Frontend and Backend Architecture for Credit Management System

1. Introduction

The Credit Management System is a full-stack web application designed to streamline the process of managing client credits and repayments. The system is built using modern technologies and follows best practices in software development.

Technology Stack

- **Frontend**: Angular 17 (Standalone Components)
- **Backend**: Spring Boot 3.x
- **Database**: MySQL
- **Authentication**: JWT (JSON Web Tokens)
- **Styling**: Tailwind CSS
- **Build Tools**: Maven, npm
- **Version Control**: Git

Purpose

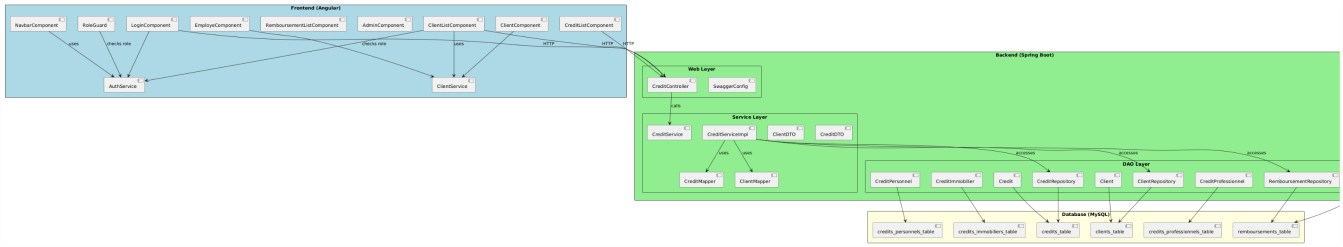
The application serves as a comprehensive solution for:

- Managing client information
- Processing credit applications
- Tracking credit repayments
- User authentication and role-based access control
- Real-time credit status monitoring

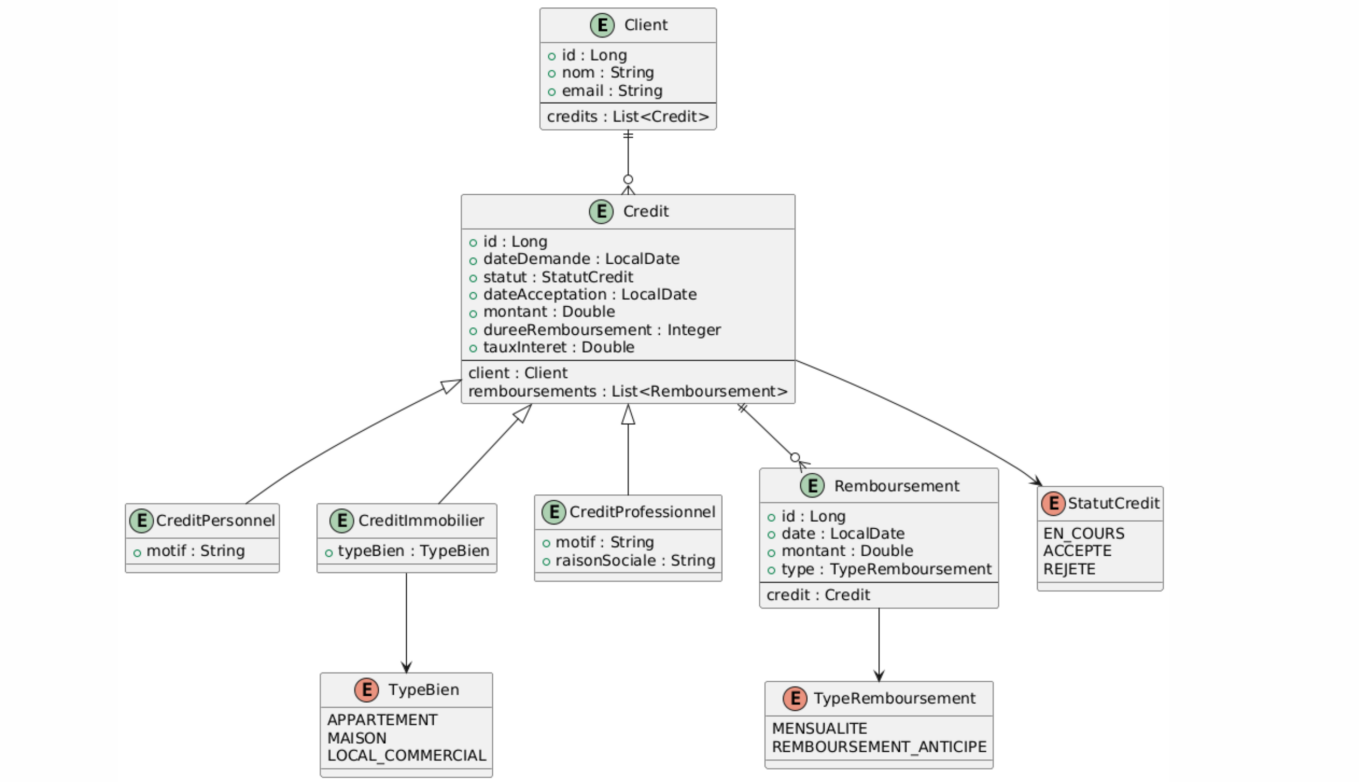
2. Project Architecture

The system follows a modern microservices architecture with clear separation of concerns.

