Capstone Project Documentation

Title:

Capstone Project - Bank Management System

Introduction:

The **Bank Management System** is a web-based application designed to provide users with secure and efficient tools for managing their financial activities. This system includes user authentication, account management, transaction processing, and an EMI calculator for loan planning. The application integrates a robust backend powered by **Spring Boot** and a responsive frontend built with **React.js**, ensuring a seamless user experience.

Objective:

The primary goal of this project is to provide users with an intuitive platform for managing their finances, with features such as account management, secure transactions, and loan planning. The system ensures data security, user privacy, and accurate financial operations.

Topics Covered:

1. **Modules and Features**
    - Authentication Module
    - Account Management Module
    - Transaction Management Module
    - Loan Module (EMI Calculator)
2. **User flow**
3. **Backend Endpoints**
    - Overview of API endpoints and their functionality.
4. **Frontend URLs**
    - Mapping of user-facing URLs to their respective components.
5. **Database Schema**
    - Details of tables and relationships used in the application.

6. ER-Daigram
7. **Tools and Technologies**
    - Spring Boot, React.js, MySQL, JWT, and more.
8. Github (Link to code)

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1. Modules and Features

1.1 Authentication Module

Handles user registration, login, and authentication. Uses **JWT** for secure session management.

- **Features**:
    - **User Registration**:
      Creates a user account and stores hashed passwords in the database.
    - **User Login**:
      Authenticates the user and issues a JWT token for subsequent requests.
- **Database Changes**:
    - `User` table is updated with new records for registration.

1.2 Account Management Module

Enables users to create, view, and delete financial accounts.

- **Features**:
    - **Create Account**:
      Adds a new account to the user's profile.
    - **View Accounts**:
      Lists all accounts linked to the user.
    - **Delete Account**:
      Removes an account from the database.
- **Database Changes**:
    - `Account` table is updated with new or modified records.

1.3 Transaction Management Module

Allows users to perform deposits, withdrawals, and transfers between accounts.

- **Features**:

    - **Deposit**: Adds funds to an account.
    - **Withdraw**: Deducts funds from an account.
    - **Transfer**: Moves funds between accounts.
    - **View Transactions**: Lists all transactions for a user or account.
- **Database Changes**:
    - Updates the `Account` table for balances.
    - Adds entries to the `Transaction` table for transaction history.

1.4 Loan Module (EMI Calculator)

Helps users calculate loan EMIs based on input parameters like loan amount, interest rate, and tenure.

- **Features**:
    - Calculates and displays monthly installment amounts using financial formulas.
    - Provides users with insights for better financial planning.
- **Database Changes**:
    - No direct database impact; functionality is calculation-based.

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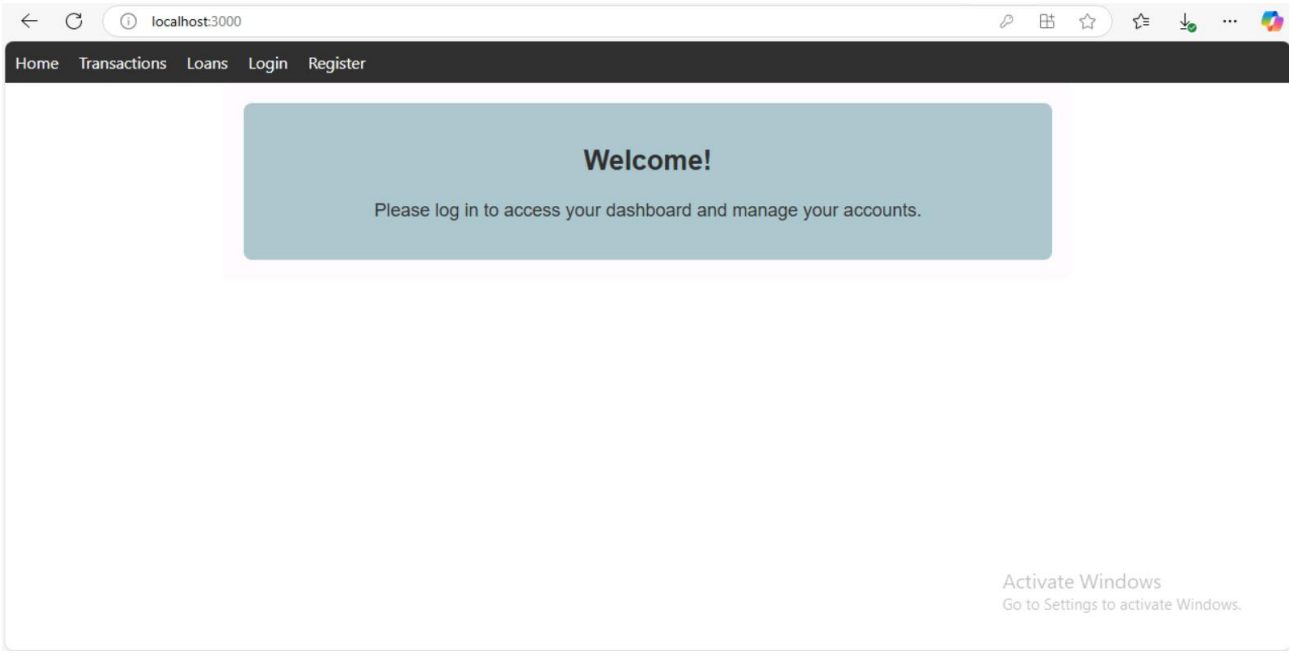
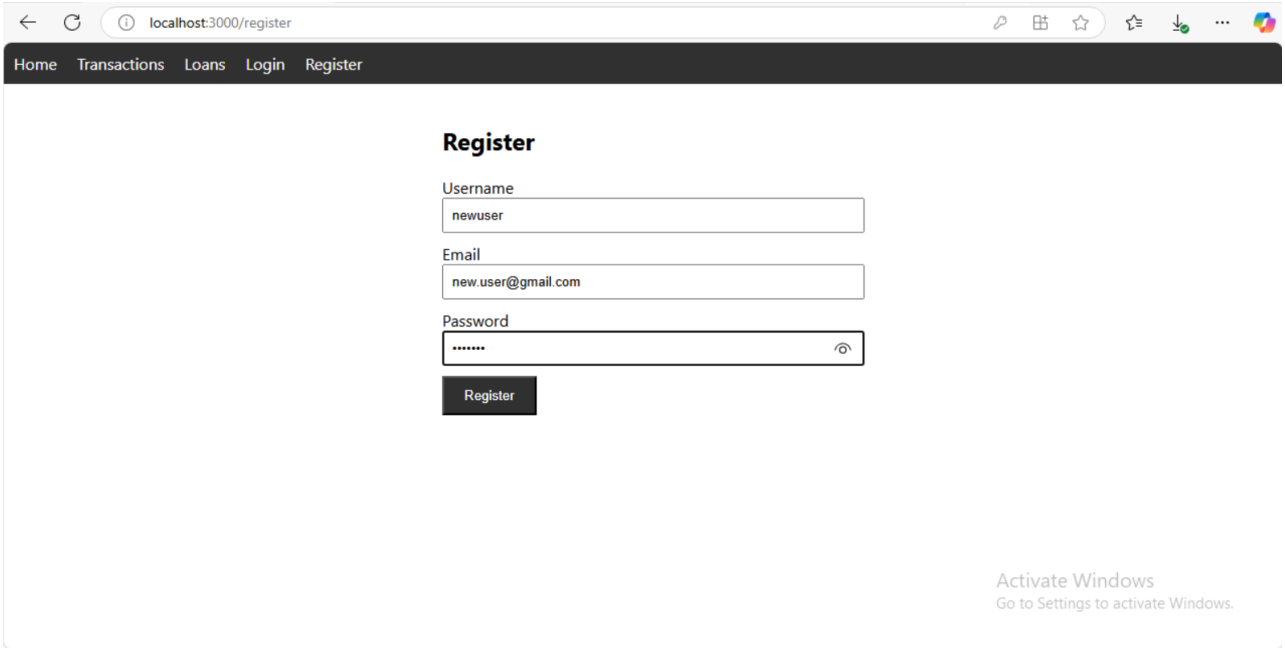
2. User flow

Landing Page:



2.1 Authentication

- Register Flow

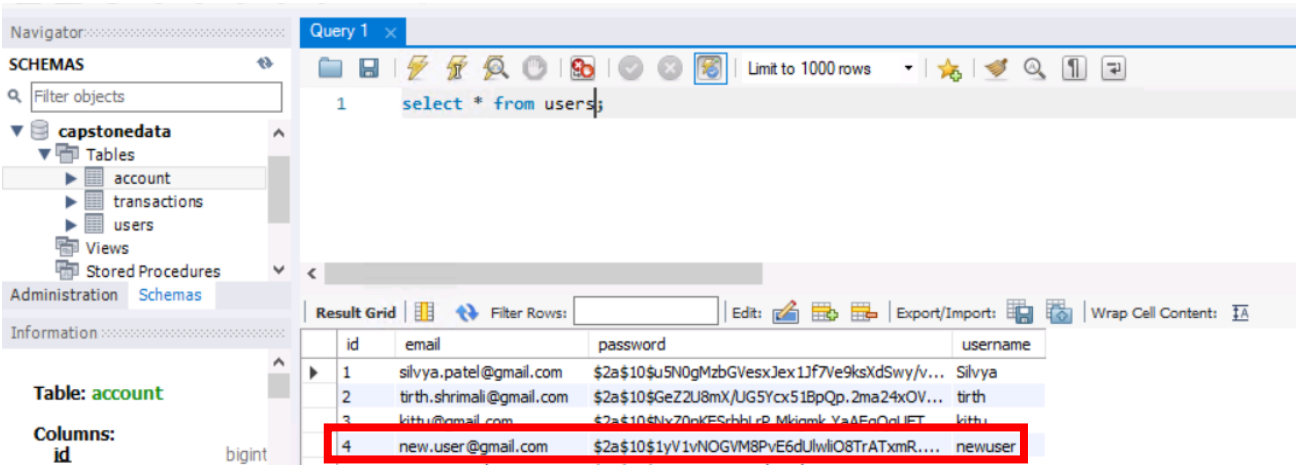


Registration form UI.

