser Page	The user can see all the movies, books and music which the system has in the database.
Browser Page	The user can perform a search operation inside the displayed data.
Profile Page	The user can see the information of his/her own account and can change password or recommendation preferences through this page.
Details Page	The user can see the recommendation in detail and rate the recommendations from 1 to 5. (1->Not related, 5-> Highly related)

The system is responsible for making recommendations according to user preferences.

Initially, the admin will be registered to the system automatically by the system developer. The admin will login to the system, monitor the performance of the model, update the database and retrain the recommendation when it is required, and logout from the system.

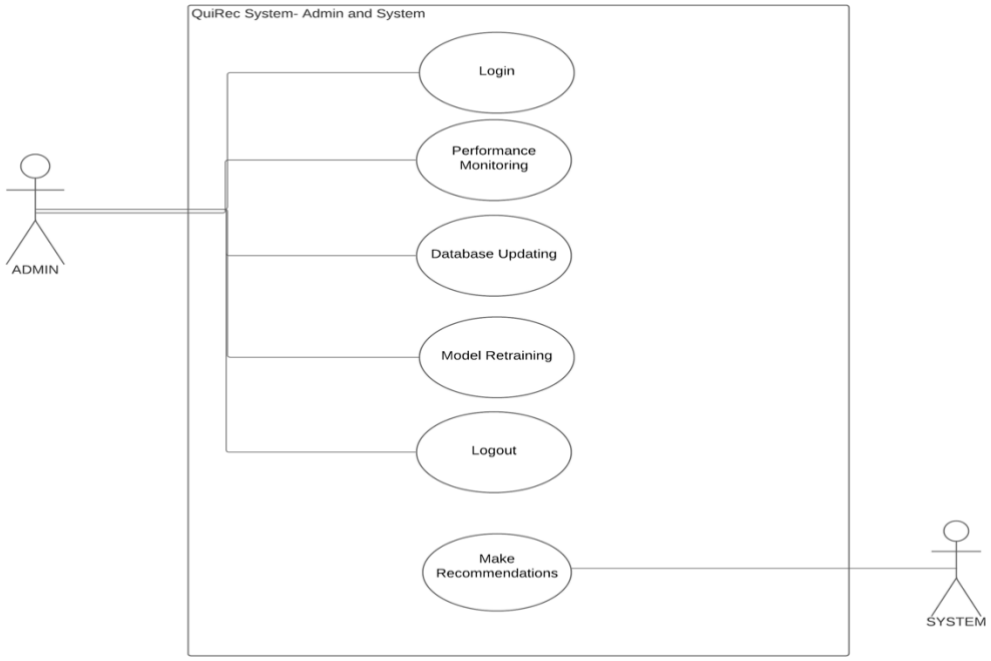

Figure 4: The Use Case Diagram of The Admin and System

Table 2: The Position-Action Diagram of Admin

Admin Position	**Action**
Main Page	The admin can go to the login page.
Login Page	The admin can log into the system.
Administration Page	The admin can monitor the performance of recommendations, update the database used for recommendations and retrain the recommendation model. The admin also can logout from the system from this page.

2.5 Activity diagram

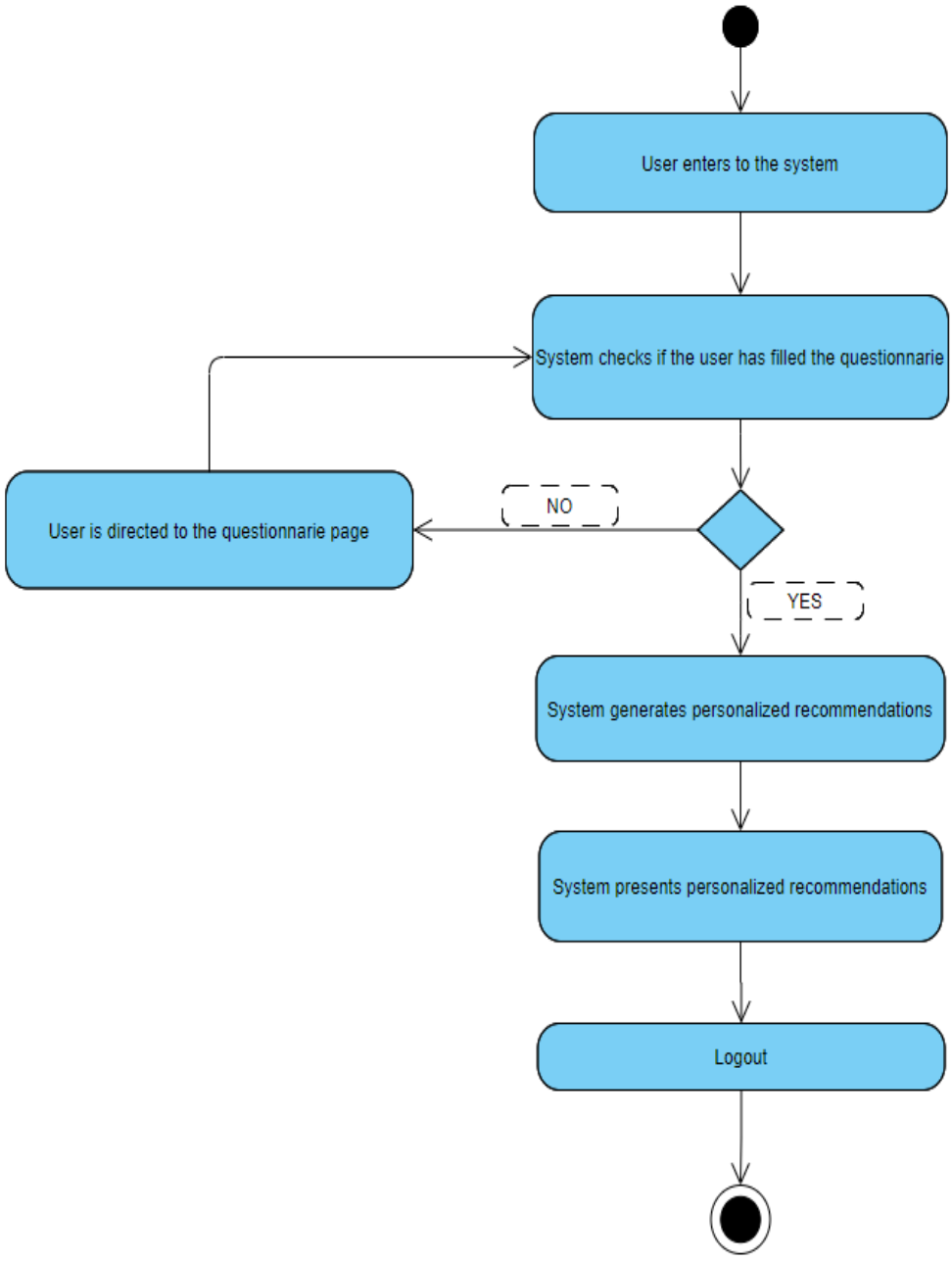

Figure 5: Activity Diagram of The User

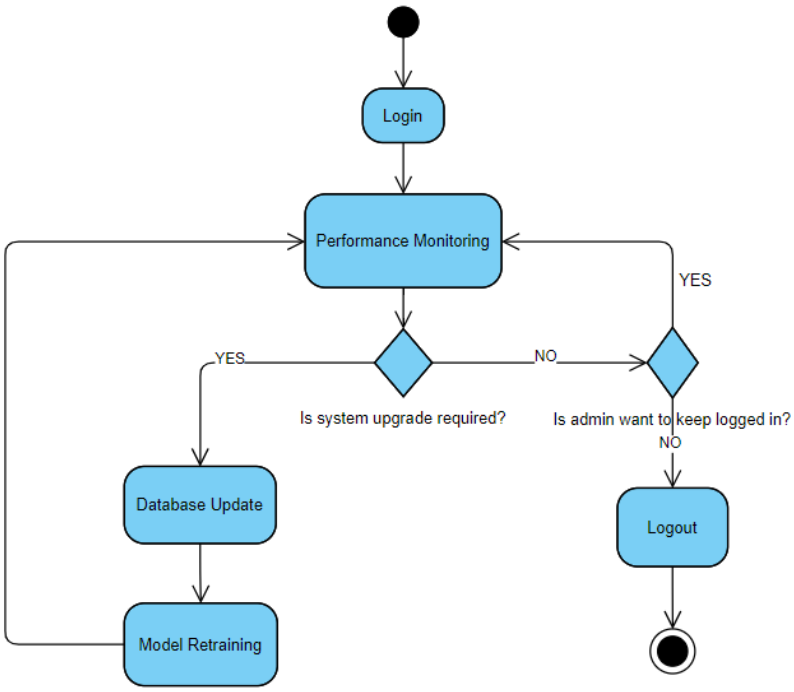

Figure 6: Activity Diagram of The Admin

3. USE CASE REALIZATION

3.1. UI Design Descriptions

The QuiRec project has eleven different pages which are exemplified with UI screenshots and explained below. Both the web application and mobile application of the project will carry the same UI designs and descriptions. This part of the document contains only the screenshots designed for web application, but the mobile application will be developed with the same design, just by converting the designs applicable for a mobile device. Explanations of the designs will be the same for both the web and mobile applications.

Main Page:

The application meets the user on this page. In this page, the main description of the platform is displayed to the user, and with “login” and “sign up” buttons, the user is directed to a related page.