Technical Architecture



Class Diagram



3. Frontend (Angular)

Component Structure

The frontend is built using Angular's standalone components architecture:

Core Components

- **AppComponent**: Main application component with navigation
- **LoginComponent**: Handles user authentication
- **Dashboard Components**:
  - AdminDashboard
  - ClientDashboard
  - EmployeeDashboard

Feature Components

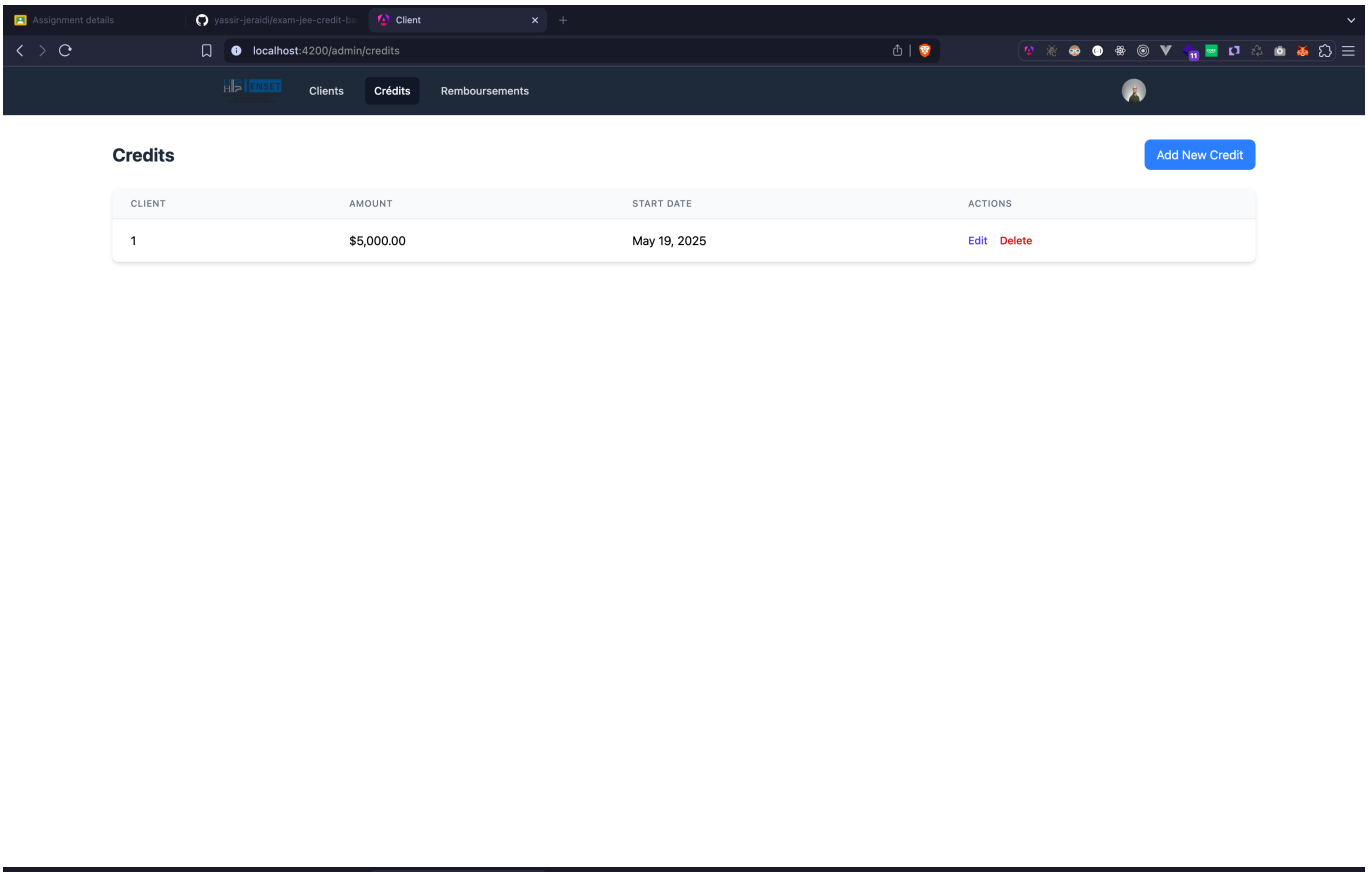
- **Client Management**
  - ClientListComponent
  - ClientFormComponent
- **Credit Management**
  - CreditListComponent
  - CreditFormComponent
- **Remboursement Management**
  - RemboursementListComponent
  - RemboursementFormComponent