Details:

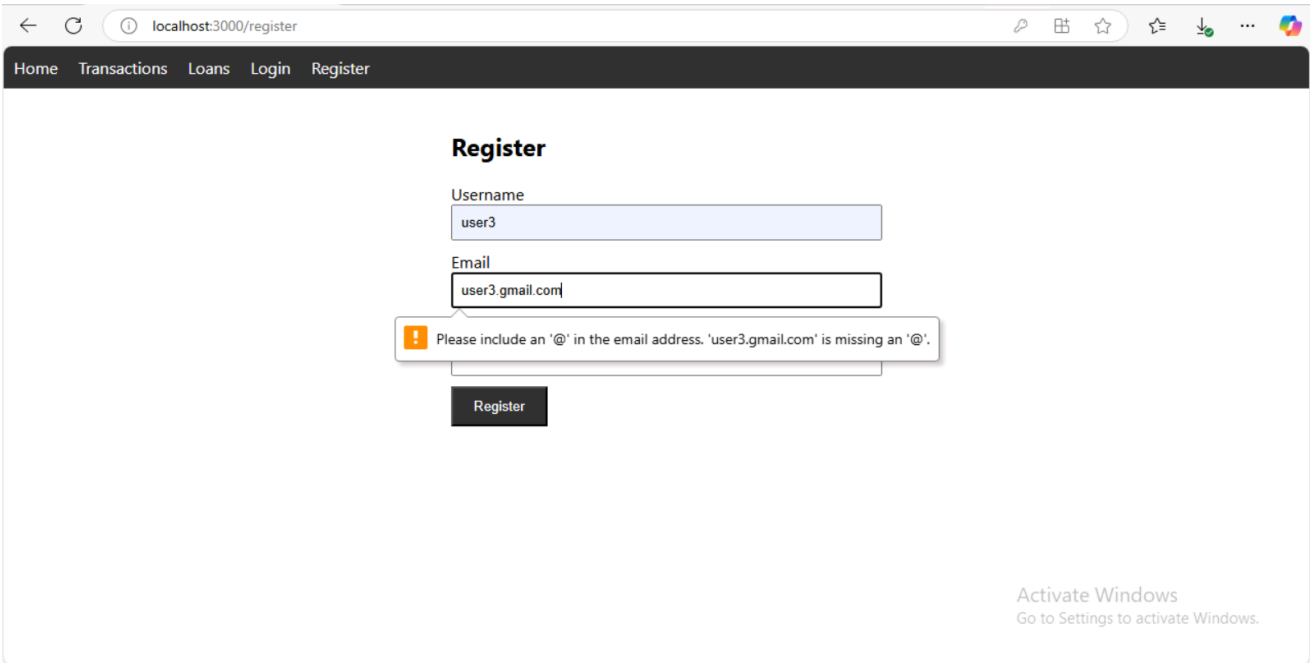
Input: Name, Email, Password.

Process: Validation → Save user details in the database.

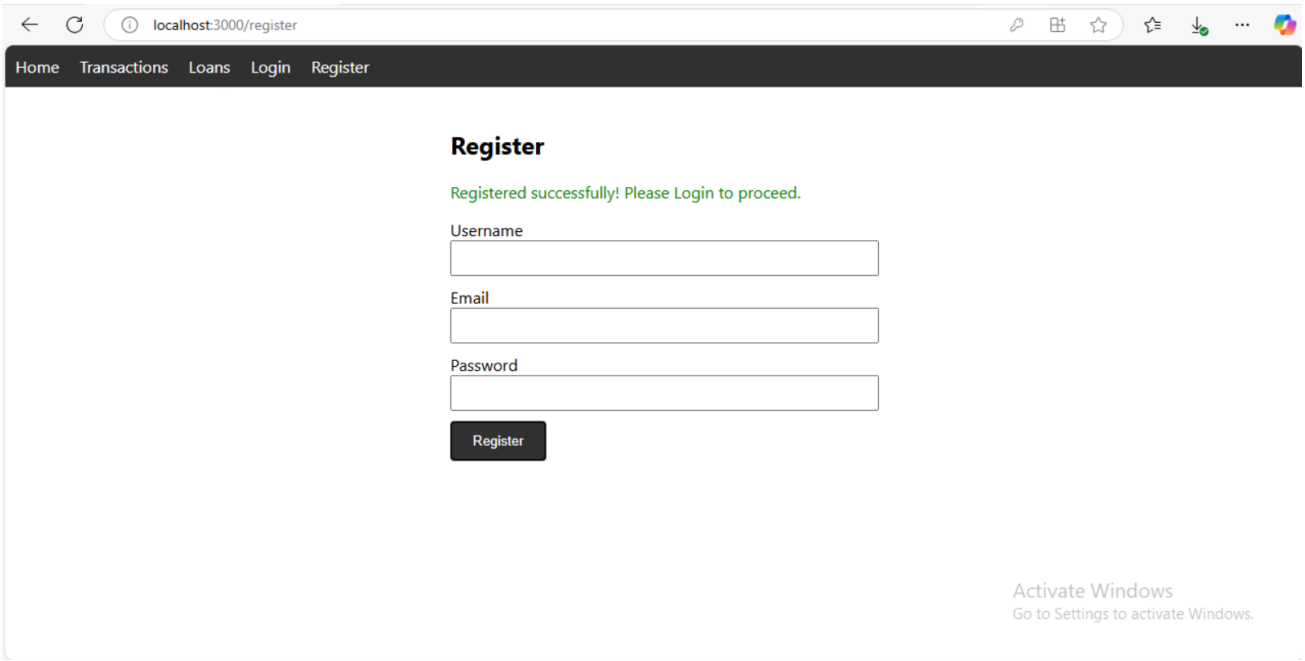


User Table.

Output:

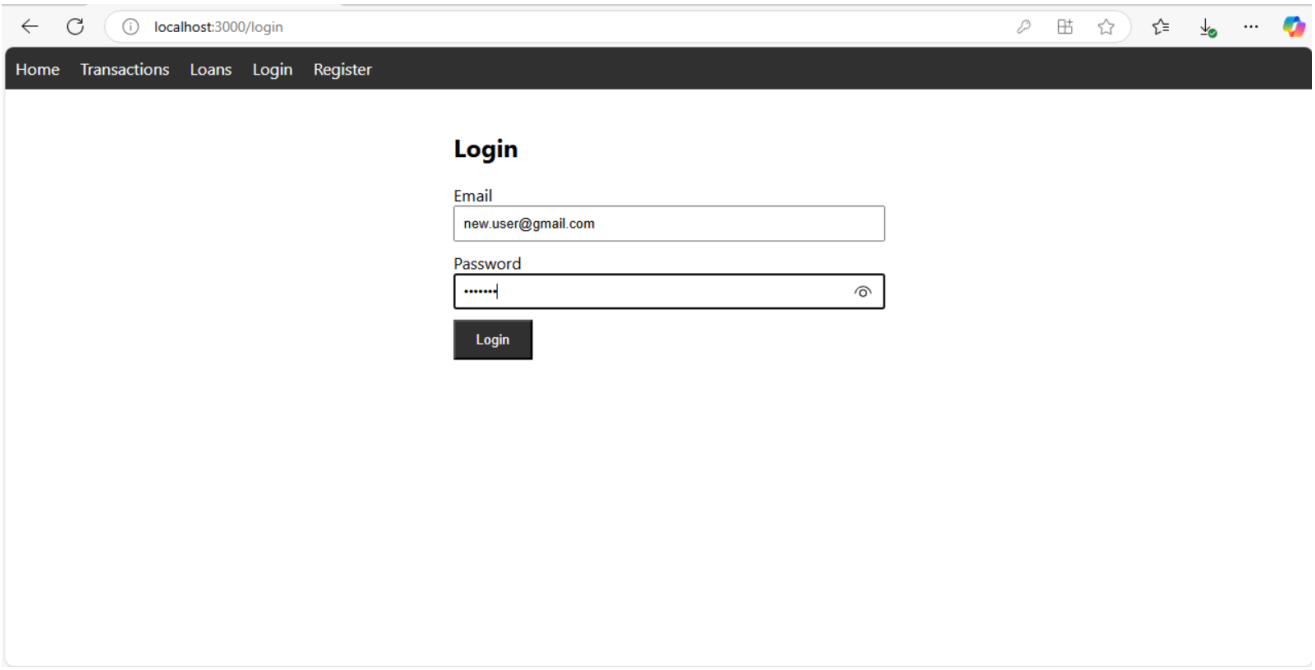


error message.



Success message and **redirect** to login.

- Login Flow



Login form UI.

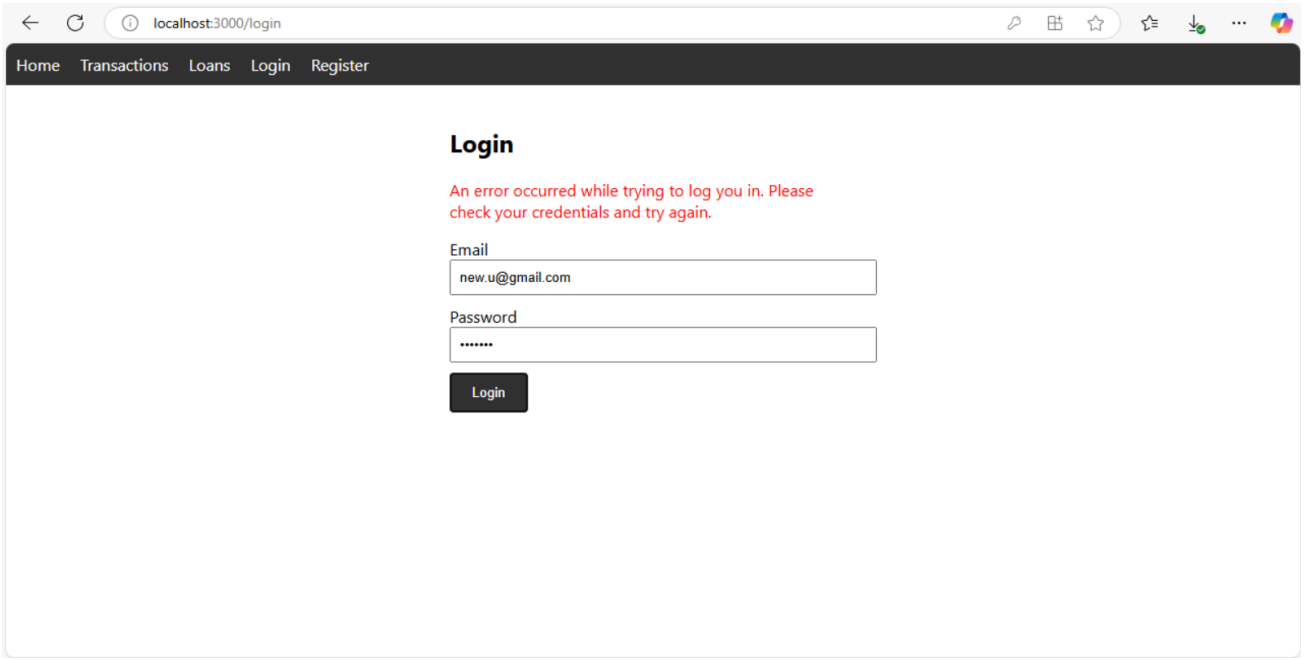
Details:

Input: Email, Password.

Process: Verify credentials → Generate JWT → Store in localStorage.