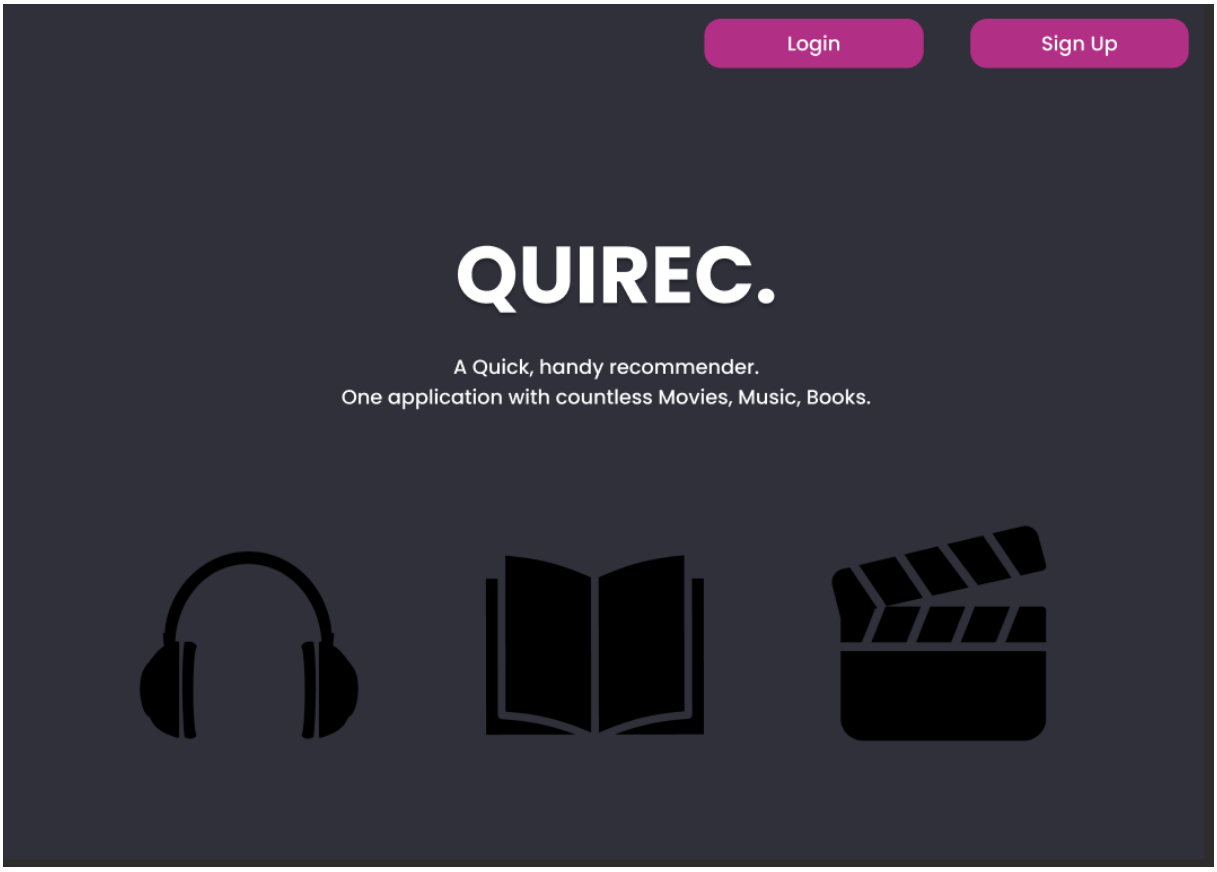

Figure 7: The Main Page of QuiRec

Registration Page:

It is required for users to register to the system to use it. If they are not already registered, they will register to the system by providing necessary information displayed on the screen, which are “username”, “email address”, “password”, and “password(again)”. If the user is already registered, they will easily switch to the login page by clicking the “login” button.

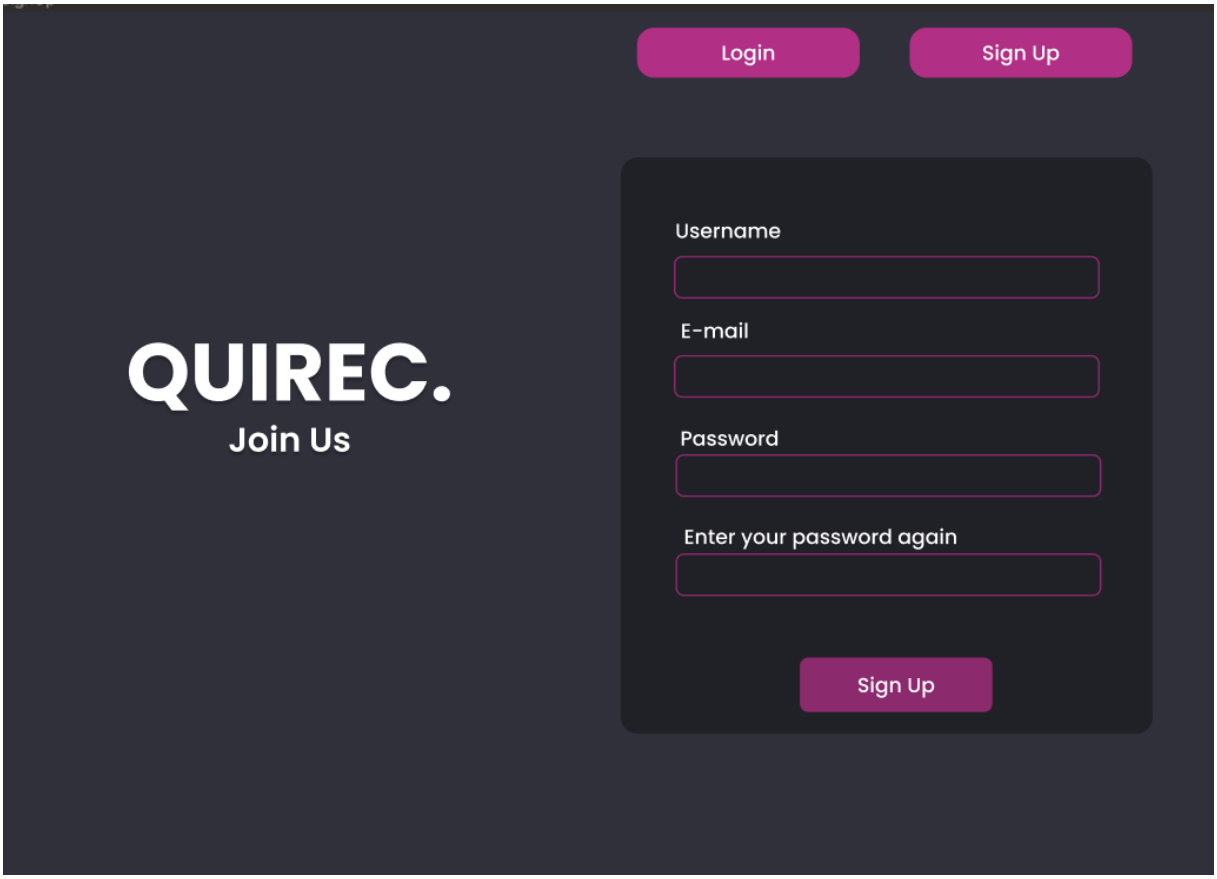

Figure 8: The Registration Page of QuiRec

Login Page:

Registered users will use this page to enter the system by filling two text areas: first one is “email/username” information, which allows users to enter the system whether with email addresses or usernames; second one is “password” information. If the user forgets his/her password, they will click to the “forgot password” button. And if a user is directed to the login page, but is not registered to the system, they will easily switch to the registration page by clicking the “sign up” button.

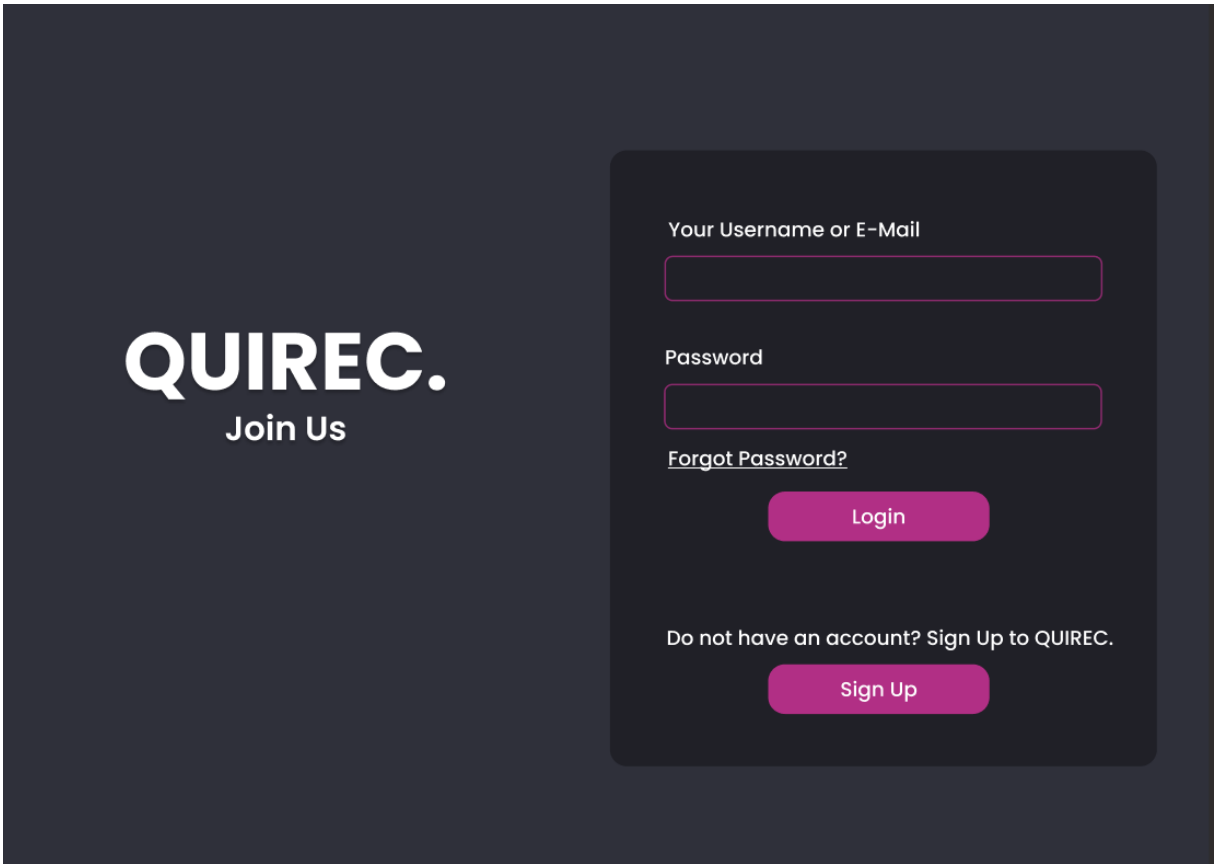

Figure 9: The Login Page of QuiRec

Forgot Password Page:

When the user clicks to the “forgot password” button on the login page, a pop-up text area will be displayed on the screen. The user will enter his/her email address in this page and will click the “reset your password” button. And the system automatically sends an email to the user. By clicking on the link sent on the email, the user will be directed to the forgot password page. In this page, the user will change his/her password by entering a new password two times and save by clicking the save button.

