FRS

CEBU INSTITUTE OF TECHNOLOGY
UNIVERSITY

IT342-Section SYSTEMS INTEGRATION AND ARCHITECTURE 1

FUNCTIONAL REQUIREMENTS SPECIFICATION (FRS)

Project Title: InStock

Prepared By: Gregory Ivan Onyx M. Badinas

Date of Submission: 02/03/2026

Version: 1

Table of Contents

1. Introduction

1.1. Purpose

The purpose of this document is to define the functional and non-functional requirements for the **Identity and Access Management (IAM) subsystem** of InStock. This subsystem provides the foundational security architecture required to manage user lifecycles across the Android mobile application, React web application, and Spring Boot backend.

1.2. Scope

The **InStock** system consists of three main components operating within a unified ecosystem:

1. **Mobile Client (Android/Kotlin):** A native application optimized for on-the-go pantry management and cooking assistance.
2. **Web Client (React):** A responsive web interface for recipe planning, profile management, and broader discovery.
3. **Backend (Spring Boot):** A centralized server providing RESTful APIs for authentication, data persistence, and the recipe matching logic.

1.3. Definitions, Acronyms, and Abbreviations

- **FRS:** Functional Requirements Specification.
- **API:** Application Programming Interface.
- **REST:** Representational State Transfer; the architectural style for the backend web services.
- **JWT:** JSON Web Token; used for stateless user authentication.
- **IAM:** Identity and Access Management

2. Overall Description

2.1. System Perspective

InStock operates as a distributed client-server system.

- **Presentation Layer (Frontend):** The Android and React clients capture user credentials and manage session states (Login/Logout).

- **Business Logic Layer (Backend):** The Spring Boot application acts as the "brain," enforcing security policies, password hashing, and role-based access control during registration and login.
- **Data Layer:** A centralized relational database (PostgreSQL/MySQL) provides data durability for user profiles and hashed credentials

2.2. User Classes and Characteristics

- **End User:** Individuals who register accounts to personalize their experience. They require a seamless, high-usability interface for authentication.
- **System Administrator:** Responsible for monitoring system health and managing user accounts through the backend administrative interface.

2.3. Operating Environment

- **Mobile Client:** Android devices (Android 7.0+) .
- **Web Client:** Modern browsers utilizing **Secure & HttpOnly cookies** to protect session tokens from malicious JavaScript.
- **Backend Server:** Spring Boot environment managing RESTful API endpoints for authentication.
- **Network:** Requires an active connection to verify credentials against the server in real-time.

2.4. Assumptions and Dependencies

- **Connectivity:** Users must be online to register or log in; however, the system uses **JWT (JSON Web Tokens)** to allow for stateless session verification once the initial login is successful.
- **Token Integrity:** It is assumed that the client securely handles the **Logout** process by invalidating local tokens and clearing session metadata to prevent unauthorized access.

3. System Features and Functional Requirements

3.1. Feature 1:

Description: Enables new users to create a unique identity within the InStock ecosystem. This feature follows a "Backend-first" strategy, ensuring that all data validation and password hashing are centralized within the Spring Boot business layer to maintain consistency across the React and Android platforms.

Functional Requirements:

- **REQ-1.1:** The system shall provide a registration interface to capture user details, including Email, Password, and Full Name.
- **REQ-1.2:** The Spring Boot backend shall validate the uniqueness of the email address and enforce password complexity requirements before persistence.

- **REQ-1.3:** The system shall utilize industry-standard hashing (e.g., BCrypt) to secure passwords at rest in the relational database.
- **REQ-1.4:** Upon successful registration, the system shall provide a clear, actionable success message to the user or an error message if the registration fails.

3.2. Feature 2:

Description: The mechanism for verifying user identity and establishing a secure session. To prevent authorization code injection, the system implements the Authorization Code with PKCE flow, which is mandatory for modern mobile and SPA security.

Functional Requirements:

- **REQ-2.1:** The system shall authenticate users via a REST API and issue a **JSON Web Token (JWT)** for stateless session management.
- **REQ-2.2:** The backend shall issue short-lived Access Tokens and long-lived Refresh Tokens.
- **REQ-2.3:** The Android client shall store tokens in the **Android Keystore**, providing encryption-at-rest for sensitive credentials.
- **REQ-2.4:** The React client shall store tokens in **Secure & HttpOnly cookies** to prevent access by malicious JavaScript (XSS).

3.3. Feature 3:

Description: Ensures the secure termination of the user session across distributed clients. This process prioritizes data integrity by clearing sensitive session metadata.