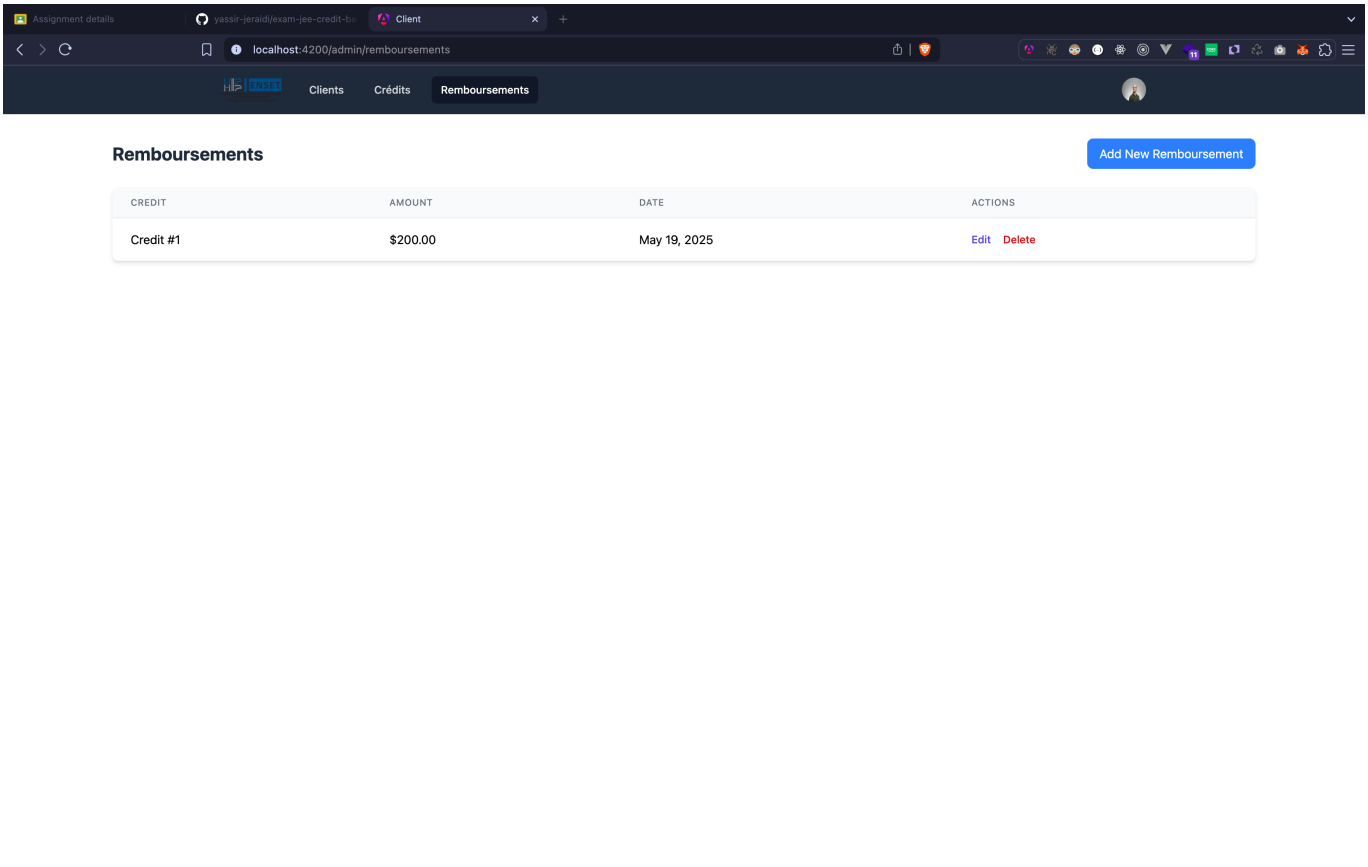
Services

- **AuthService**: Handles authentication and JWT management
- **ClientService**: Manages client-related operations
- **CreditService**: Handles credit operations
- **RemboursementService**: Manages repayment operations