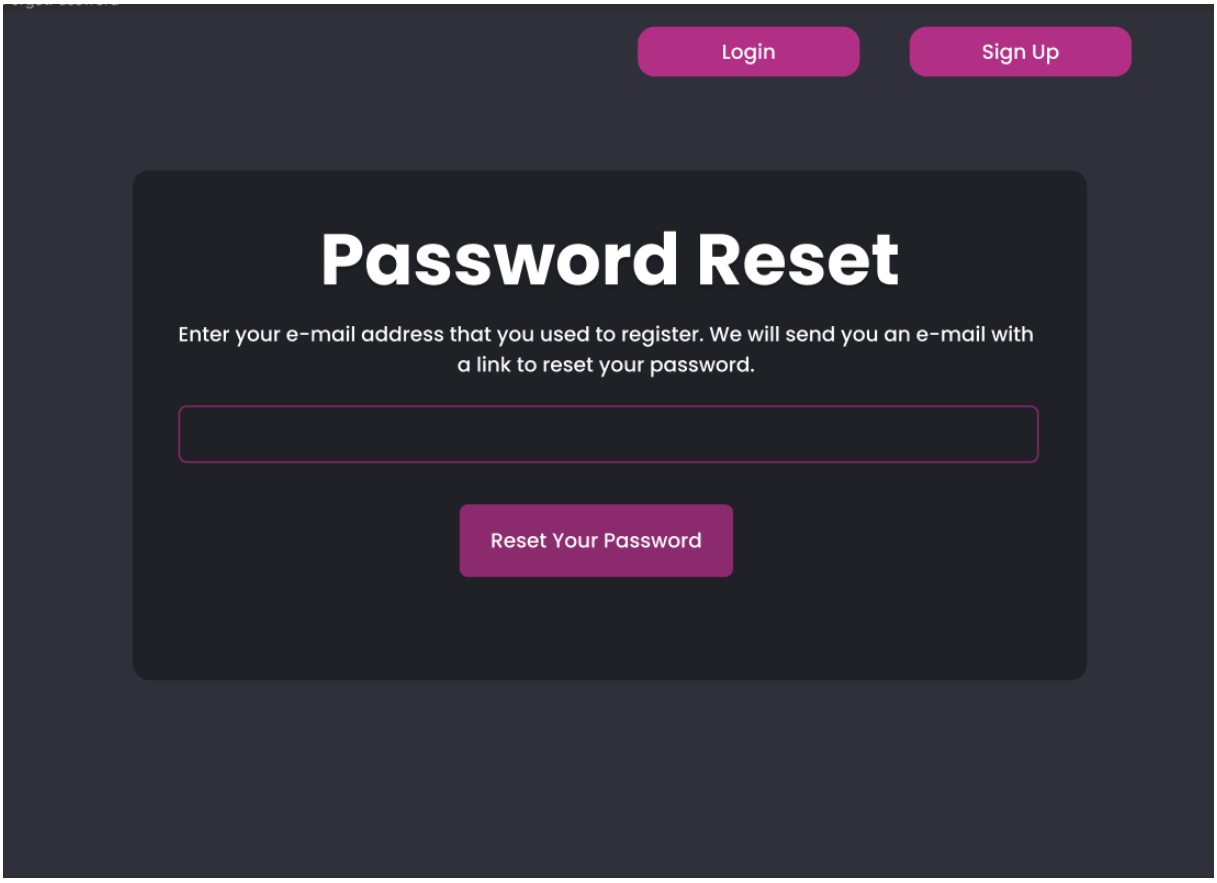

Figure 10:The Forgot Password Page of The QuiRec

Change Password Page:

This page contains 3 text-boxes. User fills the first box with his/her current password. After that s/he enters his/her new password and re-enters it. When s/he clicks the “Change Your Password” button, changes will be made.

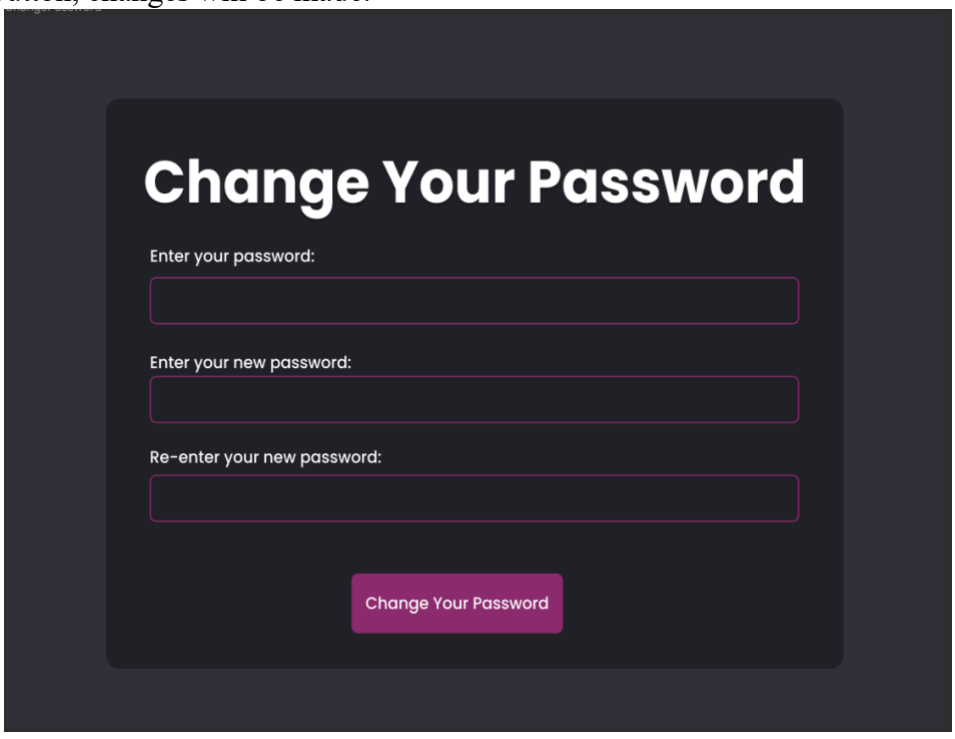

Figure 11: Change Password Page of QuiRec

Questionnaire Page:

This page contains 3 parts with checkboxes and genres. User will check the related boxes to specify his/her preferences. When s/he clicks the ‘Submit My Preferences’ button, database will be updated, and the necessary changes will be saved. User will be directed to Recommendations Page.

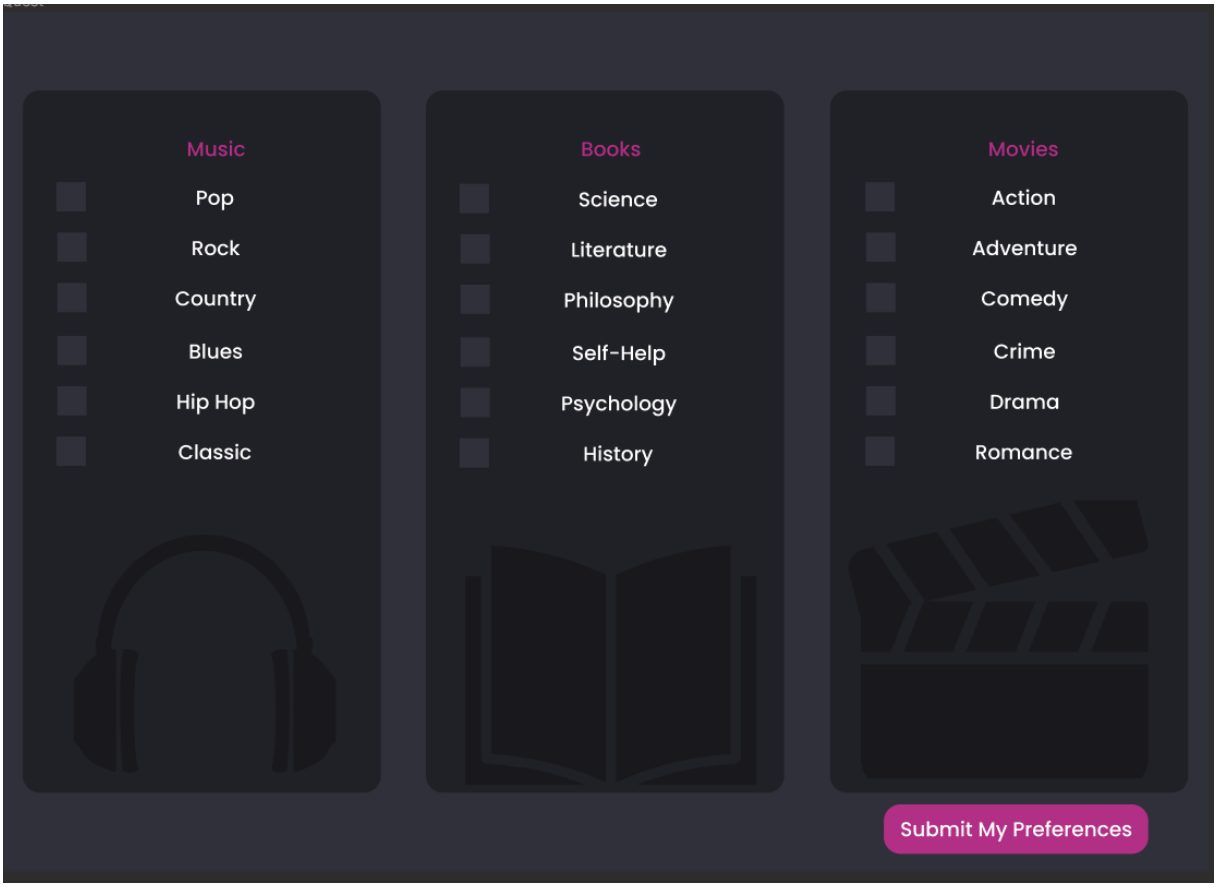

Figure 12: The Questionnaire Page of QuiRec

Recommendations Page:

The recommended music, movies and books are displayed on this page. User will be directed to the details page which contains detailed information of these when s/he clicks on them.