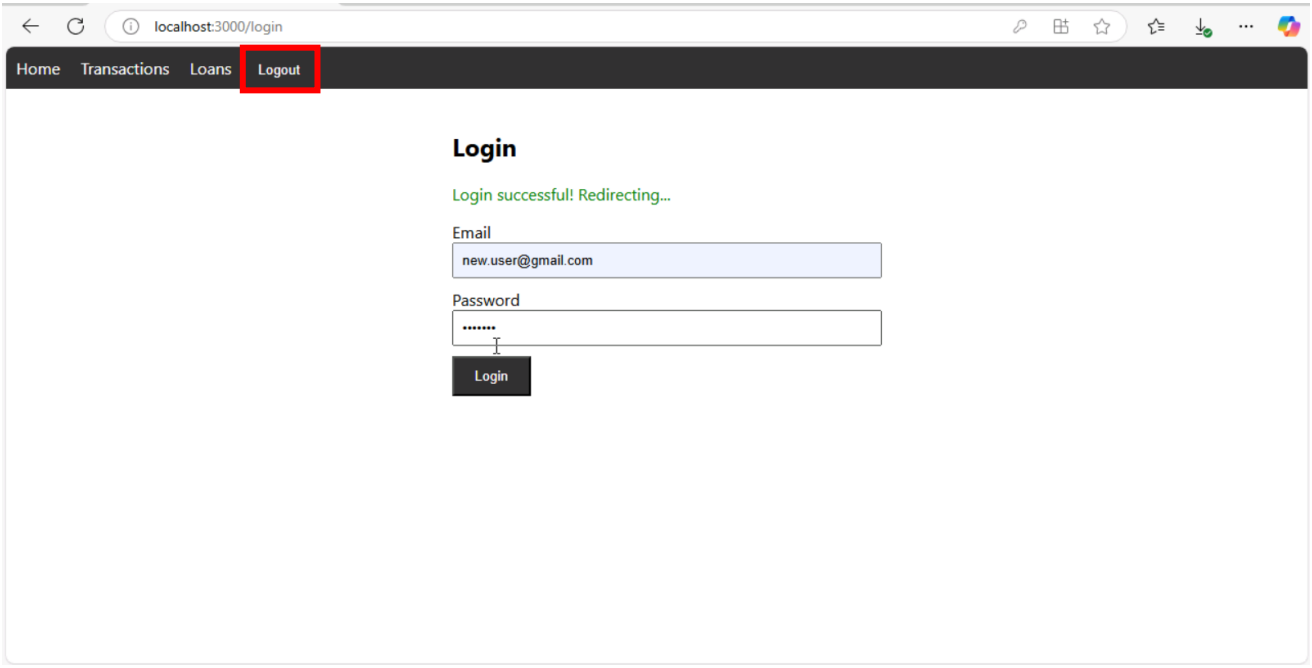
Output:

Upon error:



error message.

Upon success: Login, Register buttons are not displayed anymore. Instead there is Logout now

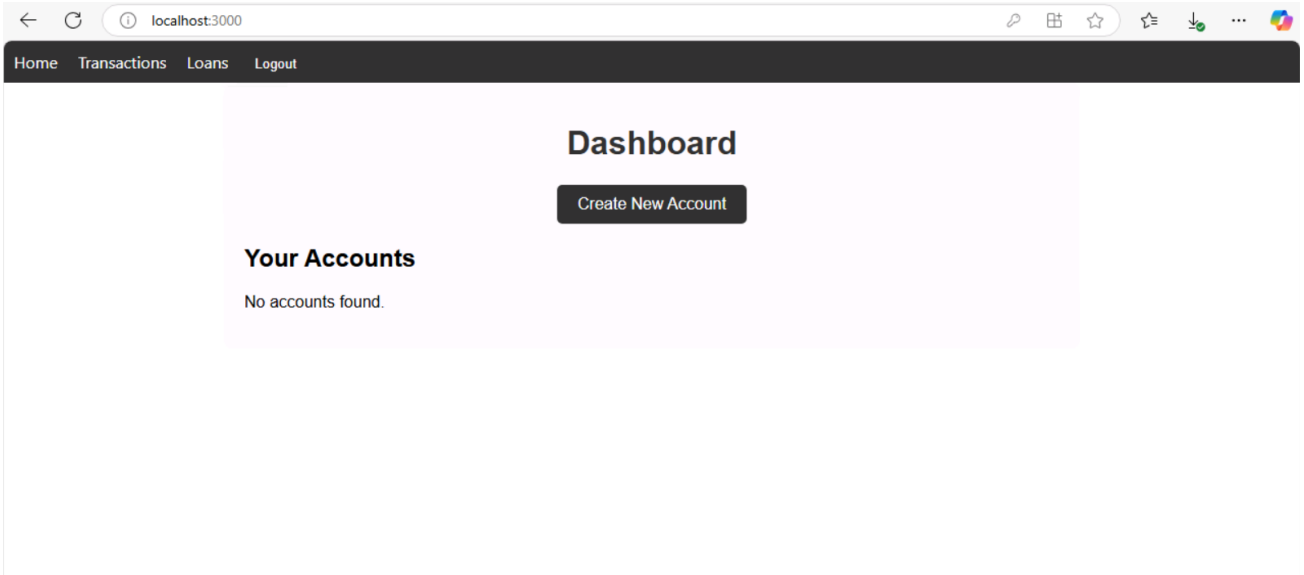


Redirect to the dashboard.

2.2 Account Management

The landing page changes to Dashboard according to user logged in

- View Accounts



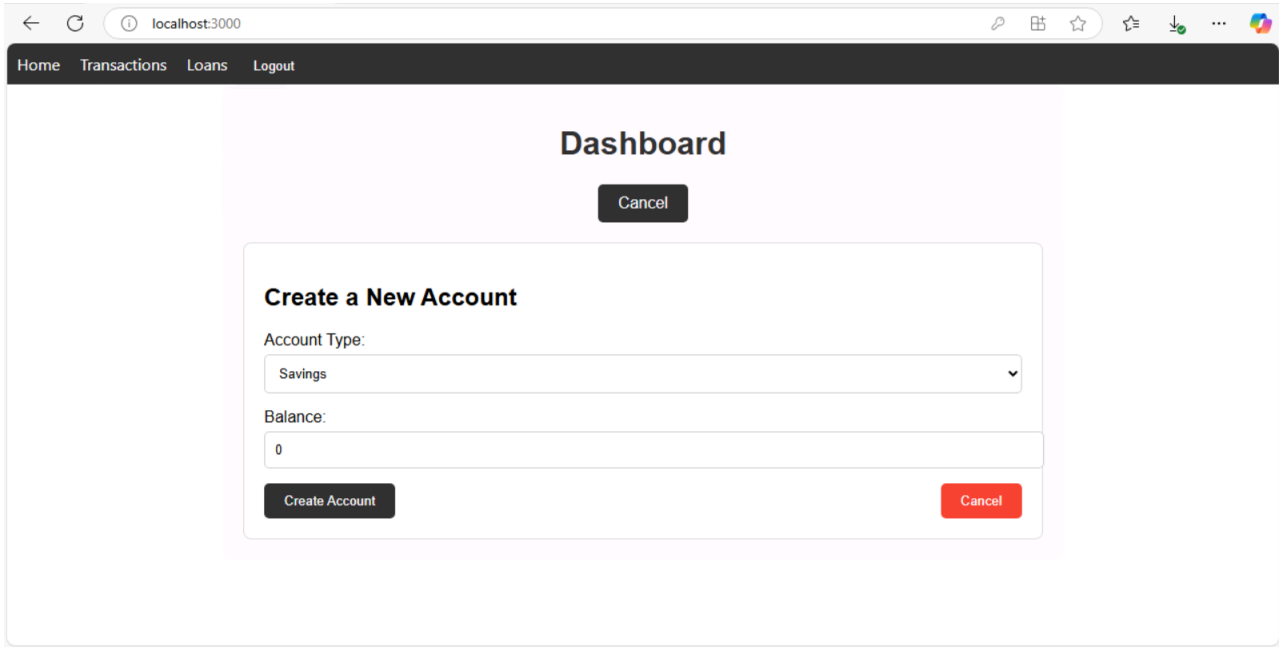
Accounts list table.

Details:

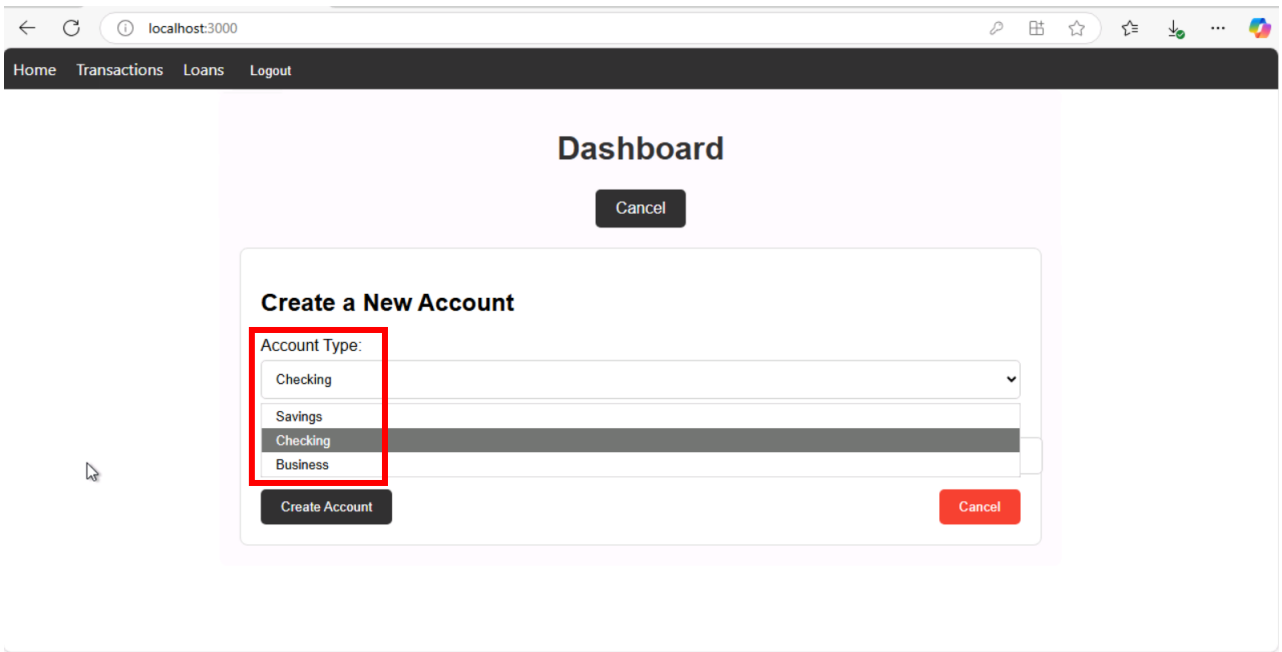
Backend fetches accounts associated with the authenticated user. Displays account number, type, and balance.