Functional Requirements:

- **REQ-3.1:** The system shall provide a "Logout" function that clears the local JWT and session data from the client's secure storage.
- **REQ-3.2:** The Spring Boot backend shall provide an endpoint to invalidate or blacklist the current Refresh Token to prevent further access.
- **REQ-3.3:** The system shall immediately redirect the user to the login interface upon successful session termination.
- **REQ-3.4:** The system shall "Fail Gracefully," ensuring local tokens are cleared even if a network error occurs during the logout request.

4. Non-Functional Requirements

4.1. Security

- Authentication: All user endpoints must be secured using OAuth 2.0 or JWT (JSON Web Tokens). Passwords must be hashed using BCrypt before storage.

- Data Privacy: User data, specifically email and dietary restrictions, must be encrypted at rest and in transit (HTTPS/TLS 1.3).

4.2. Performance

- Latency: The Recipe Generation API call should return results in under 30 seconds for a standard query of <20 ingredients.
- Scalability: The Spring Boot backend must be stateless to support horizontal scaling across multiple instances if user load increases.

4.3. Reliability & Availability

- **Centralized Error Handling:** Use middleware to categorize errors by severity. For example, a "Database Timeout" during registration is a **P0 (Critical)** failure, while an "Invalid Email Format" is a **P2 (Minor)** user-input error.
- **User-Centric Feedback:** Rather than exposing technical stack traces or generic 500 codes, the system must provide actionable, plain-language messages (e.g., "Account already exists" or "Check your internet connection").
- **Availability:** The authentication subsystem must prioritize **Partition Tolerance and Availability** (referencing the CAP Theorem), ensuring users can still access the system even if certain non-critical background services are down.

4.4. Usability

- Feedback: The system must provide visual feedback (loading spinners, toast notifications) forRegistration, Logging in, and Logout.