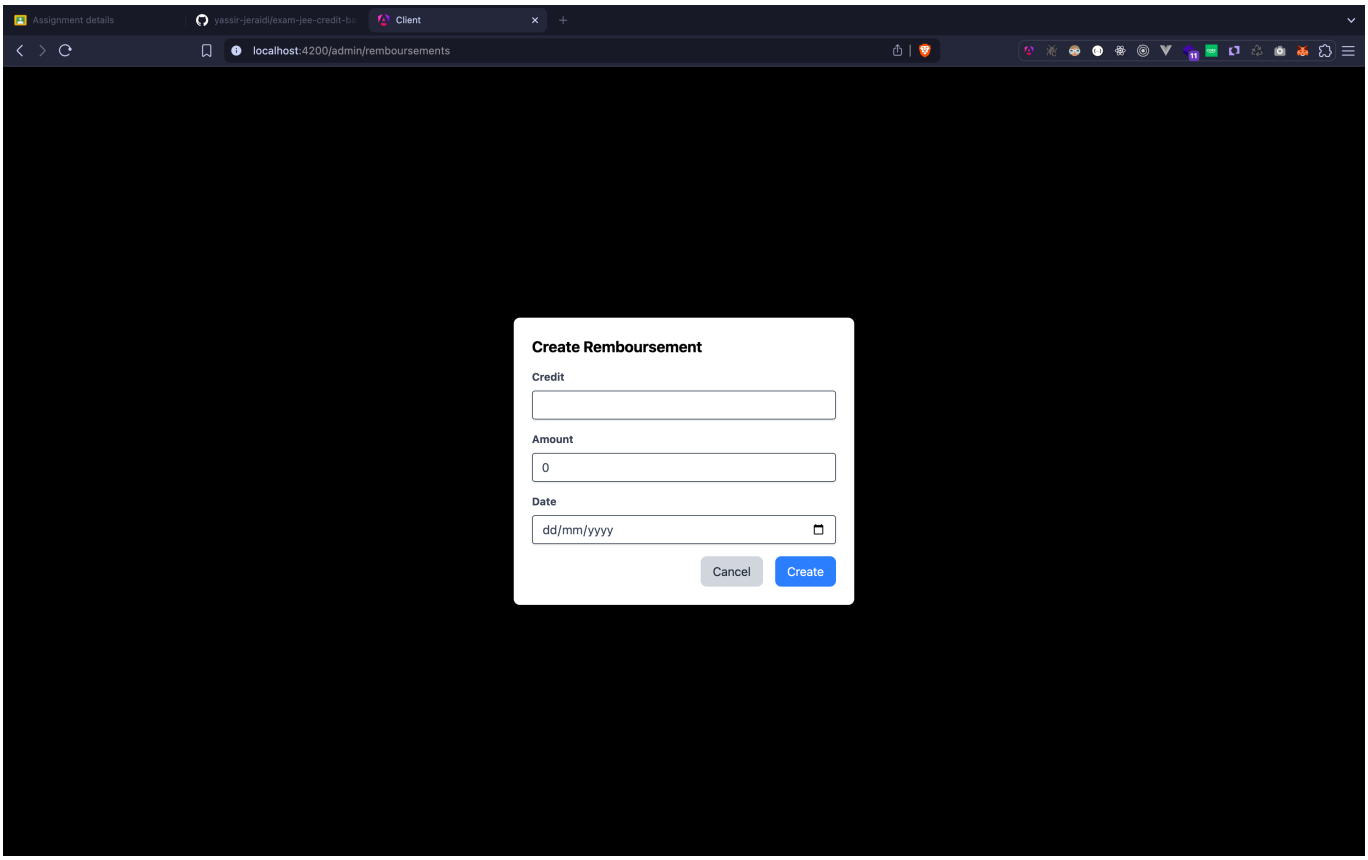
UI Screenshots

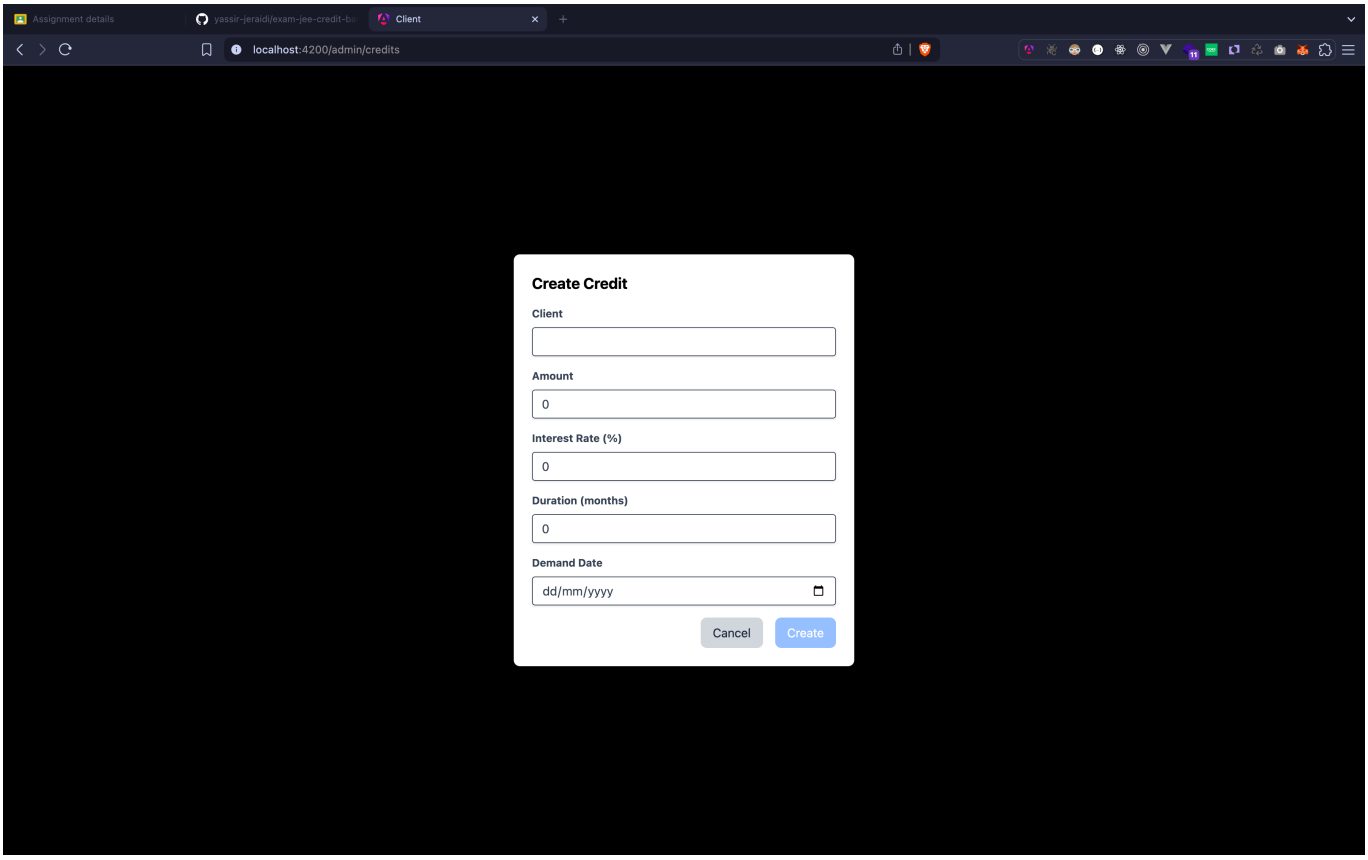
Authentication



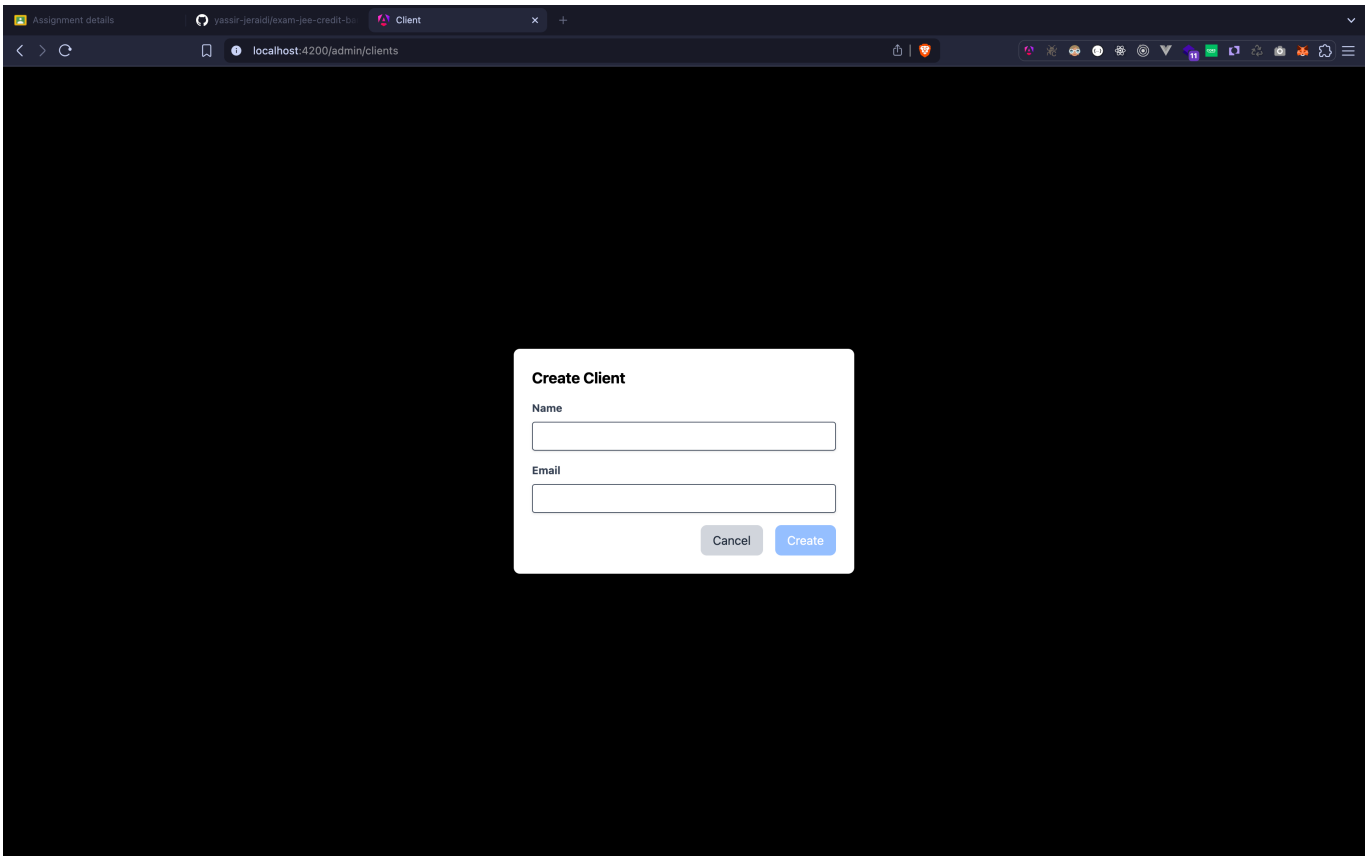


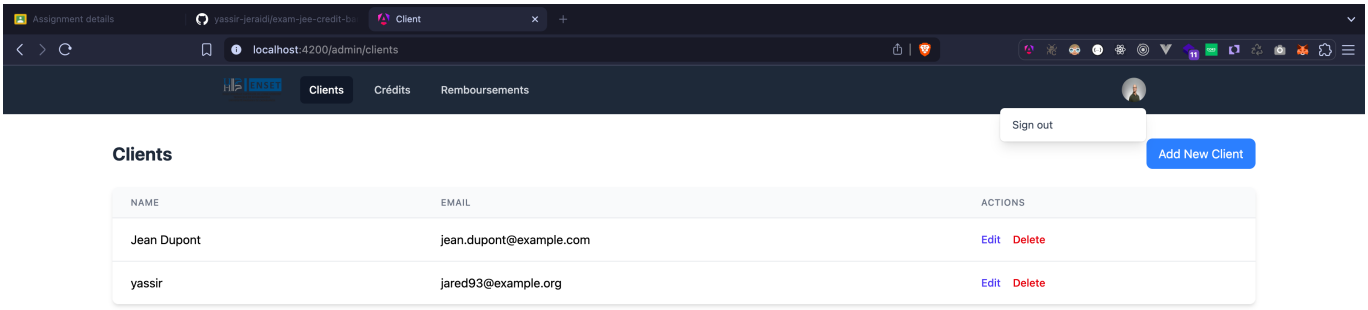
Client Management



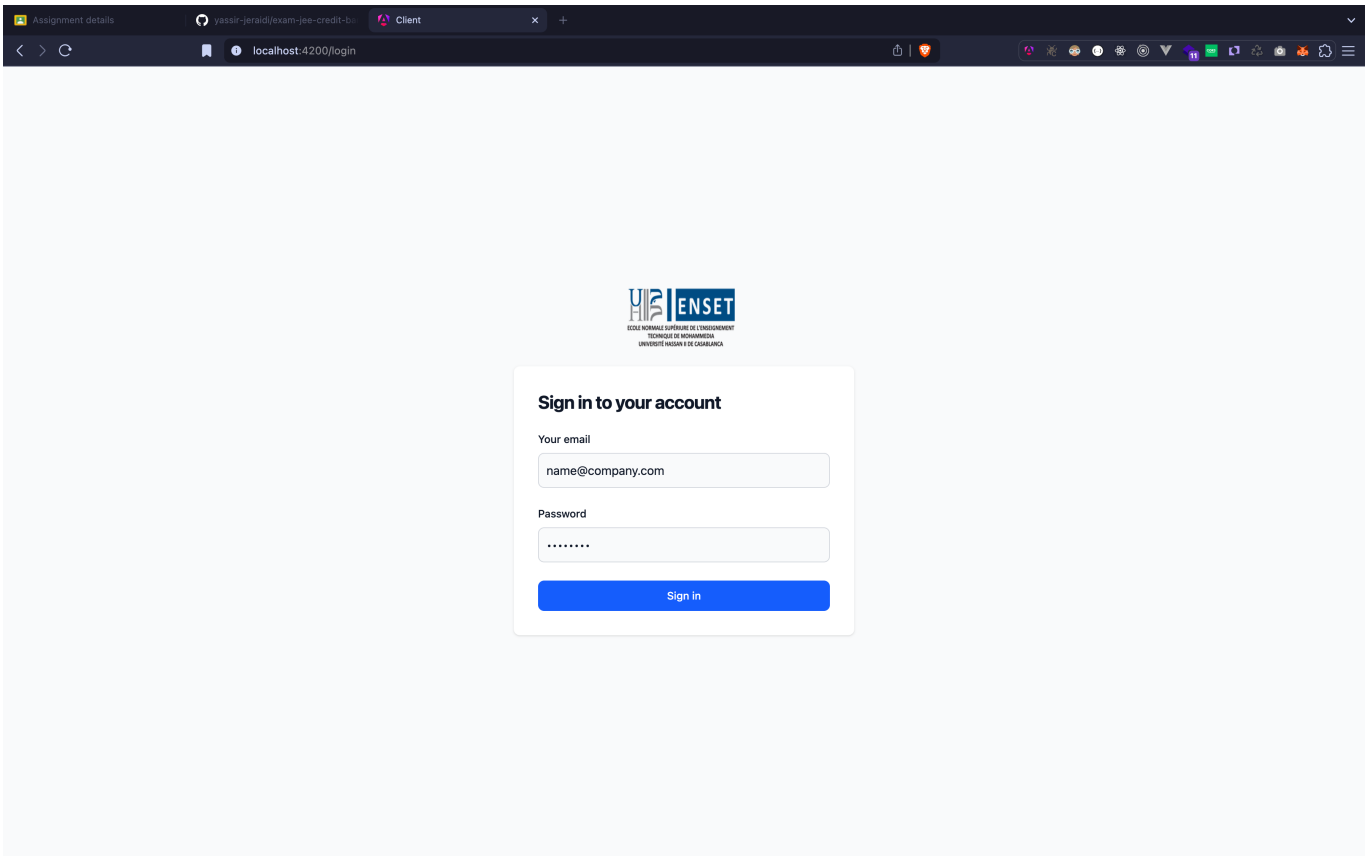


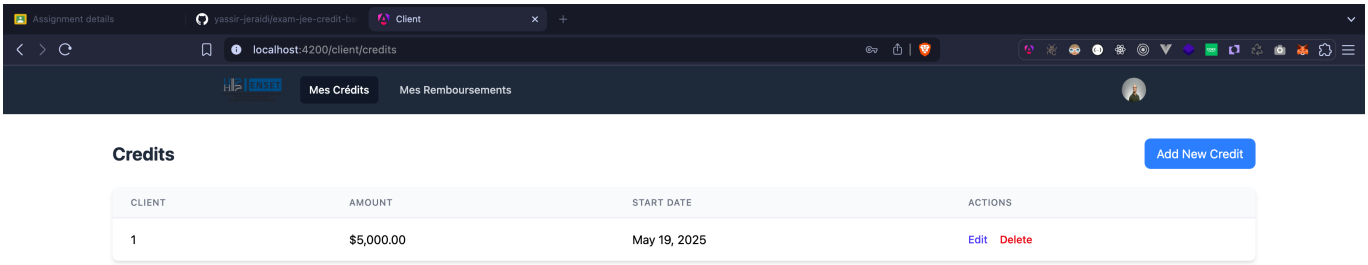
Credit Management



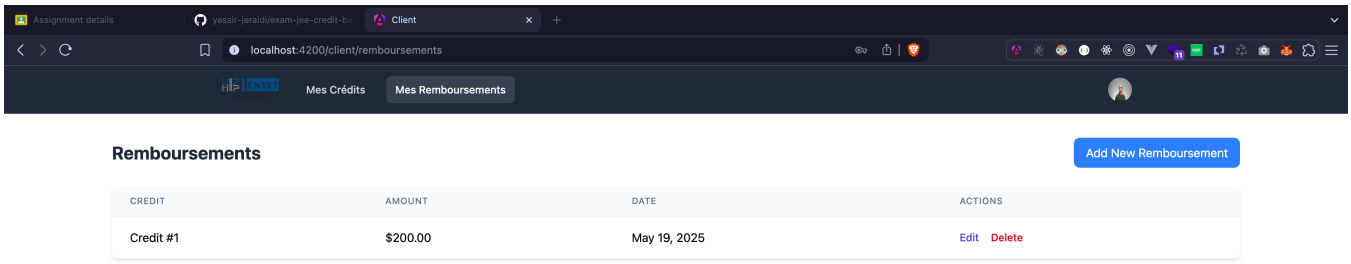


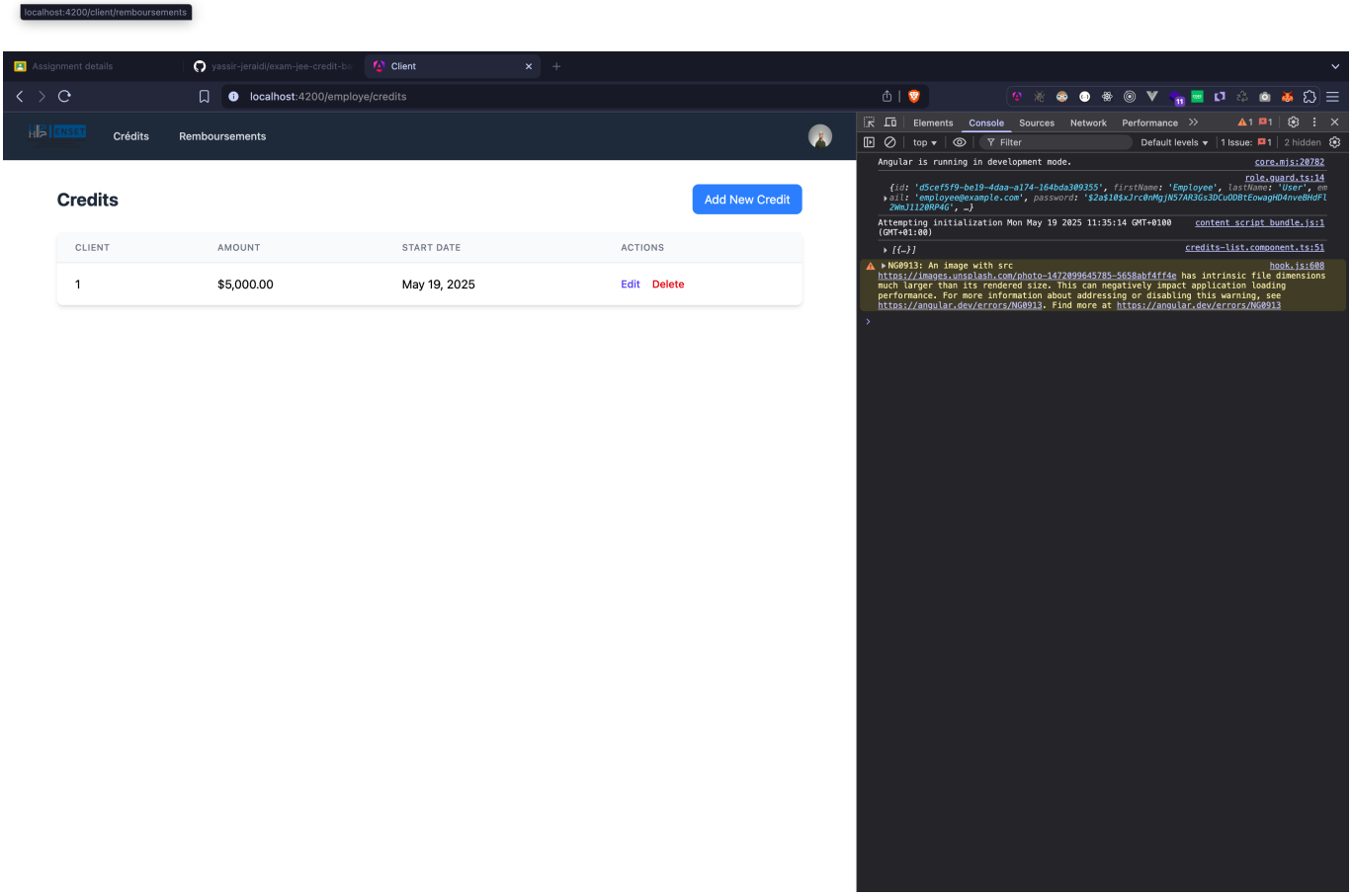
Remboursement Management





Dashboard Views





4. Backend (Spring Boot)

Architecture Layers

1. **Controller Layer**
    - AuthenticationController

        - POST /api/auth/login
        - POST /api/auth/register
    - ClientController
        - GET /api/clients
        - GET /api/clients/{id}
        - POST /api/clients
        - PUT /api/clients/{id}
        - DELETE /api/clients/{id}
    - CreditController
        - GET /api/credits
        - GET /api/credits/{id}
        - GET /api/credits/client/{clientId}
        - POST /api/credits
        - PUT /api/credits/{id}
        - DELETE /api/credits/{id}
    - RemboursementController
        - GET /api/remboursements
        - GET /api/remboursements/{id}