- Create Account:

  Each user can create multiple accounts



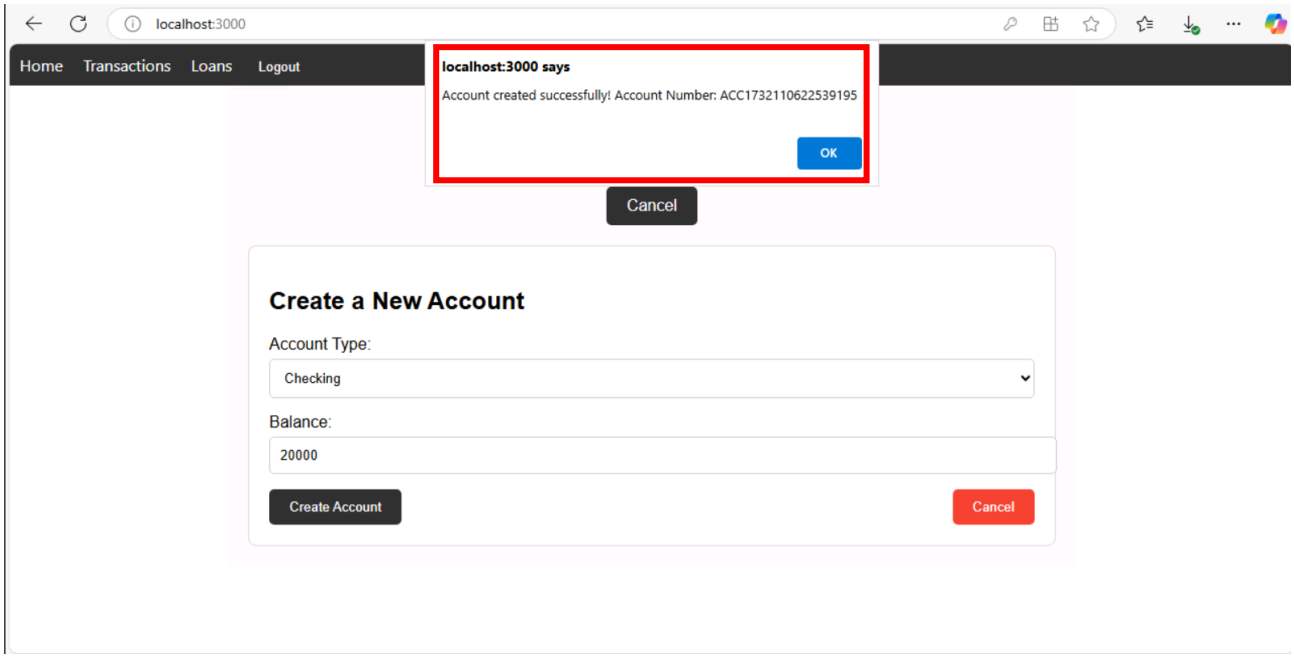
Account creation form.



Account creation form.

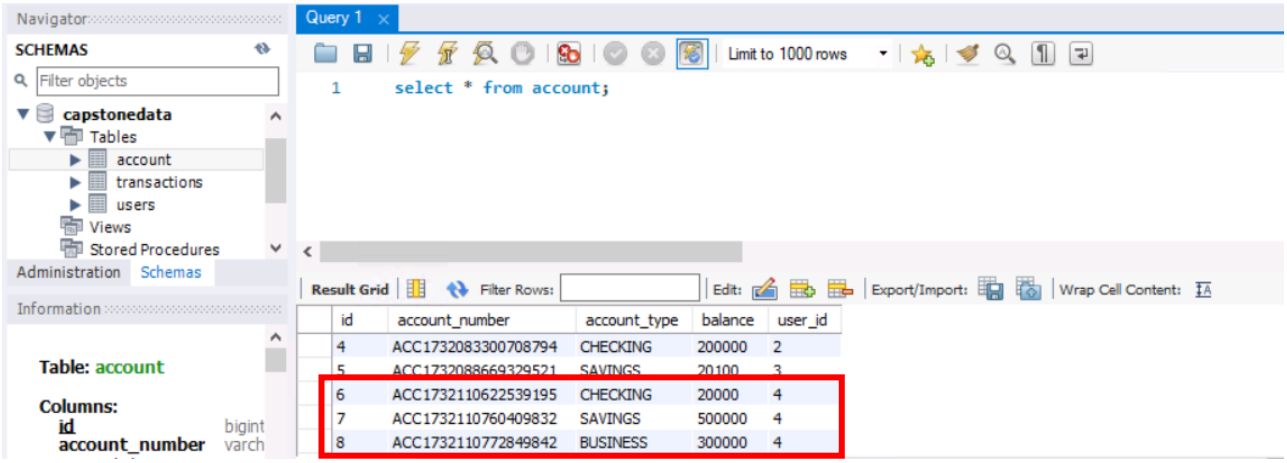
Details:

Input: Account type, Initial deposit



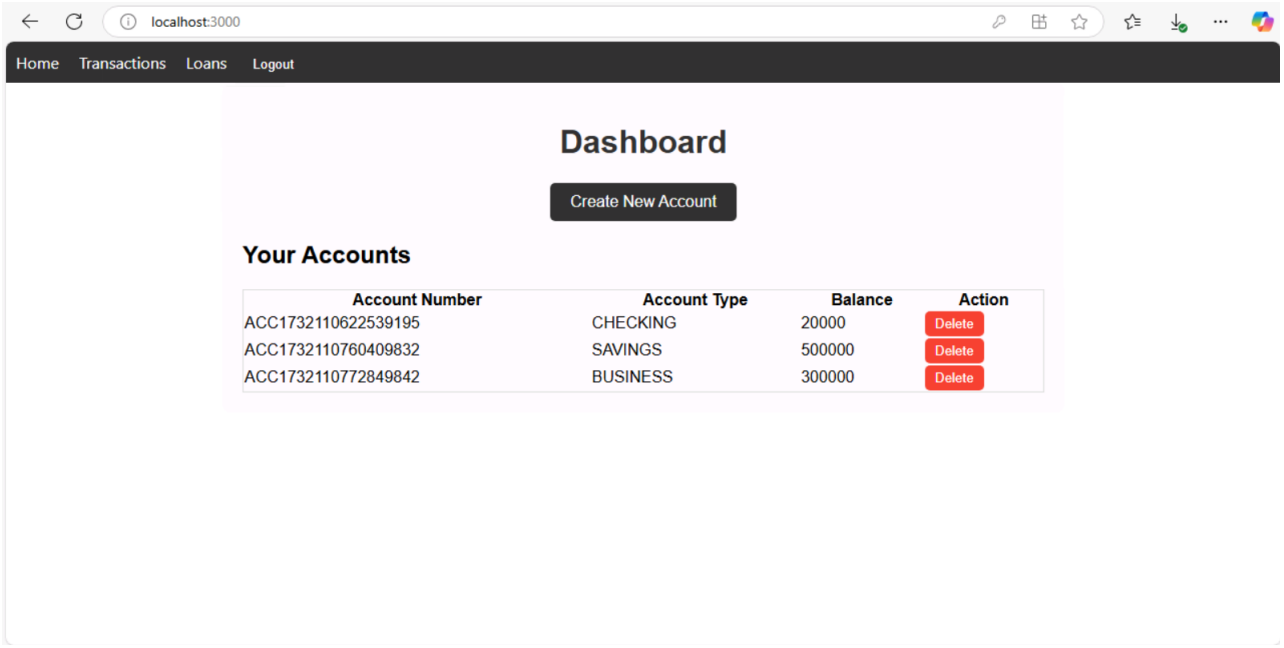
On Button Click.

Process: Save account in the database → Link to user.



Output:

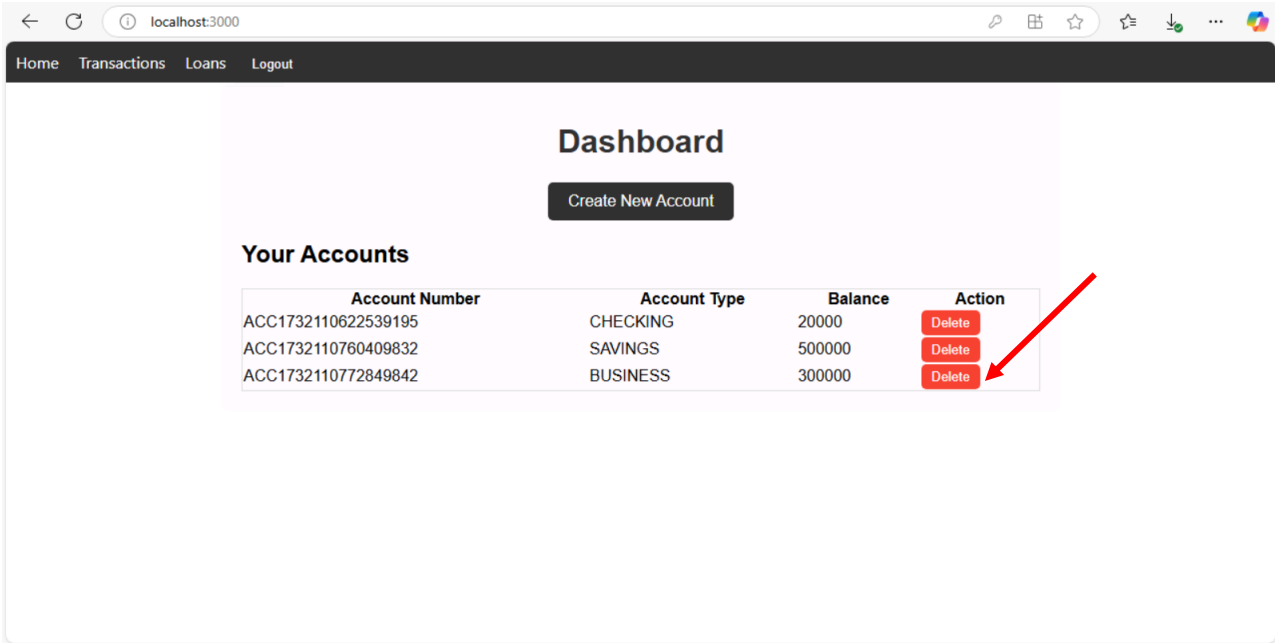
Autogenerated Account Number



Updated accounts table.

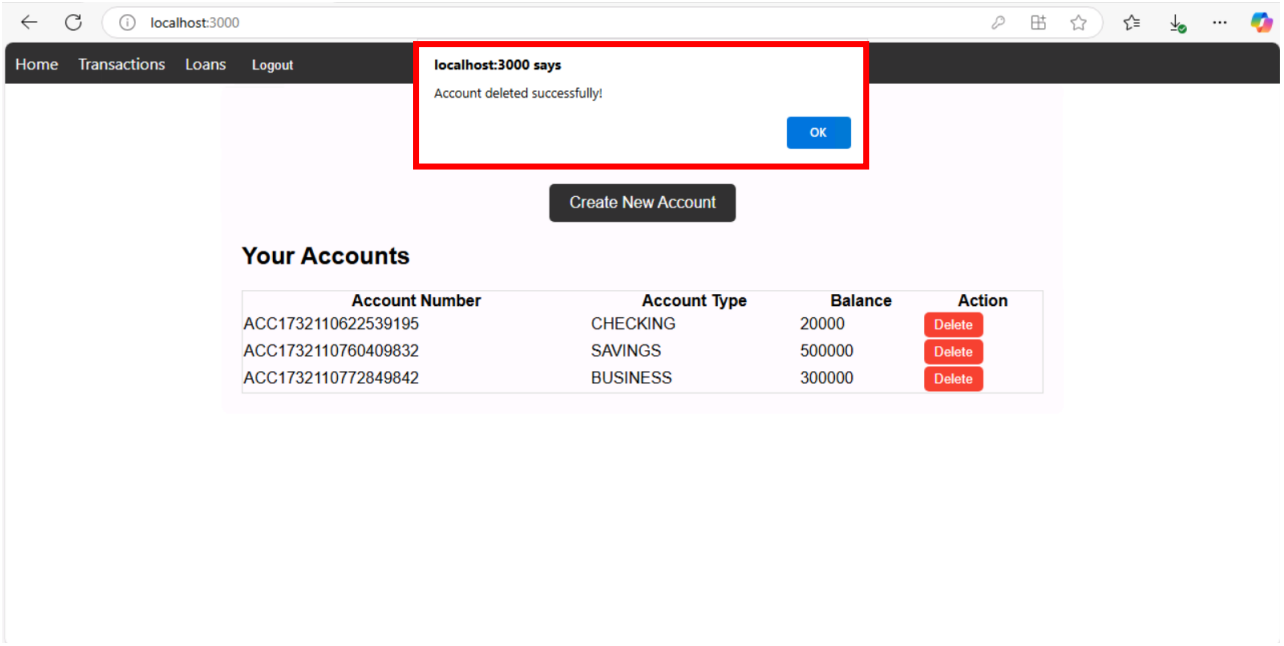
- Delete Account

Input:

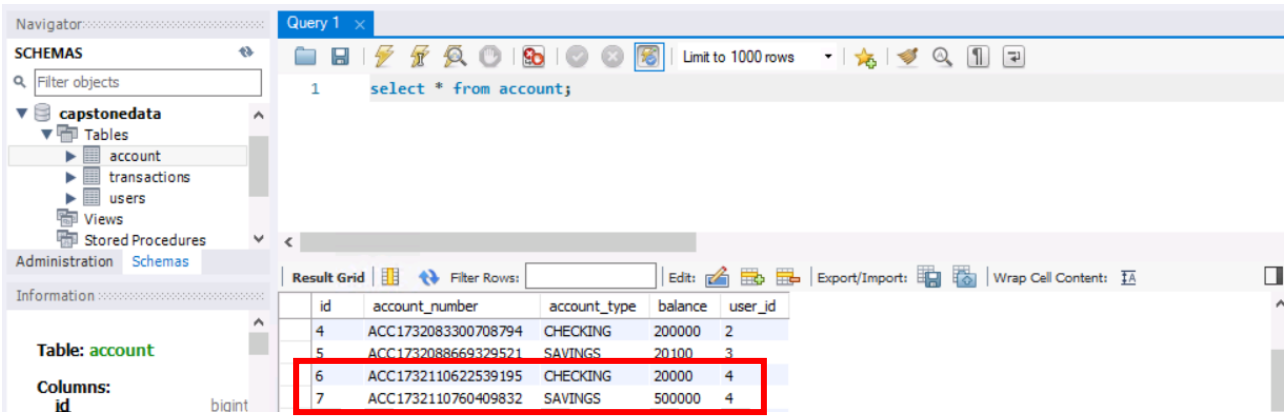


Click Delete.

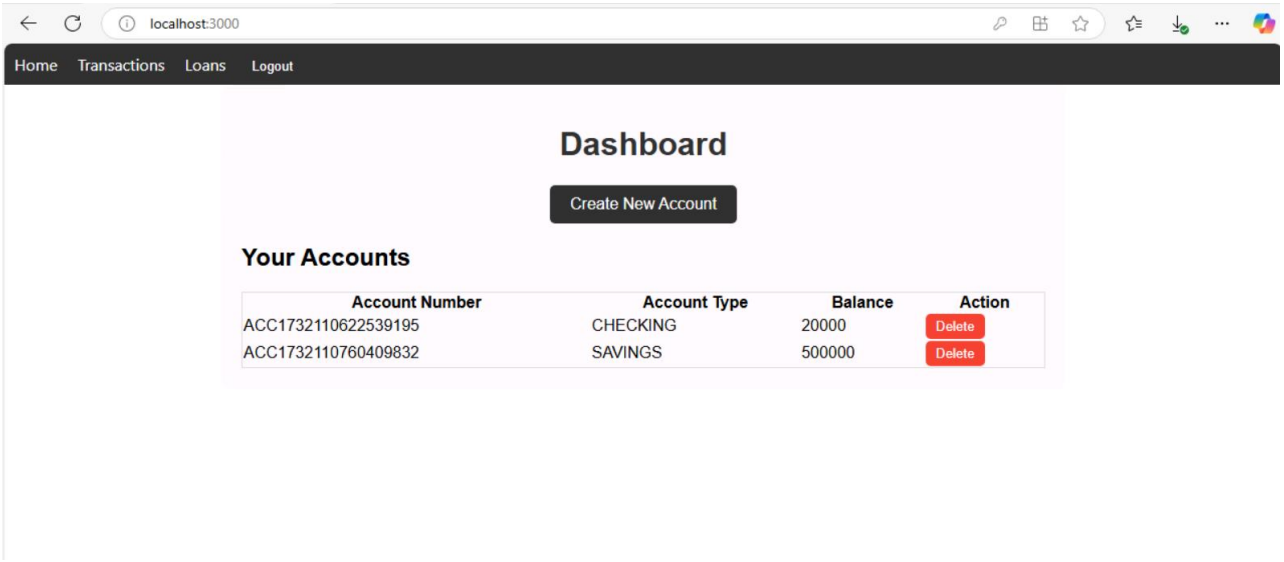
Process:



Alert.



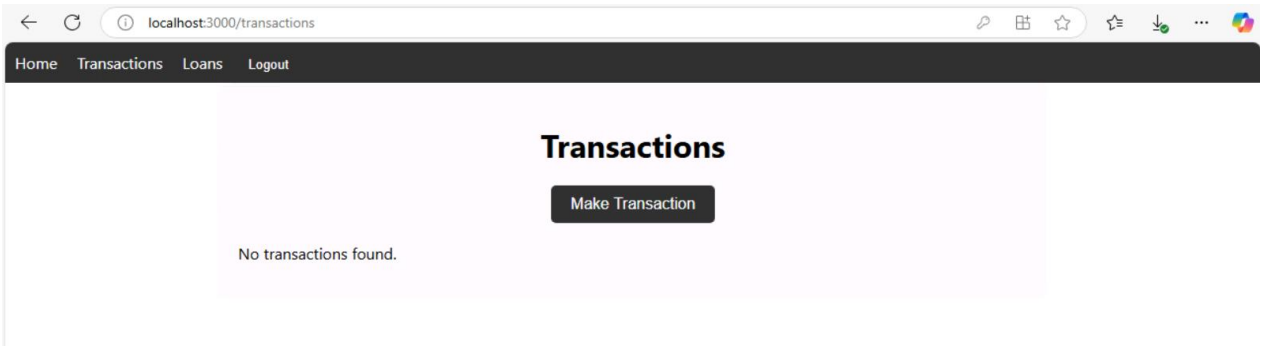
Output:



New list.

2.3 Transaction Management

Landing Page



- Transfer Funds

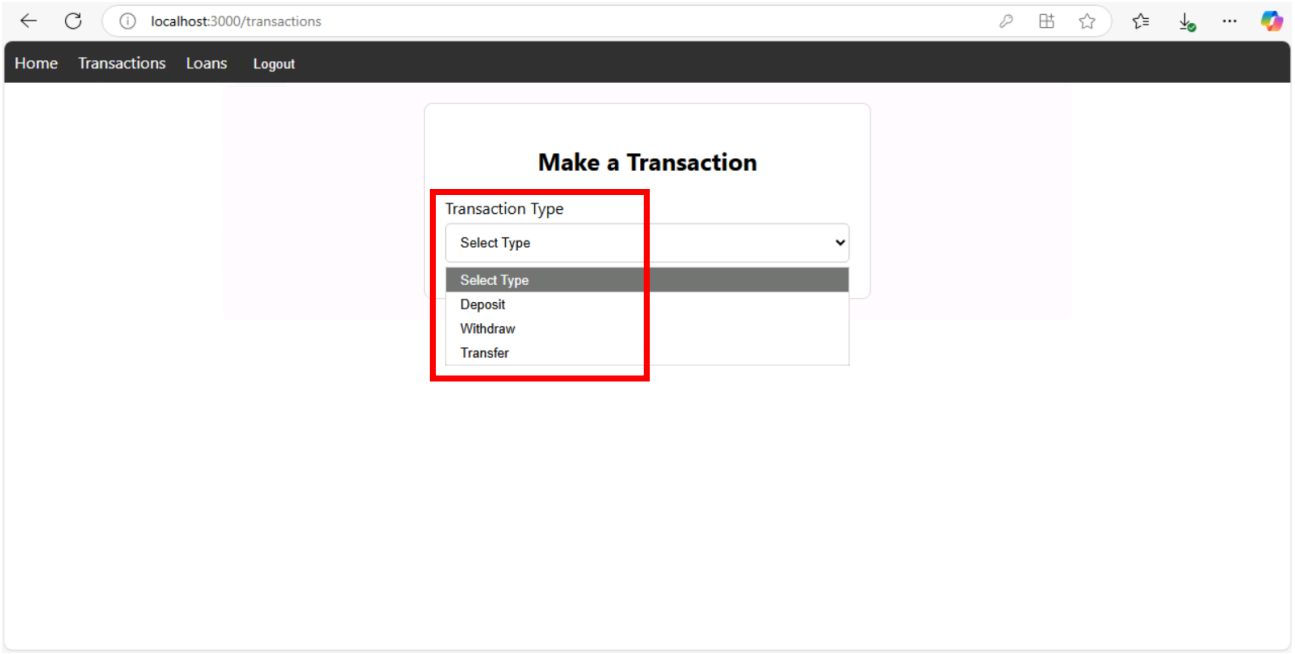
Details:

Input:

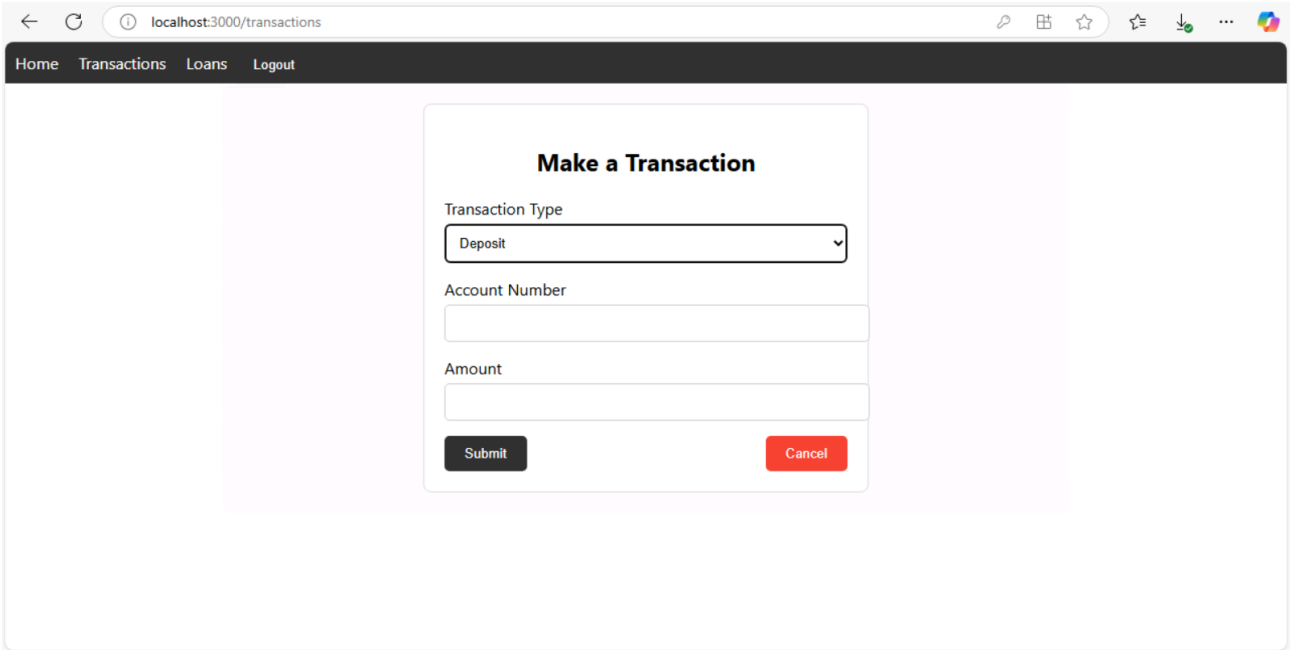
Deposit: Account, amount

Withdraw: Account, Email(for checking if it is someone else’s account), amount

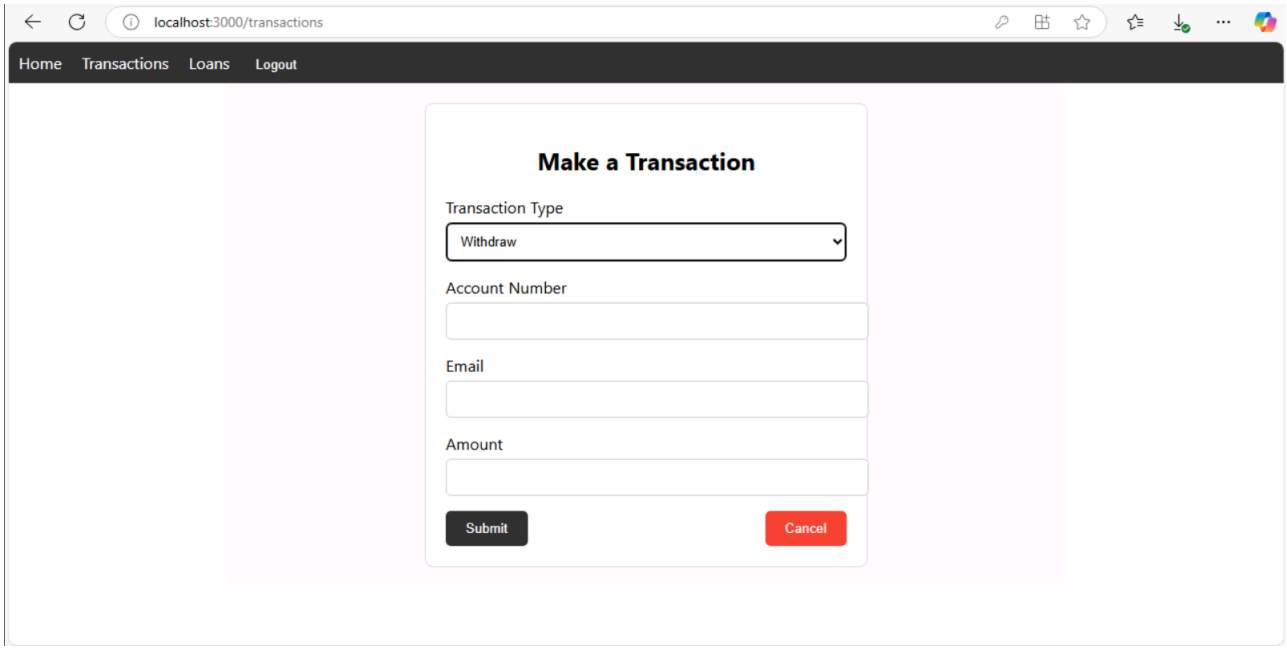
Transfer: Source account, destination account, amount.



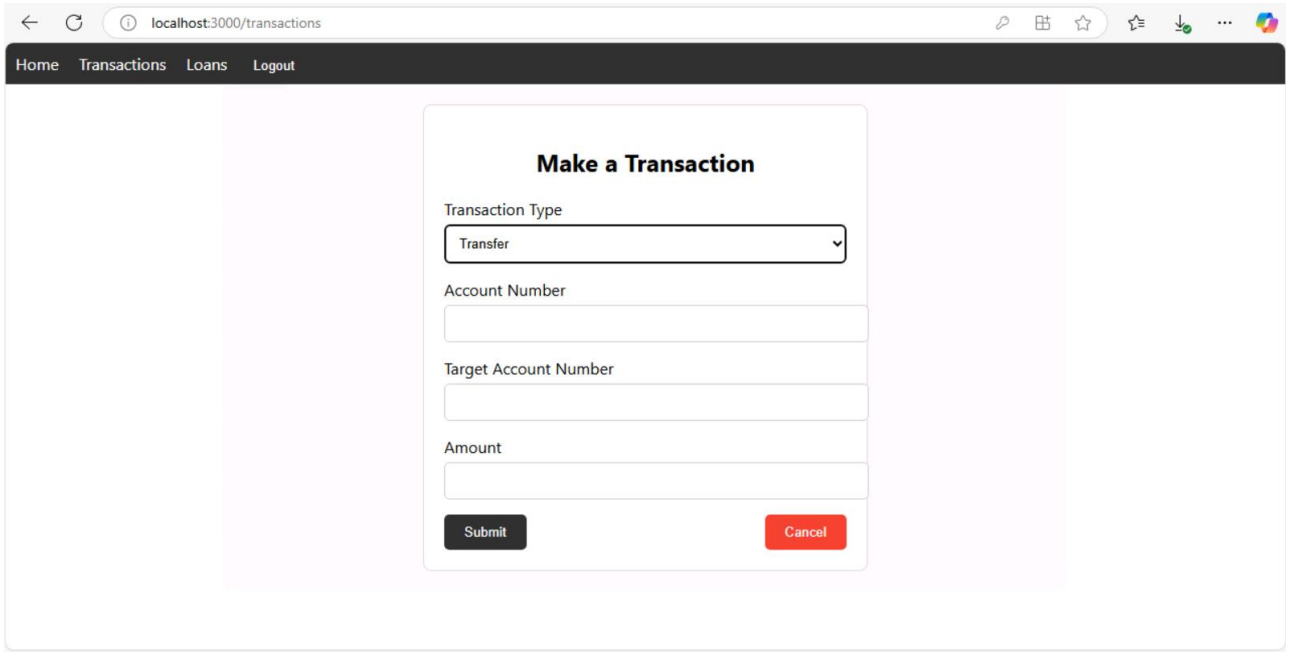
Transaction form.



Deposit funds form.



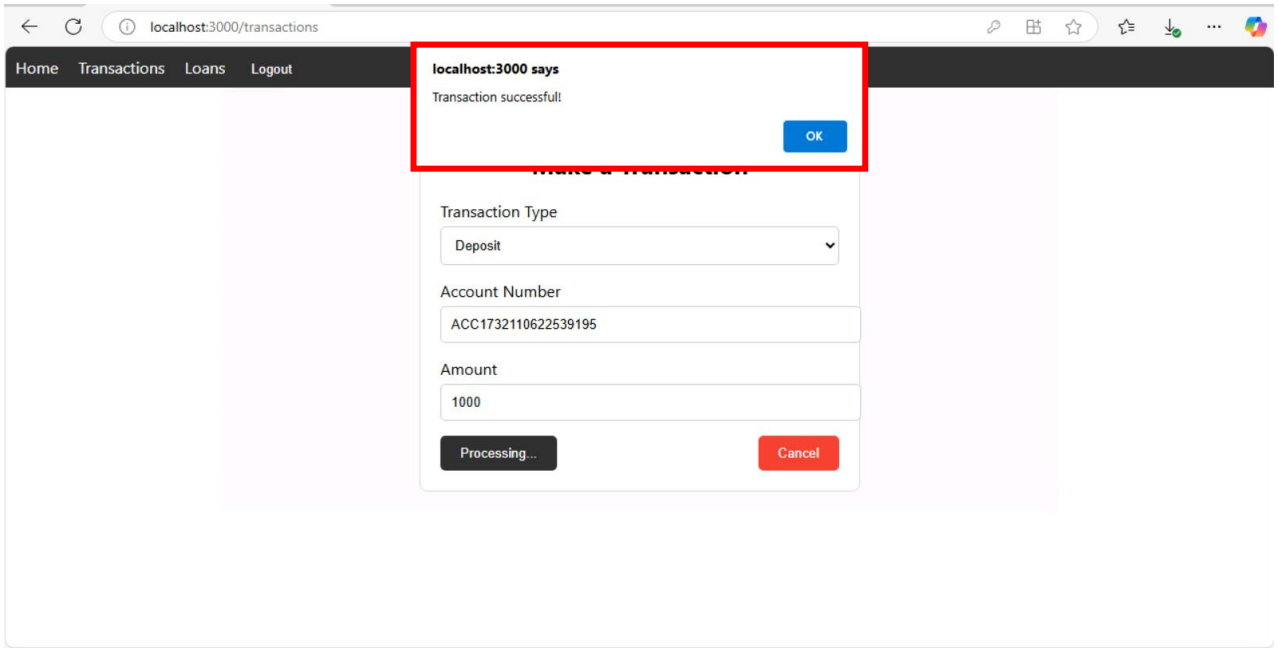
Withdraw funds form.

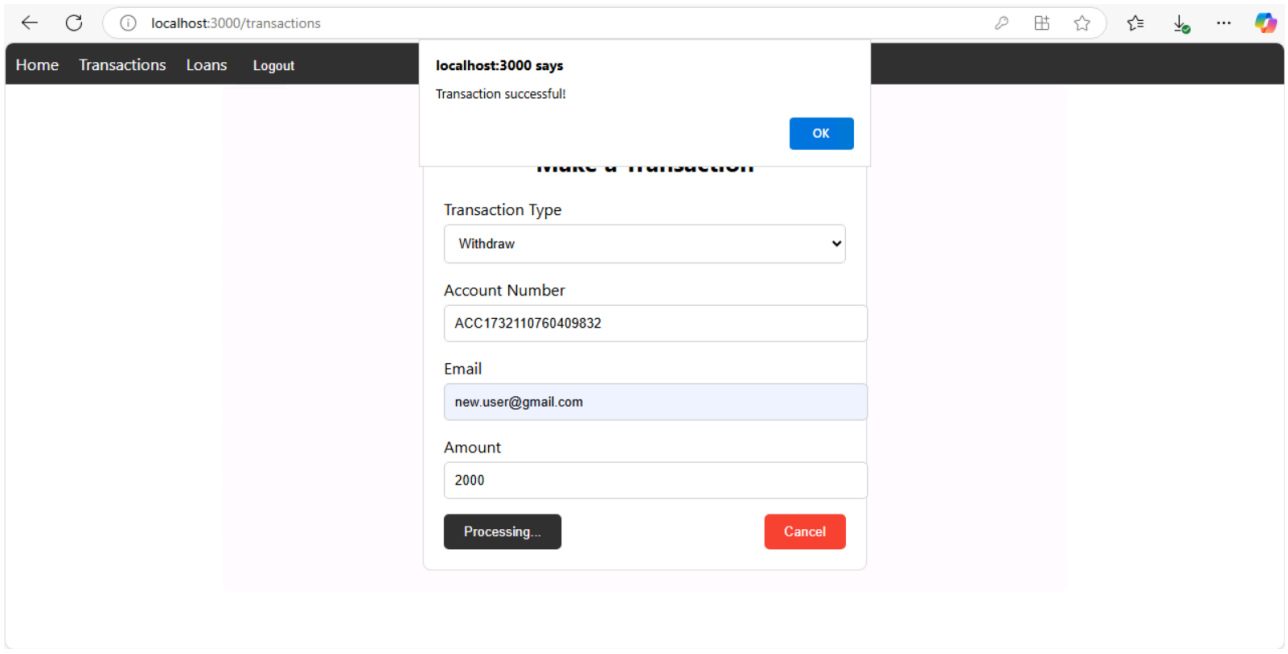


Transfer funds form.