Figure 13: The Recommendations Page of QuiRec

Profile Page:

The user can show his/her personal information and change his/her password or preferences, after these processes s/he will be directed to the recommendations page.

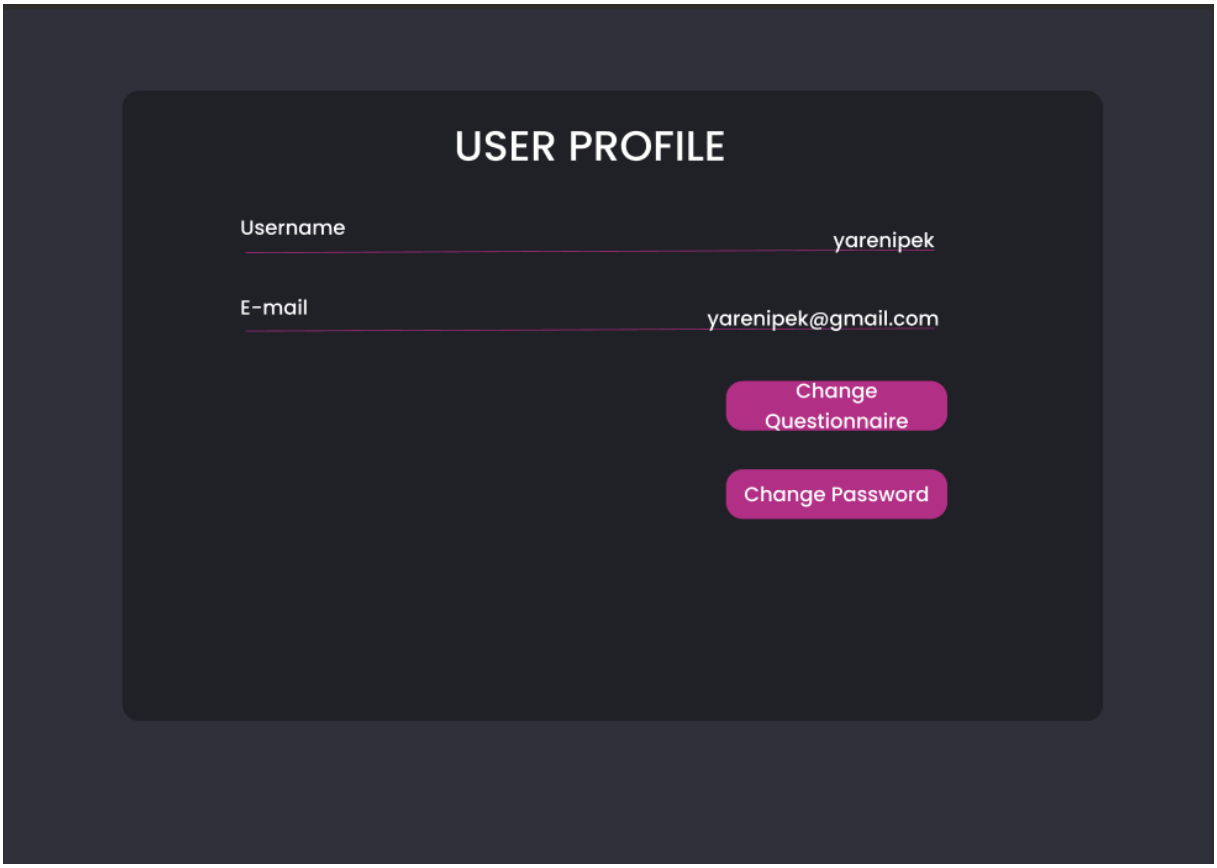

Figure 14: Profile Page of The QuiRec

Browser Page:
Music, movies and books are displayed on this page. S/he enters a string to the Search Button and the related music, movie or book will be displayed on the screen. S/he will be directed to the details page if s/he clicks on them.

Figure 15: The Browser Page of The QuiRec

Administration Page:

The admin will make the monitoring of the recommendation model's performance. The admin can update the database, retrain the model by clicking the related buttons. S/he can log out from the page.

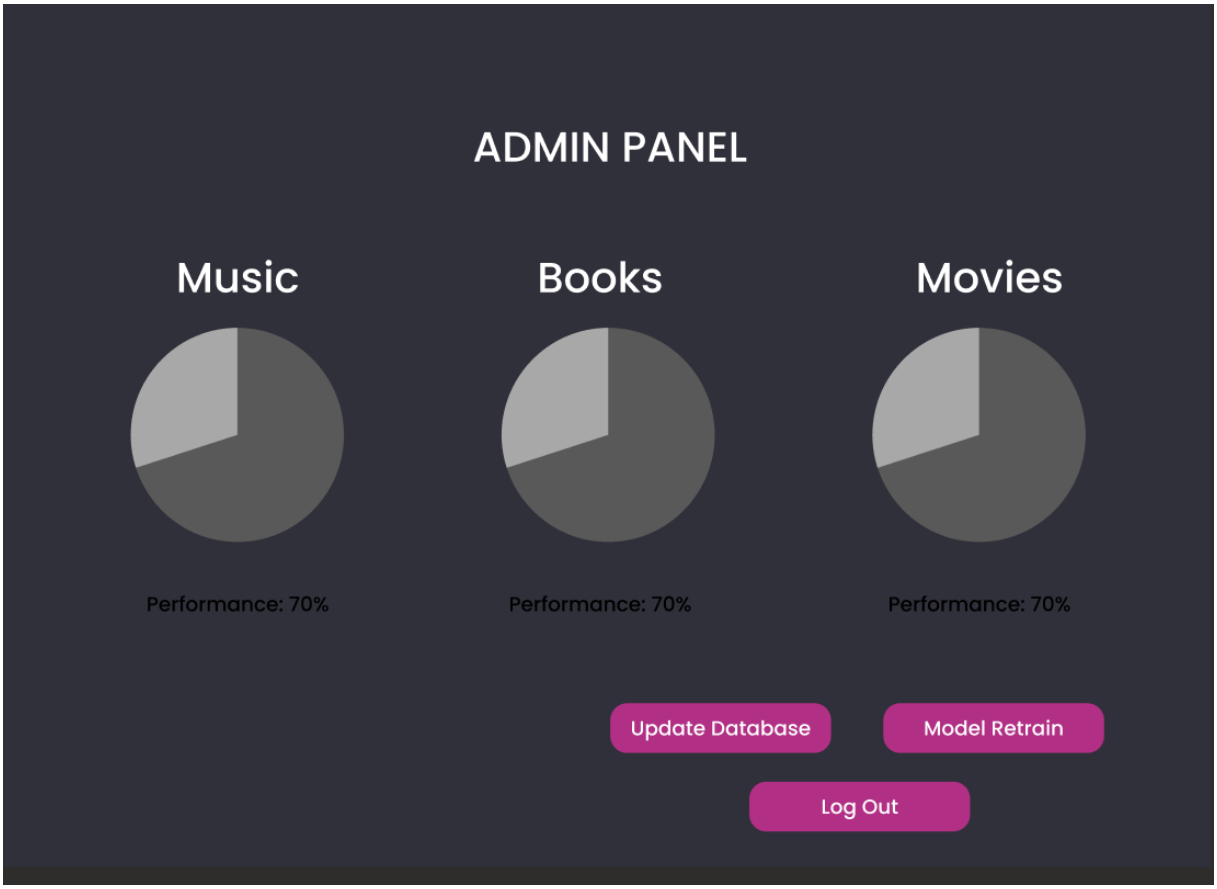

Figure 16: The Administration Page of QuiRec

Details Page:

The user can see the detailed information of the music, movies or books. S/he can rate them from 1 up to 5. S/he will be directed to the main page when s/he clicks on the ‘Go Back To Main Page’ button.