5. System Models (Diagrams)

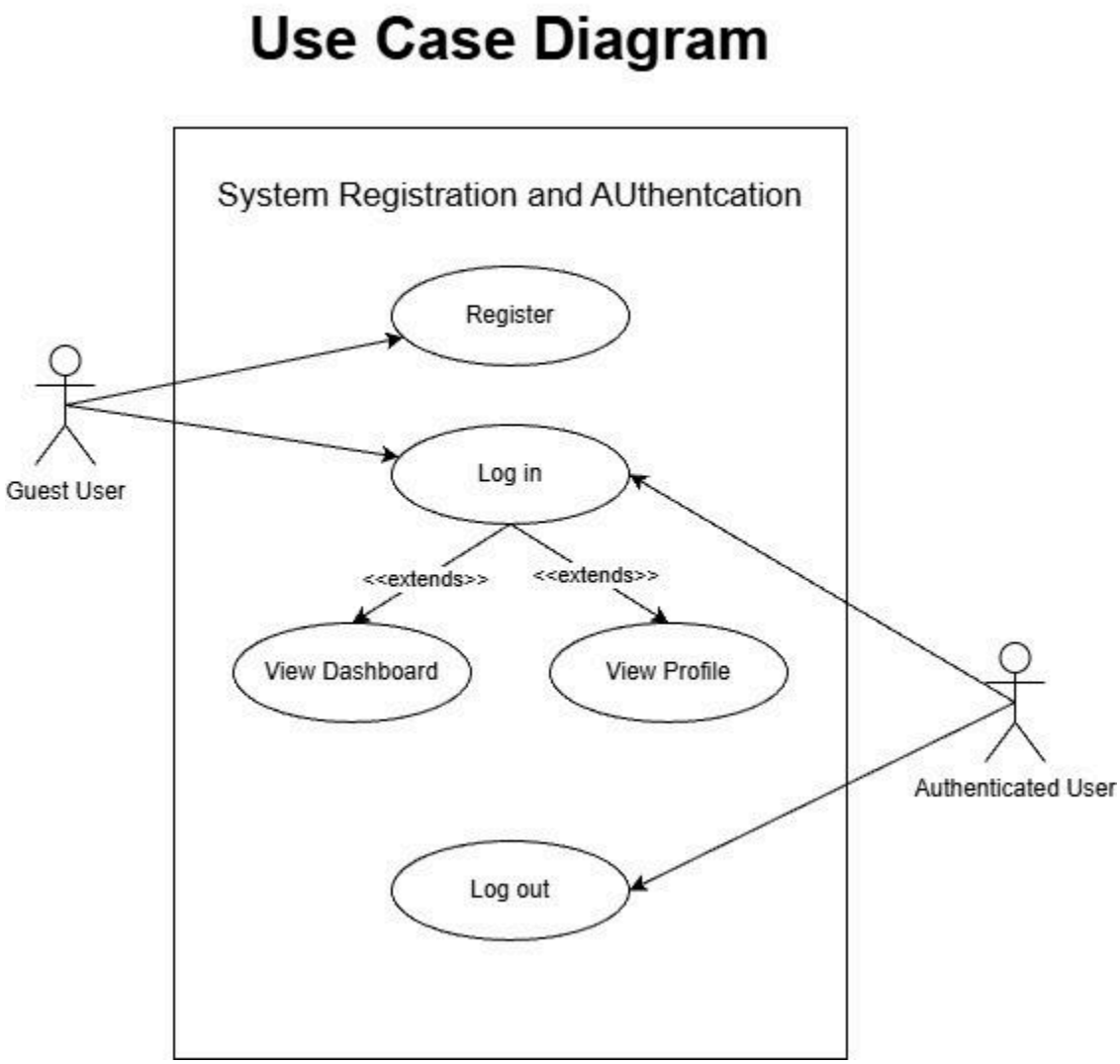
5.1. ERD

ERD

System Registration and Authentication

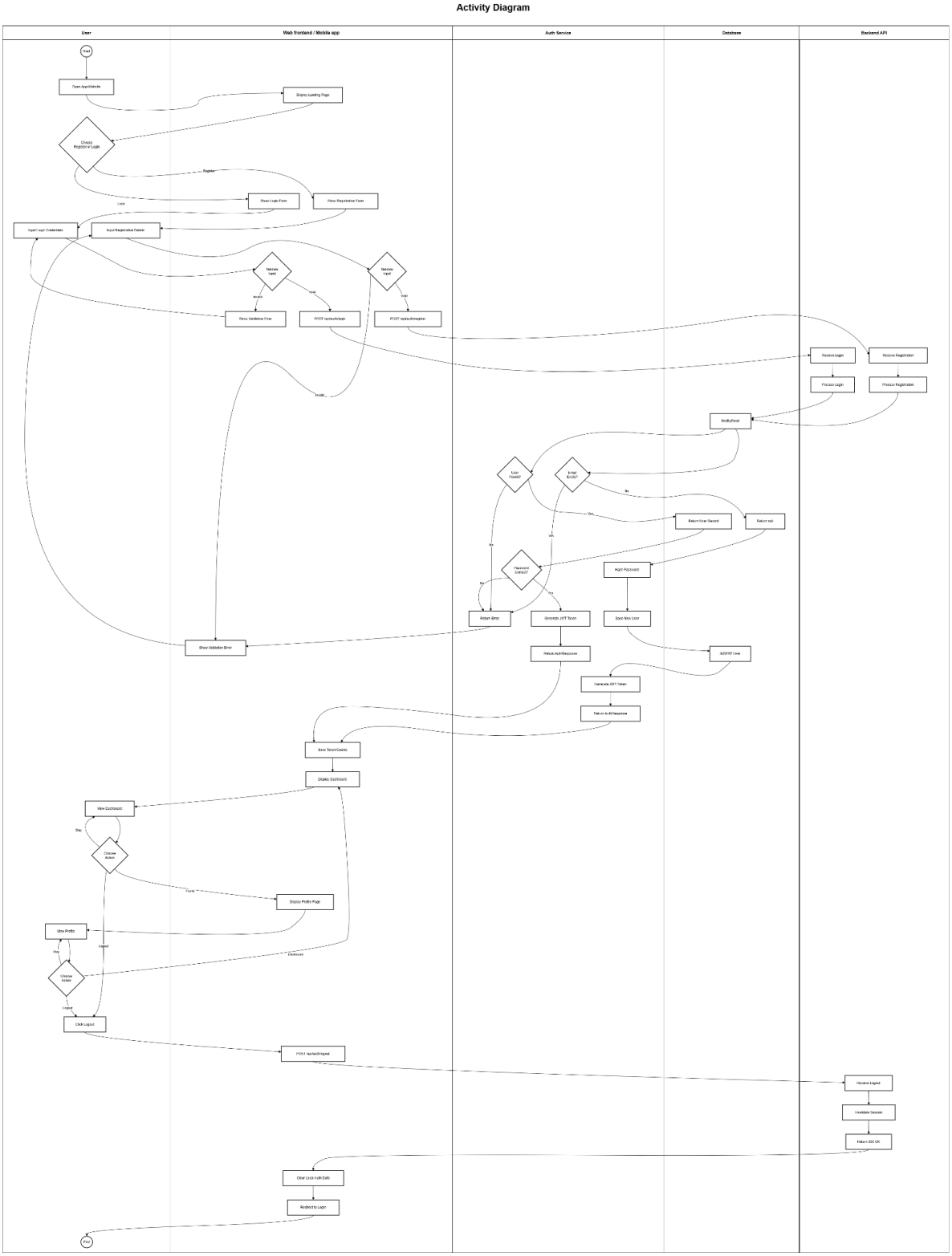
USER			
Long	id	PK	Auto-incrementing ID
String	name		User full name
String	email	UK	Unique, used for login
String	password		Bcrypt hashed password