        - GET /api/remboursements/credit/{creditId}
        - POST /api/remboursements
        - PUT /api/remboursements/{id}
        - DELETE /api/remboursements/{id}

2. **Service Layer**

    - ClientService
        - CRUD operations for clients
        - Client validation
        - Credit history retrieval
    - CreditService
        - CRUD operations for credits
        - Credit calculation
        - Payment schedule generation
    - RemboursementService
        - CRUD operations for remboursements
        - Payment tracking
        - Balance calculation
    - AuthenticationService
        - User authentication
        - JWT token management
        - Password encryption

3. **Repository Layer**

    - ClientRepository
        - JPA repository for client operations
    - CreditRepository
        - JPA repository for credit operations

    - RemboursementRepository
        - JPA repository for remboursement operations

Key Features

- RESTful API endpoints
- JWT-based authentication
- Role-based authorization
- Data validation and error handling
- Transaction management
- Exception handling
- Logging and monitoring
- CORS configuration
- Swagger documentation

5. Database Design

Entity Relationships

- **Client**: One-to-Many relationship with Credit
- **Credit**: One-to-Many relationship with Remboursement
- **User**: Base entity for authentication

Tables

1. **clients**
    - id (PK, BIGINT)
    - nom (VARCHAR)
    - prenom (VARCHAR)
    - email (VARCHAR, UNIQUE)
    - telephone (VARCHAR)
    - created_at (TIMESTAMP)
    - updated_at (TIMESTAMP)
2. **credits**
    - id (PK, BIGINT)
    - montant (DECIMAL)
    - taux (DECIMAL)
    - duree (INT)
    - dateDebut (DATE)
    - client_id (FK, BIGINT)
    - status (VARCHAR)
    - created_at (TIMESTAMP)
    - updated_at (TIMESTAMP)
3. **remboursements**
    - id (PK, BIGINT)

- montant (DECIMAL)
- dateRemboursement (DATE)
- credit_id (FK, BIGINT)
- status (VARCHAR)
- created_at (TIMESTAMP)
- updated_at (TIMESTAMP)

4. **users**
   - id (PK, BIGINT)
   - username (VARCHAR, UNIQUE)
   - password (VARCHAR)
   - role (VARCHAR)
   - enabled (BOOLEAN)
   - created_at (TIMESTAMP)
   - updated_at (TIMESTAMP)

6. Communication Flow

Frontend-Backend Communication

1. **Authentication Flow**
   - User submits credentials
   - Backend validates and returns JWT