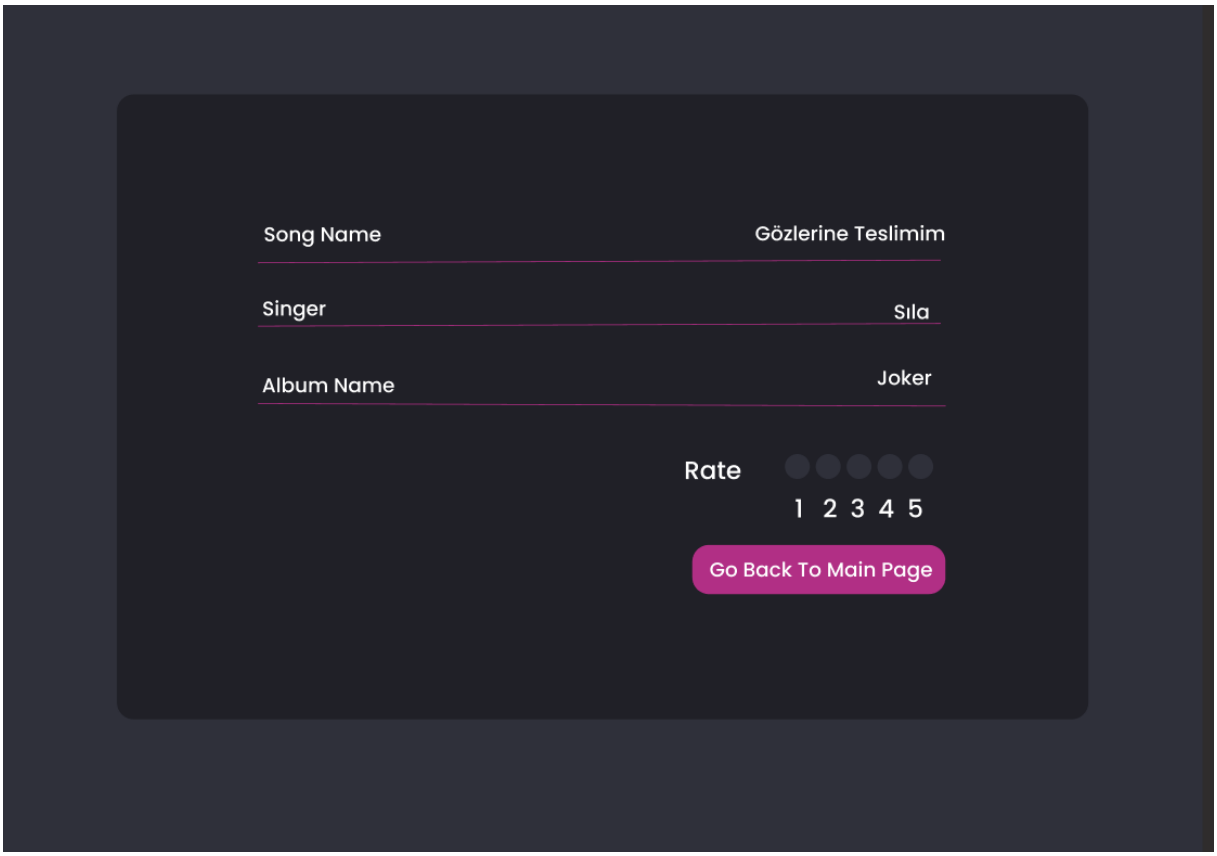

Figure 17: Details Page of The QuiRec

3.2. Sequence Diagrams

The user provides necessary information, which is displayed on the screen and required by the server, to register to the system. The interface sends that information to the server. The server makes verification of the information provided by the user using the database. And if required conditions for registration are held, the server inserts the user to the database, and returns an OK message in the verification acknowledgement. Then the user is registered to the system. Else if the required conditions are not held, the server does not save the user to the database and returns an ERROR message in the verification acknowledgement. Then the user is not registered to the system. With return messages, proper messages will be displayed on the screen so that the user understands the response of their requests.

Initially, the admin will be registered to the system automatically by the system developer. So, s/he does not have to use and make requests from the registration page.

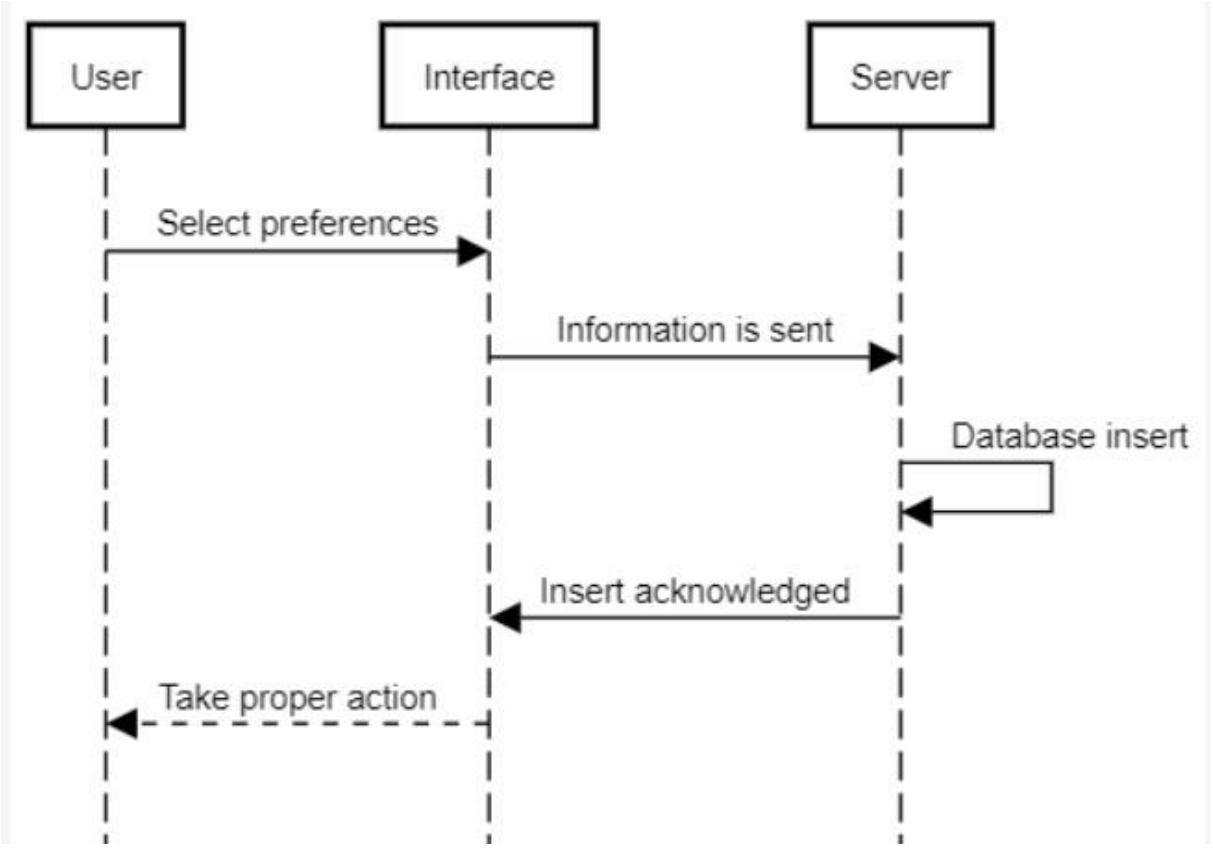

Figure 18: Sequence Diagram of Registration

The user provides necessary information, which is displayed on the screen and required by the server, to login to the system. The interface sends that information to the server. The server makes verification of the information provided by the user using the database. If the user is registered to the system, which means s/he has information already saved in the database, and if the information coming from the interface matches with the information in the database, the server returns an OK message in the verification acknowledgement. Then the user is logged in to the system. Else if the required comparisons are not matched, the server returns an ERROR message in the verification acknowledgement. Then the user is not logged in to the system. With OK return messages, the user is directed to their recommendations page, and with ERROR messages, proper messages will be displayed on the screen so that the user understands that they are not logged in to the system.

The admin also logs to the system with the process and sequence explained above. Only difference between the user and admin is, while users are directed to the recommendations page when the return messages are OK, the admin will be directed to the administration page.

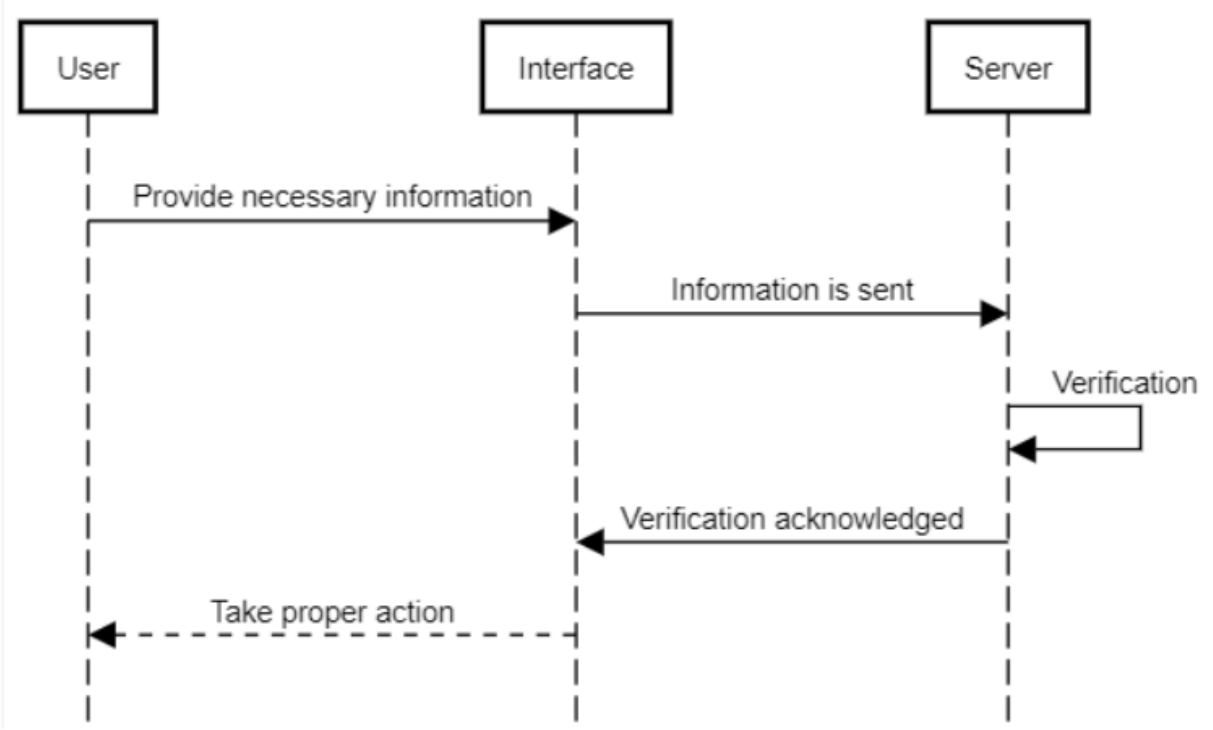

Figure 19: Sequence Diagram of The Login

The user enters necessary email information, which is displayed on the pop-up screen in the login page and required by the server, to send a mail changing link to the user. The interface sends that information to the server. The server makes verification of the information provided by the user making data querying inside the user's table. As a result of the query, if a matching data is found, which means the user is registered to the system, the server will send a mail to the user's address which includes a routing link to change his/her password, and the server returns an OK message in the mail sent acknowledgement. And if no matching data is found, which means the user is not registered to the system, the mail will not be sent, and the server returns an ERROR message in the mail sent acknowledgement. With return messages, proper messages will be displayed on the screen so that the user understands the response of their requests.