5.2. Use Case Diagram



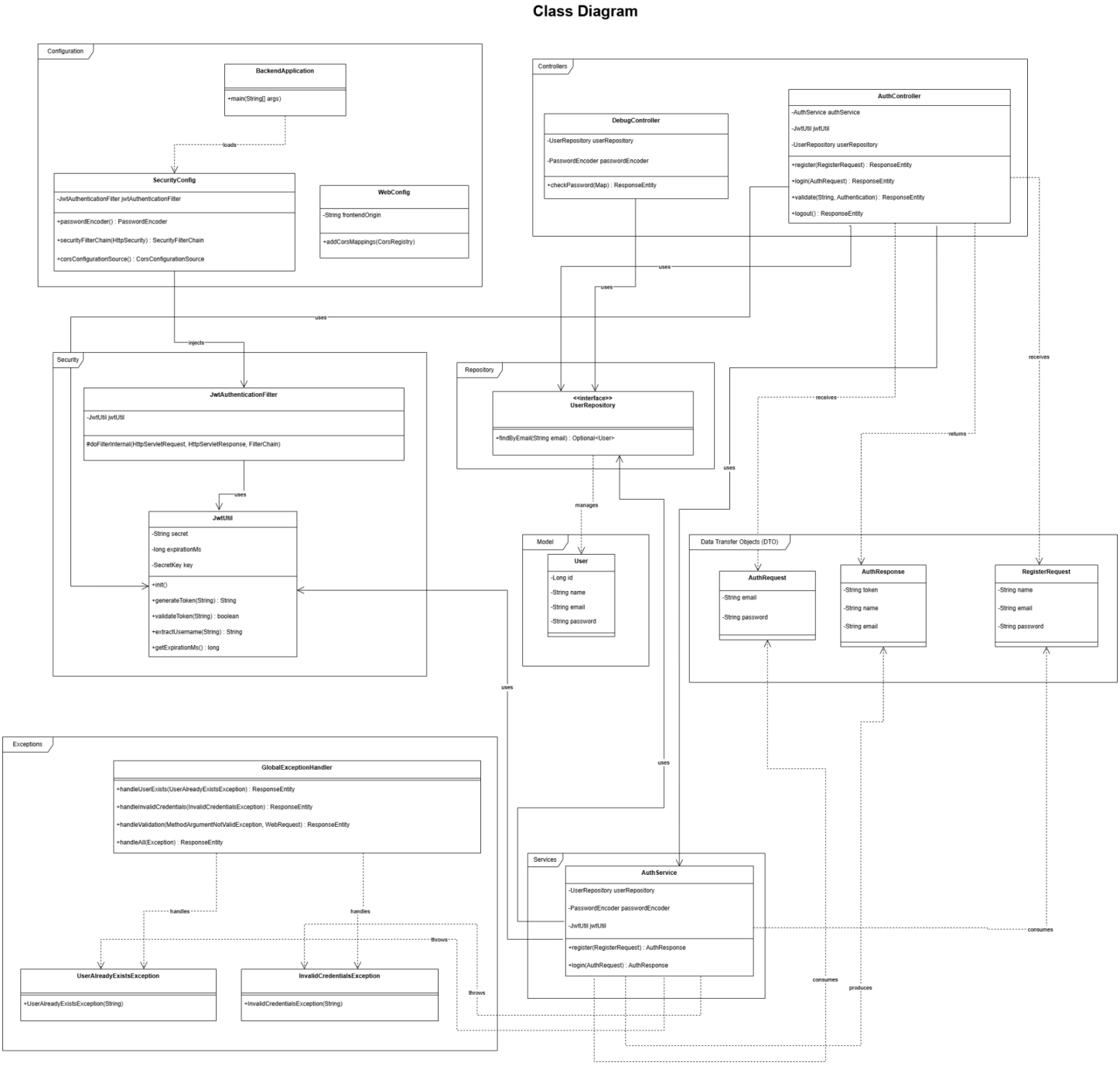
5.3. Activity Diagram

https://1drv.ms/u/c/cd7169125e303623/IQBiTUWiqHo4Q5F4rtyPegmNAZIIW9IN3YMEXBeJ755PUwU?e=my6OmJ