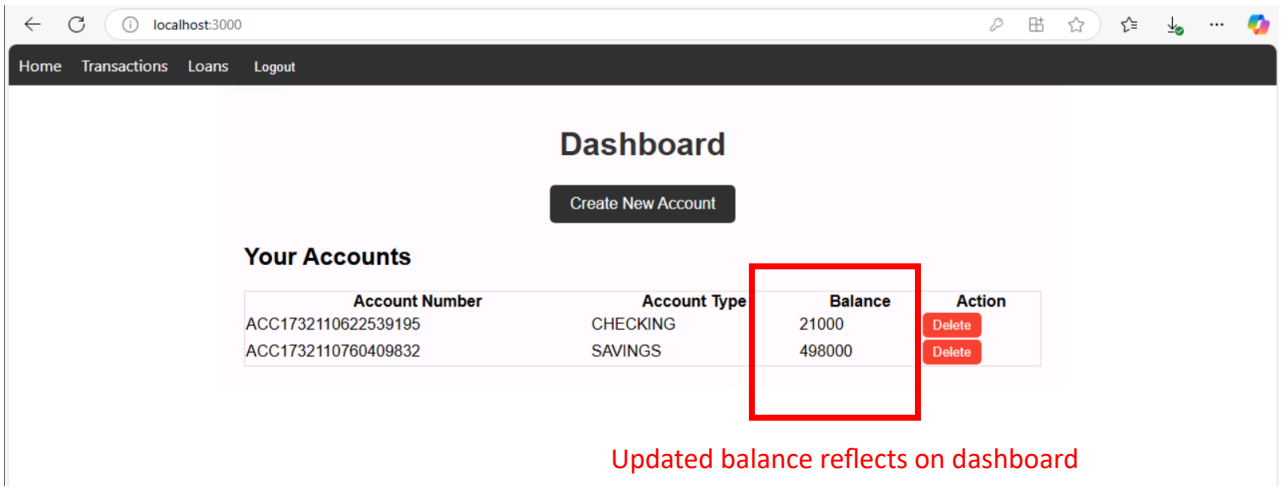
Process: Validate accounts and balance → Save transaction in the database.

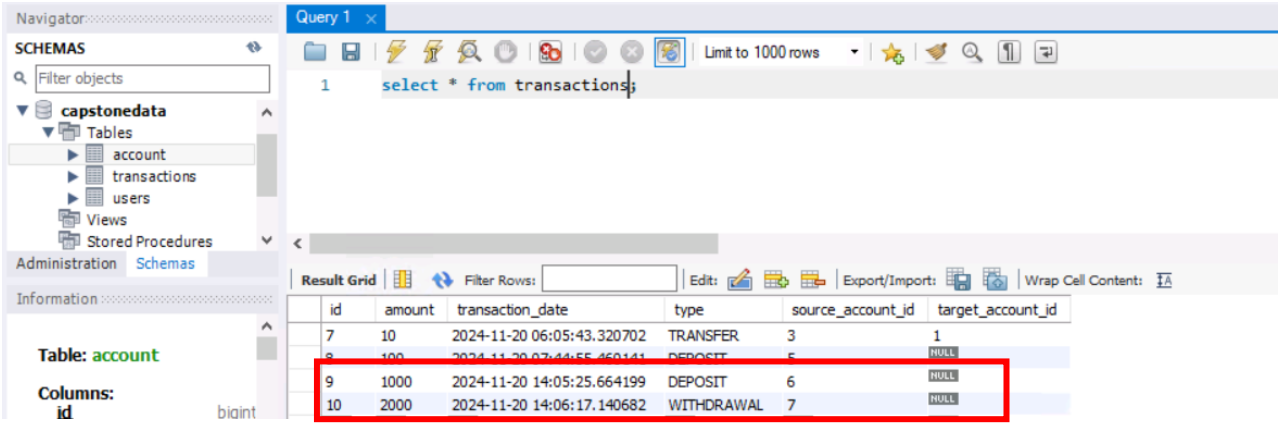
Output: Updated balances and transaction list.


localhost:3000/transactions
Home
Transactions
Loans
Logout
localhost:3000 says
Transaction successful!
OK
Transaction Type
Deposit
Account Number
ACC1732110622539195
Amount
1000
Processing...
Cancel

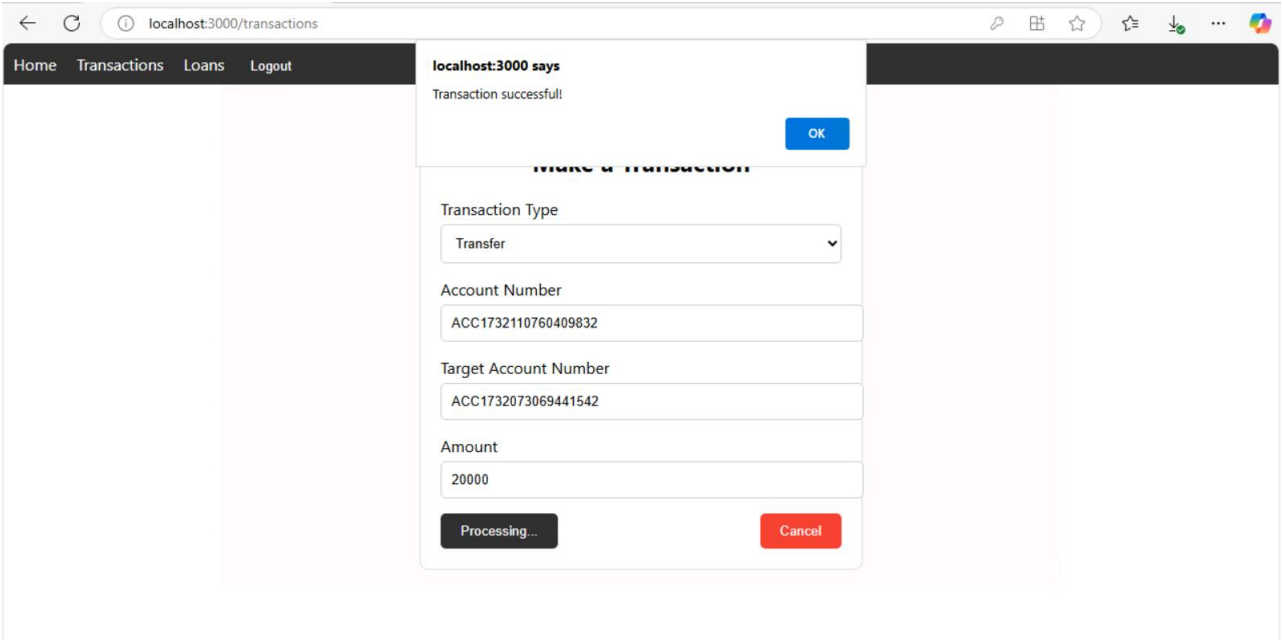

localhost:3000/transactions
Home
Transactions
Loans
Logout
localhost:3000 says
Transaction successful!
OK
Transaction Type
Withdraw
Account Number
ACC1732110760409832
Email
new.user@gmail.com
Amount
2000
Processing...
Cancel

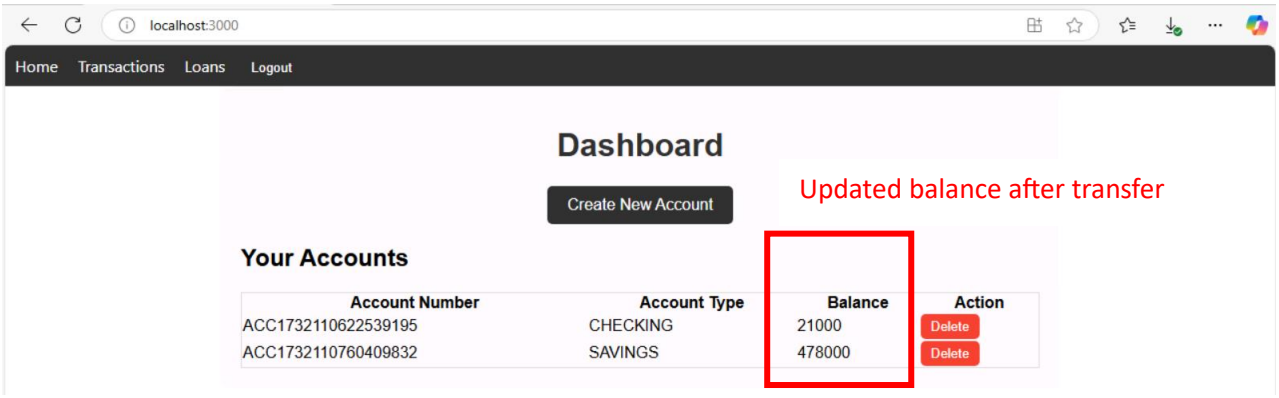
After deposit and Withdrawal.

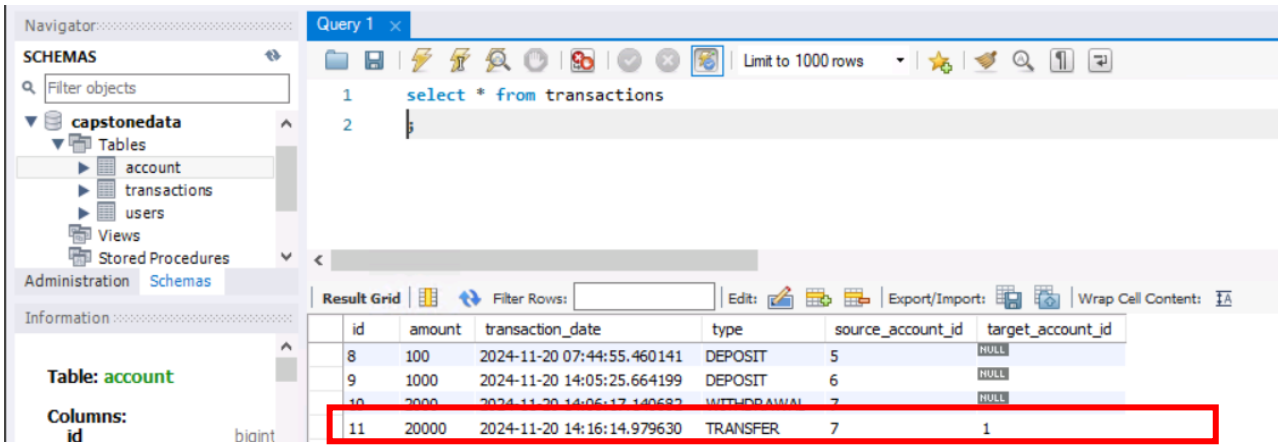




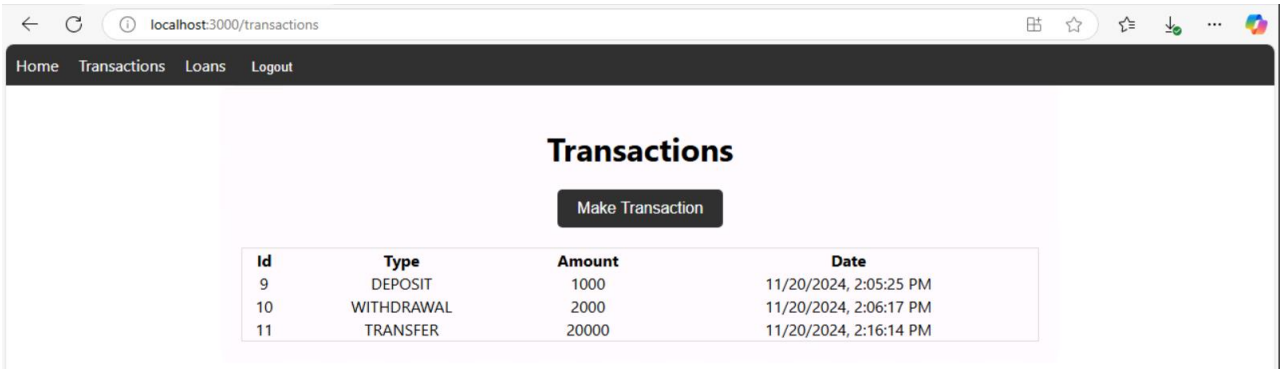
After Transfer.