If the user receives a mail, they will click to the link inside the mail, and will be directed to the password changing page. The user enters necessary password information, which is displayed on the screen and required by the server, to change his/her password. The interface sends that information to the server. And if required conditions for insert operation are held, such as user verification of user's operation, the database will be updated with new password information. So, the user's password will be changed. And if verification is failed, the database will not be updated. Then the result of the request will be sent to the interface in the update acknowledgement. With return messages, proper messages will be displayed on the screen so that the user understands the response of their requests.

Since the admin will be registered to the system automatically by the system developer, the change password operations also will be held by the system developer. So, password change using the interface will not be available for the admin.

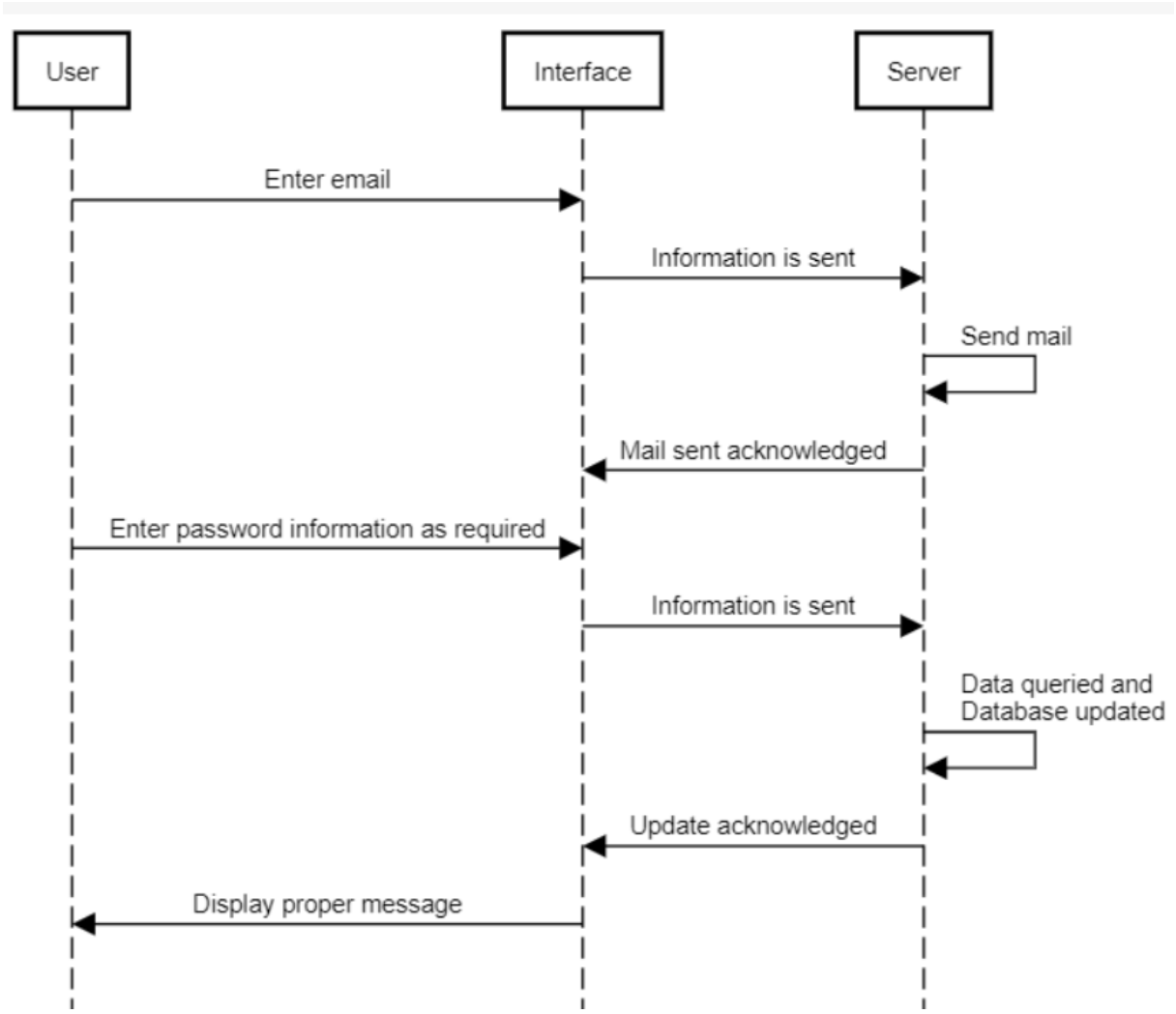

Figure 20: Sequence Diagram of Forgot Password

The user enters necessary password information, which is displayed on the screen and required by the server, to change his/her password. The interface sends that information to the server. The server makes verification of the information provided by the user making data querying inside the user's table. As a result of the query, if a matching data is found, it will be updated with new password information. So, the user's password will be changed. And if no matching data is found, the database will not be updated. Then the result of the request will be sent to the interface in the verification acknowledgement. With return messages, proper messages will be displayed on the screen so that the user understands the response of their requests.

Since the admin will be registered to the system automatically by the system developer, the change password operations also will be held by the system developer. So, password change using the interface will not be available for the admin.

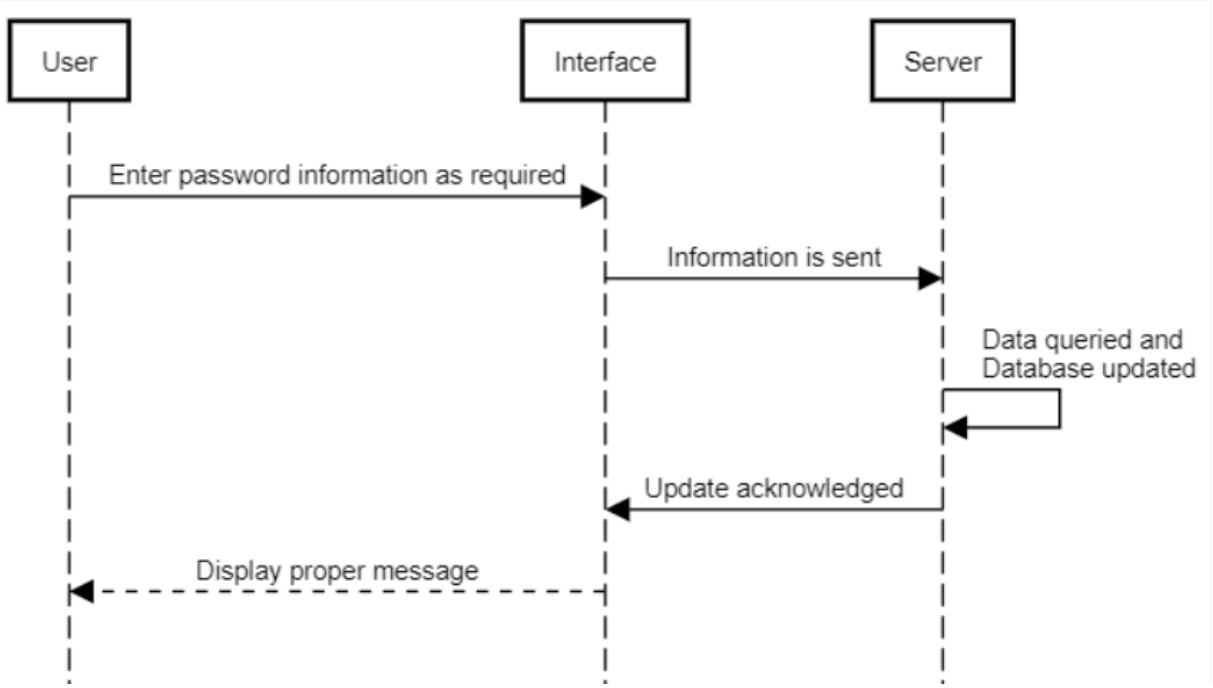

Figure 21: Sequence Diagram of Change Password

When the user opens the recommendations page, the interface sends the user information to the server. The server makes required verifications, such as access token verification, to allow users to see personalized recommendations. Result of the verification will be sent to the interface by the system in the verification acknowledgement. If an error is returned from the server, the information sending step will be skipped by the interface and a proper error message will be displayed. If no error is returned from the server, the interface will send the user information again to the server. With this information, the server will query the database to find a matching record in the database. Then, the result of the query, the server either produces and sends recommendation items to the interface or returns an empty response. If the interface receives an empty response, it will display a proper message on the screen which routes the user to the questionnaire page. Else if the interface receives recommendation items, the user will see these recommendations on the screen.