   - Frontend stores JWT for subsequent requests
   - JWT included in Authorization header

2. **Data Operations**
   - HTTP GET for retrieving data
   - HTTP POST for creating new records
   - HTTP PUT for updating existing records
   - HTTP DELETE for removing records
   - Error handling and status codes
   - Response data formatting

API Endpoints

```
/api/auth/*
/api/clients/*
/api/credits/*
/api/remboursements/*
```

7. Role Management and Authorization

User Roles

1. **ADMIN**
    - Full system access
    - User management
    - System configuration
    - View all clients and credits
    - Manage all remboursements
2. **CLIENT**
    - View own credits
    - View own repayments
    - Update personal information
    - Request new credits
    - View payment history
3. **EMPLOYE**
    - Process credit applications
    - Manage repayments
    - View client information
    - Generate reports
    - Handle client queries

Security Implementation

- Role-based route guards
- JWT token validation
- Secure password hashing
- CORS configuration
- Request validation
- Input sanitization
- SQL injection prevention
- XSS protection

8. Conclusion

The Credit Management System demonstrates a well-structured, secure, and scalable application architecture. The separation of concerns between frontend and backend, along with proper implementation of security measures, makes it a robust solution for credit management.

Future Improvements

1. **Technical Enhancements**
    - Implement WebSocket for real-time updates
    - Add comprehensive logging system
    - Implement caching for better performance
    - Add unit and integration tests
    - Implement CI/CD pipeline

2. **Feature Additions**
    - Credit scoring system
    - Automated payment reminders
    - Advanced reporting and analytics
    - Mobile application development
    - Email notifications
    - Document management

3. **Security Enhancements**
    - Two-factor authentication
    - Audit logging
    - Enhanced encryption
    - Rate limiting
    - IP whitelisting

4. **User Experience**
    - Enhanced dashboard visualizations
    - Improved form validations
    - Better error handling and user feedback
    - Responsive design improvements
    - Accessibility features
    - Multi-language support