- View Transactions

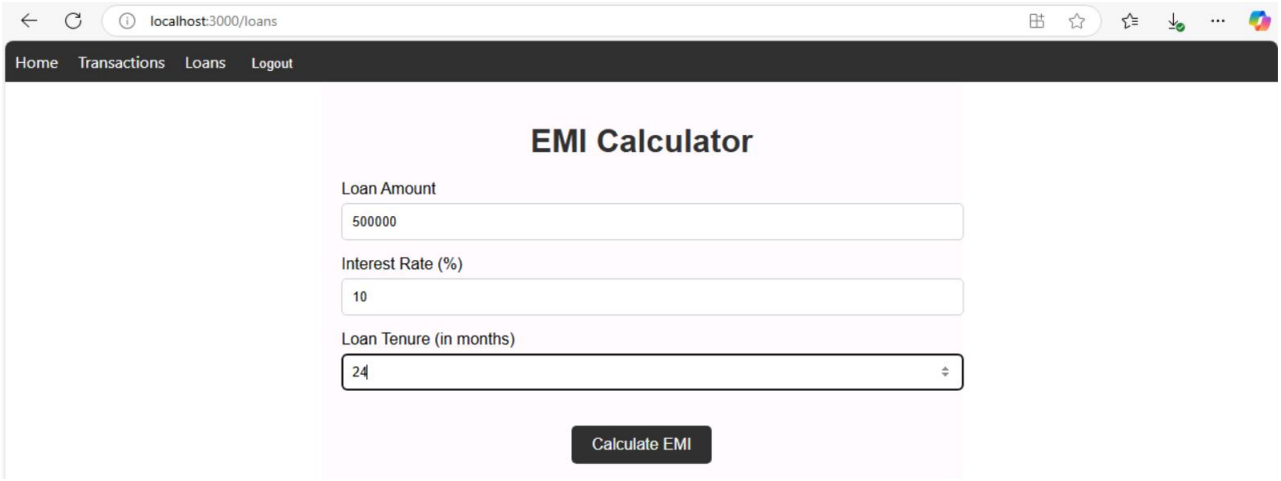


Transactions history table.

Details: Backend fetches transaction records. Displays details such as date, source, destination, and amount.

2.4 Loan Planning (EMI Calculator)

- Calculate EMI



EMI calculator UI.

Details:

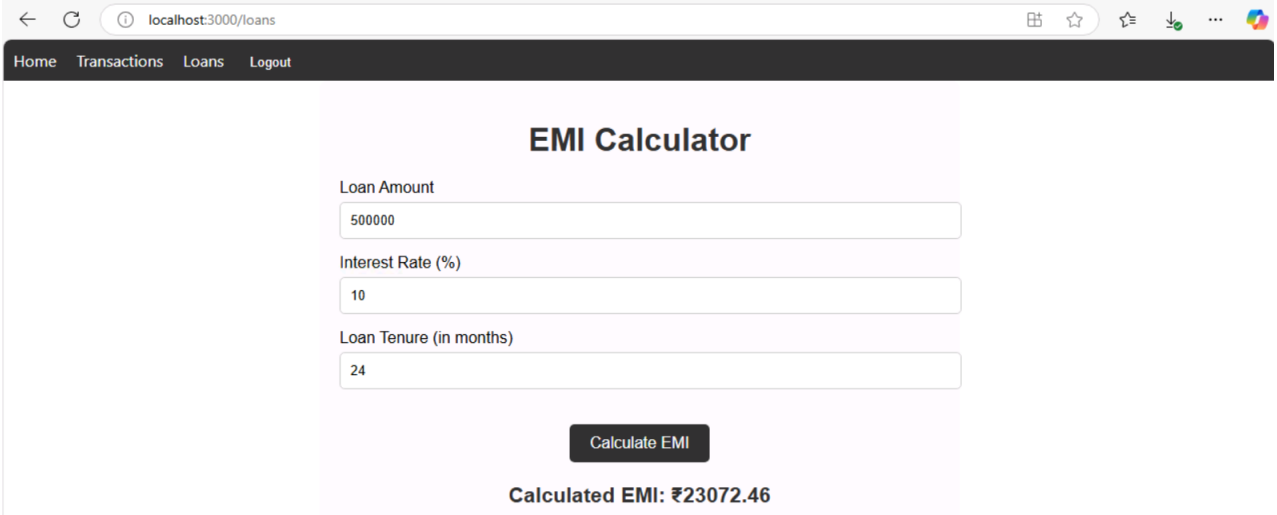
Input: Loan amount, interest rate, tenure.

Process: Calculate EMI using the formula.

$$EMI = (1+R)\ N - 1\ P \cdot R \cdot (1+R)\ N$$

(where P P is principal, R R is monthly interest, and N N is tenure in months).

Output:



Display monthly EMI amount.

3. Backend Endpoints

Endpoint	HTTP Method	Description
`/auth/register`	POST	Registers a new user.
`/auth/login`	POST	Authenticates a user and issues a JWT.
`/accounts`	POST	Creates a new account.
`/accounts/user`	GET	Fetches accounts linked to the authenticated user.
`/accounts/{id}`	DELETE	Deletes an account by ID.
`/transactions/deposit`	POST	Processes a deposit transaction.
`/transactions/withdraw`	POST	Processes a withdrawal transaction.
`/transactions/transfer`	POST	Processes a transfer transaction.
`/transactions/user`	GET	Fetches transaction history for a user.

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4. Frontend URLs

URL	Description
`/login`	User login page.
`/register`	User registration page.
`/dashboard`	User dashboard showing account details.
`/transactions`	Displays transaction history and options.
`/loans`	EMI Calculator for loan planning.

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5. Database Schema

Database Schema Documentation

5.1. Table: `users`

Column Name	Data Type	Attributes	Description
id	bigint	AUTO_INCREMENT, PK	Primary key, unique identifier for users.
email	varchar(255)	UNIQUE	Email address of the user (used for authentication).
password	varchar(255)	NOT NULL	Encrypted password for the user.
username	varchar(255)	UNIQUE	Unique username for the user.

Primary Key: `Id`

5.2. Table: `account`

Column Name	Data Type	Attributes	Description
id	bigint	AUTO_INCREMENT, PK	Primary key, unique identifier for accounts.
account_number	varchar(255)	UNIQUE	Unique identifier for each account.
account_type	enum('BUSINESS','CHECKING','SAVINGS')	NOT NULL	Type of account (business, checking, or savings).
balance	double	NOT NULL	Current balance in the account.
user_id	bigint	FK	Foreign key referencing `users(id)`.

Primary Key: `id`

Foreign Key: `user_id` → `users(id)`

Relationships:

- **One-to-Many**: A user can have multiple accounts.

5.3. Table: `transactions`

Column Name	Data Type	Attributes	Description
id	bigint	AUTO_INCREMENT, PK	Primary key, unique identifier for transactions.
amount	double	NOT NULL	Amount involved in the transaction.
transaction_date	datetime(6)	NOT NULL	Date and time when the transaction occurred.
type	varchar(255)	NOT NULL	Type of transaction (e.g., "deposit," "withdrawal," "transfer").
source_account_id	bigint	FK	Foreign key referencing `account(id)` for the source account.
target_account_id	bigint	FK	Foreign key referencing `account(id)` for the target account (if applicable).

Primary Key: `id`

Foreign Keys:

- `source_account_id` → `account(id)`
- `target_account_id` → `account(id)`

Relationships:

- **One-to-Many**: An account can have multiple transactions.
- **Self-Referencing**: Source and target accounts can belong to the same or different users.

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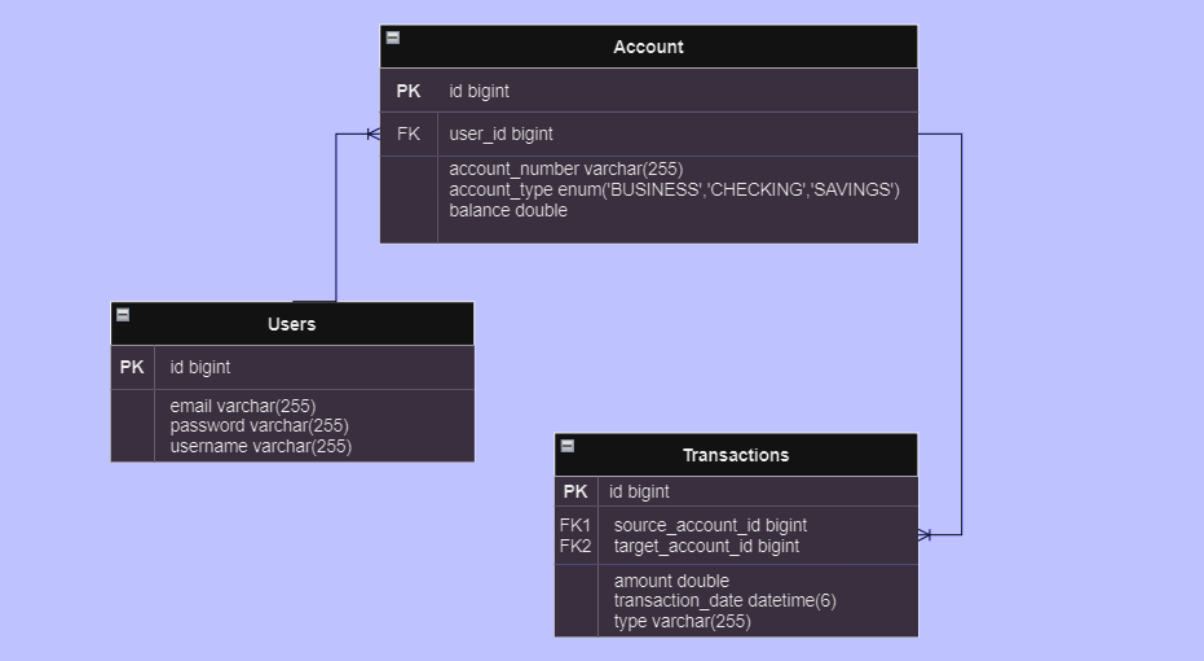
6. ER-diagram



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7. Tools and Technologies

- **Backend**: Spring Boot (Java), JWT for authentication.
- **Frontend**: React.js for responsive UI.
- **Database**: MySQL for persistent data storage.
- **Security**: BCrypt for password hashing, JWT for secure token management.

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8. Github (Link to code): [silvyapatel/Capstone]