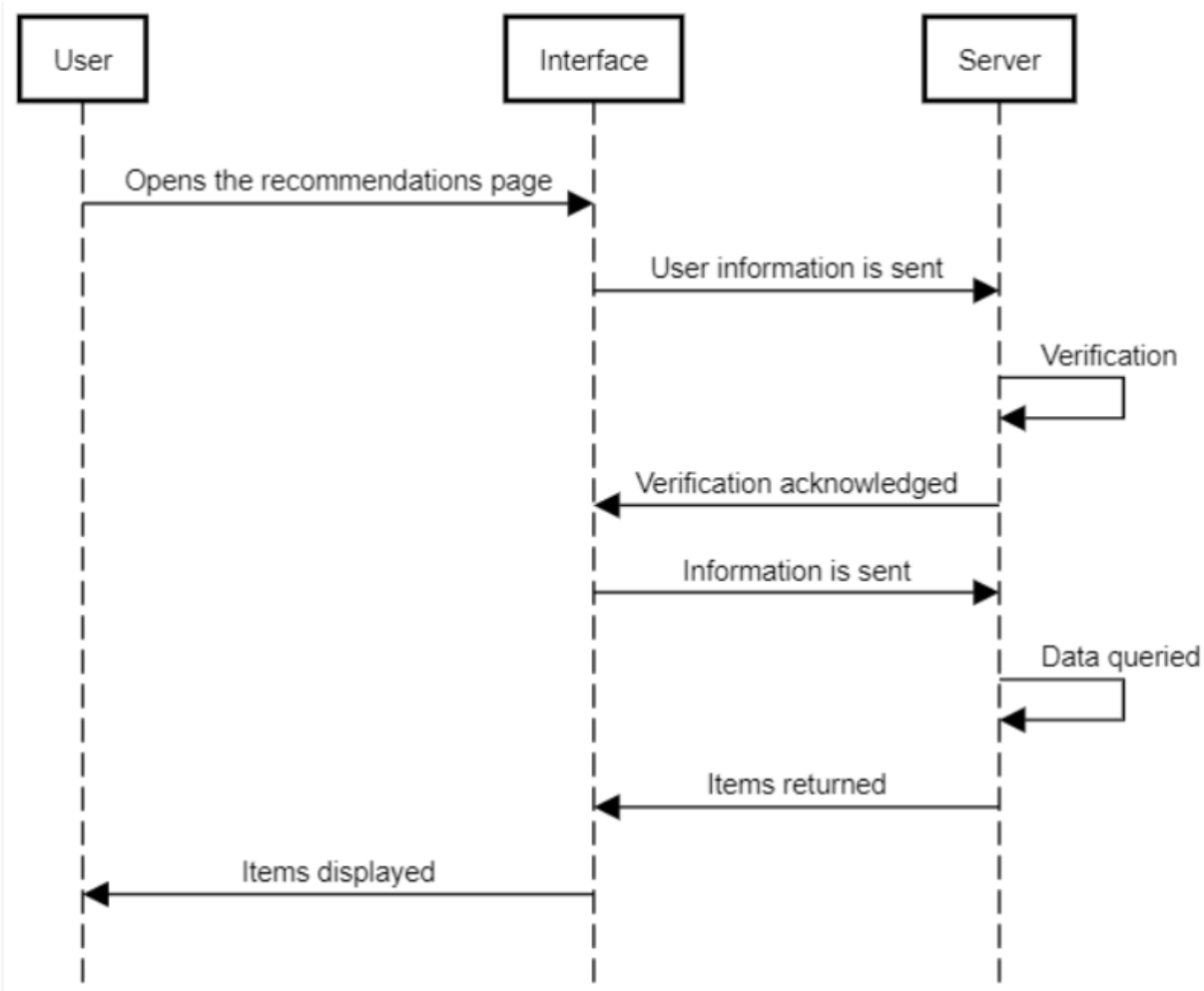

Figure 22: Sequence Diagram of Recommendation

From the details page, the user will see the detailed information about the selected movie, book or music record. To achieve this, the user selects an item from the interface, the interface transfers selected record information to the server, and the server will query the database to find a matching record in the database. Then, the result of the query will be passed to the interface. If any matching is achieved, the user will see the selected item details on the screen, but if no matching is achieved, a proper message for the situation will be displayed.

If the item is displayed properly to the user, the user will see the rating area on the screen. From this area, users will rate the recommendation from 1 to 5, 1 means not related with preferences, 5 means highly related with preferences, by selecting the related rate option. Then, the interface will send the rate information to the server, and the server inserts the rate information in the related database table and returns an OK message in the insert acknowledgement. Then the rating information of the recommendation is saved to the system. Else if any problem occurs during the insertion process, the server does not save the rating information to the database and returns an ERROR message in the insert acknowledgement. With return messages, proper messages will be displayed on the screen so that the user understands the response of their requests.

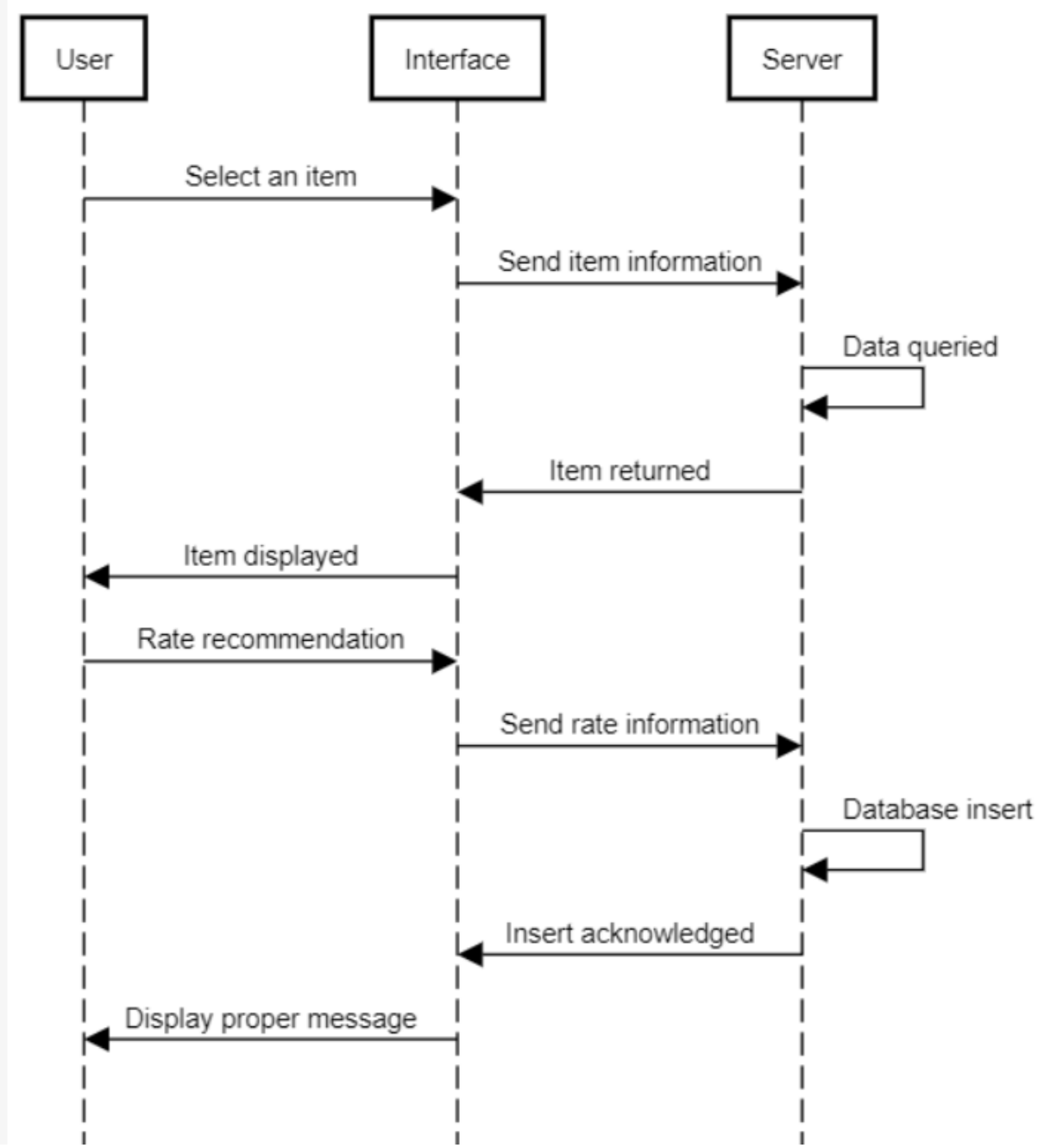

Figure 23: Sequence Diagram of Details

From the questionnaire page, the user will select their preferences according to what they would like to receive recommendations about. And if required conditions for insert operation are held, such as user access token verification, the server inserts the selections to the database, and returns an OK message in the insert acknowledgement. Then the preferences of the user are saved to the system. Else if the required conditions are not held, the server does not save the preferences to the database and returns an ERROR message in the insert acknowledgement. Then the preferences of the user are not saved to the system. With OK return messages, the user is directed to their recommendations page, and with ERROR messages, proper messages will be displayed on the screen so that the user understands that the recommendation preferences are not saved.

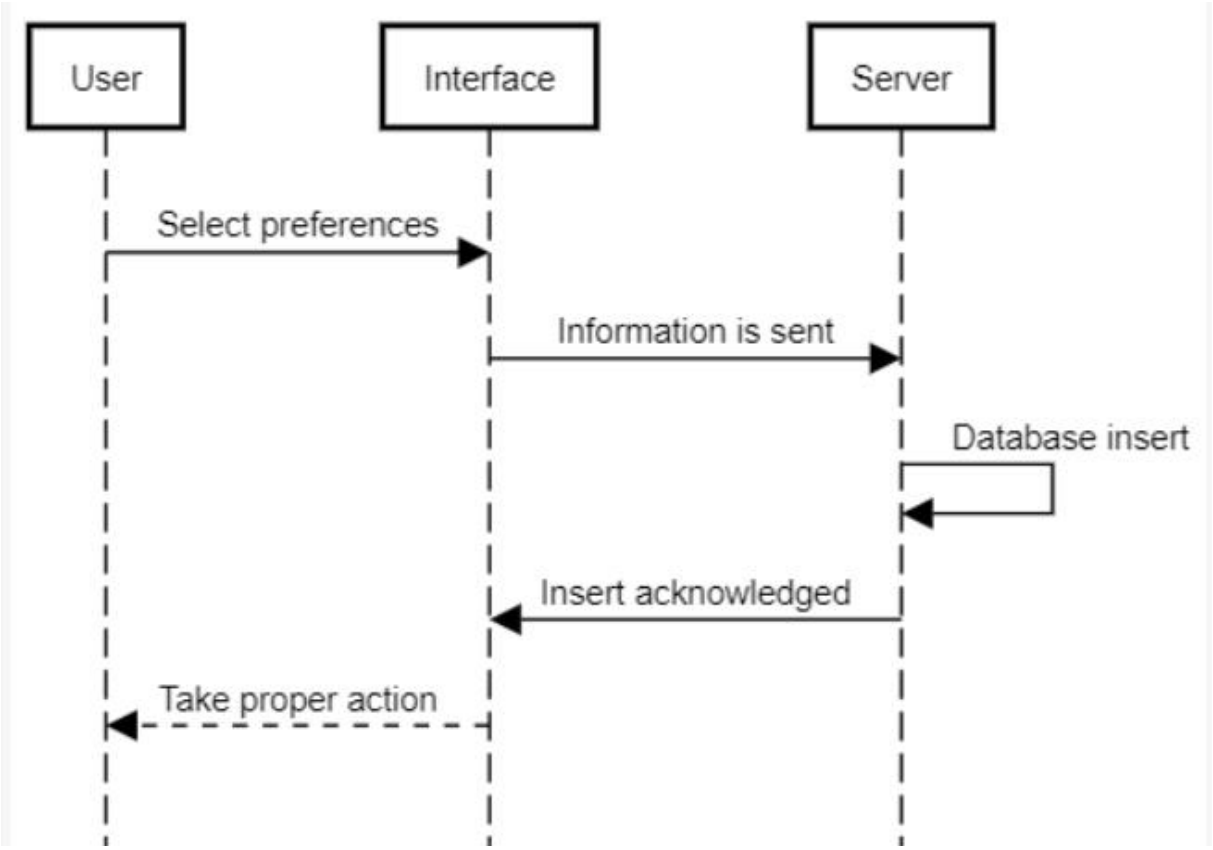

Figure 24: Sequence Diagram of The Questionnaire

From the browser page, the user will see all the movie, book and music records available in the database. To achieve this, the system will proceed as if the keywords are null, and the server will query the database to find all records in the database and return all items to the interface. Then all items will be shown to the user. Also, from this page, the user can search through the records available in the database. To achieve this, the user needs to enter keywords on the search bar according to what they want to search, and the interface transfers those keywords to the server, and the server will query the database to find a matching record in the database. Then, the result of the query will be passed to the interface. If any matching is achieved, the user will see these items on the screen, but if no matching is achieved, a proper message for the situation will be displayed.

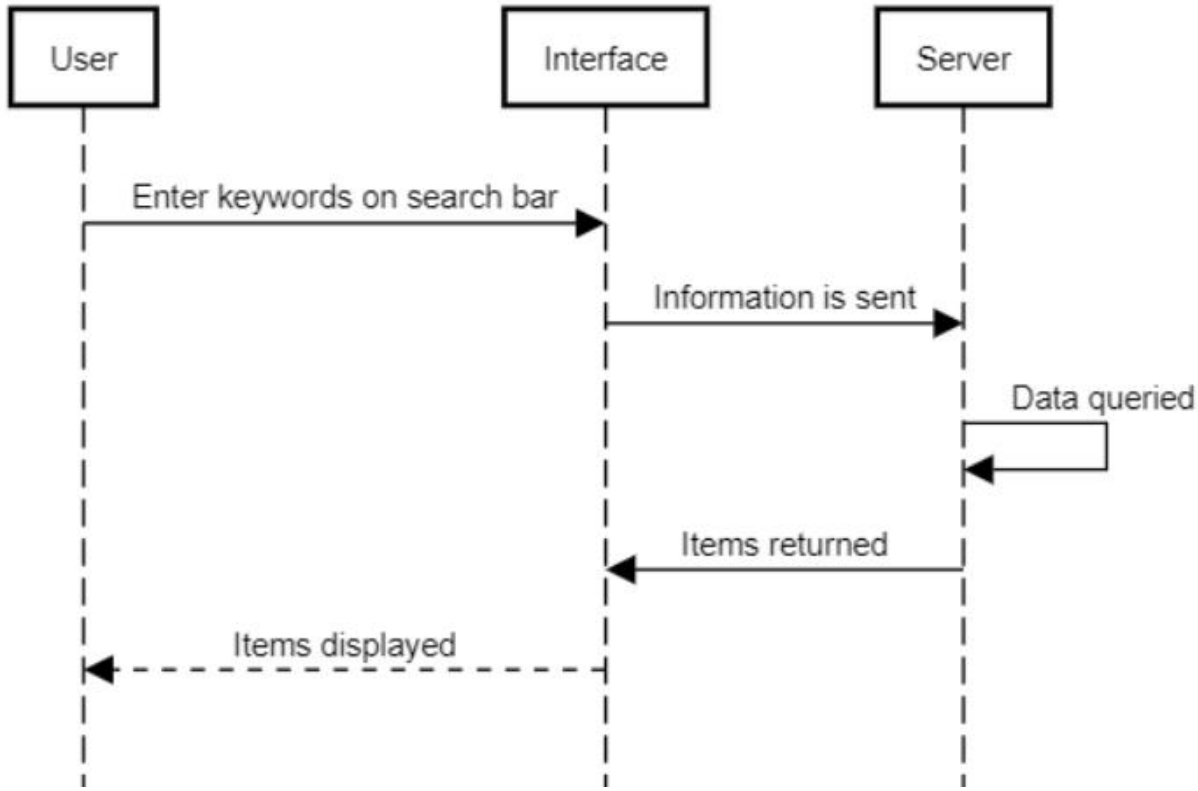

Figure 25: Sequence Diagram of Browser

When the admin opens the administration page, the interface sends the user information to the server. The server makes access token verification, to control if the user is the admin. Result of the verification will be sent to the interface by the system in the verification acknowledgement. If an error is returned from the server, the information sending step will be skipped by the interface and a proper error message will be displayed. If no error is returned from the server, the interface will send the user information again to the server. After this step, the server will query the database to find rating information according to categories. Then, the result of the query, the server either sends rating information to the interface, or returns an empty response. If the interface receives an empty response, it will display a proper message on the screen. Else if the interface receives rating information, the user will see this information on the screen.

When the admin selects the database update option on the screen, the interface sends the user information to the server. Since database update affects the system as a whole, this operation is restricted with the admin. So, another access token verification will be performed by the server to control if the user is admin. Result of the verification will be sent to the interface by the system in the verification acknowledgement. If an error is returned from the server, the database update processes will be skipped by the interface and a proper error message will be displayed. If no error is returned from the server, the server will continue with database update processes. Result of the update operation will be sent to the interface by the system in the update acknowledgement. With return messages, proper messages will be displayed on the screen so that the user understands the response of their requests.

When the admin selects the retrain model option on the screen, the interface sends the user information to the server. Since model retraining affects the system as a whole, this operation is restricted with the admin. So, another access token verification will be performed by the server to control if the user is admin. Result of the verification will be sent to the interface by the system in the verification acknowledgement. If an error is returned from the server, the model retraining processes will be skipped by the interface and a proper error message will be displayed. If no error is returned from the server, the server will continue with model retraining processes. Result of the retraining operation will be sent to the interface by the system in the retraining acknowledgement. With return messages, proper messages will be displayed on the screen so that the user understands the response of their requests.

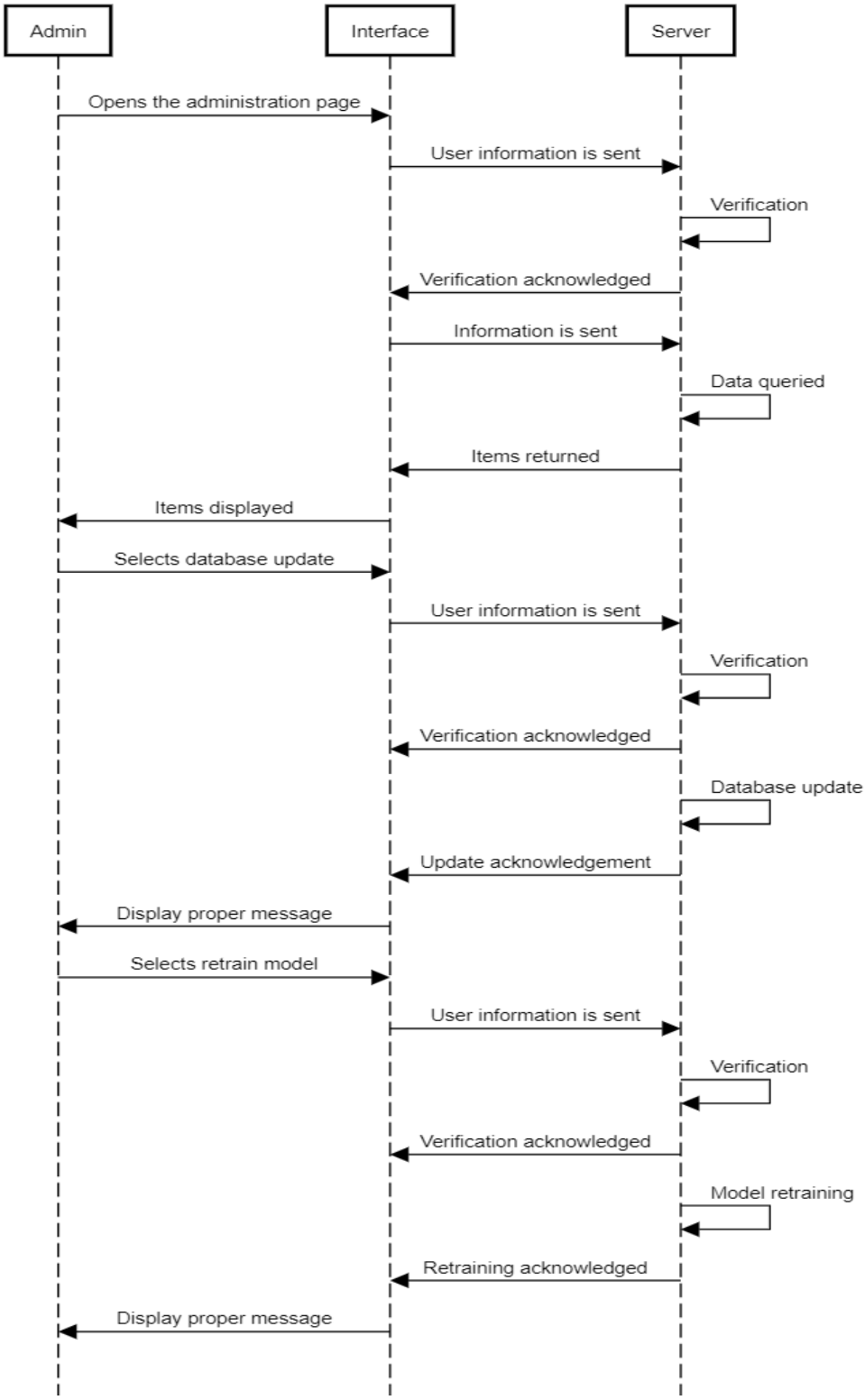

Figure 26: Sequence Diagram of Admin

REFERENCES