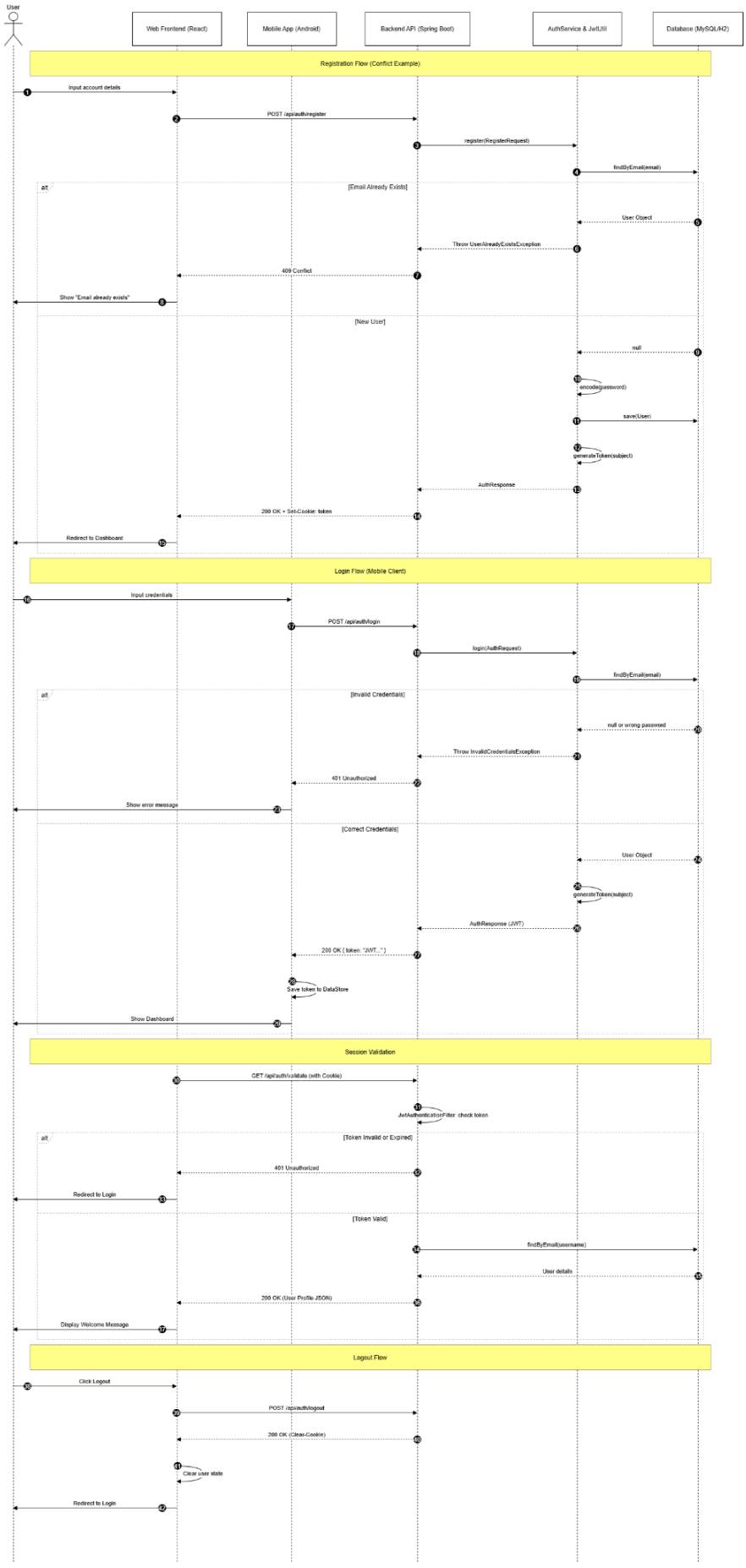
5.4. Class Diagram

https://1drv.ms/u/c/cd7169125e303623/IQBus8ba_lxQT4NLBsYpFVFdAWwIlJYdarIV7B06HHhGu6I



5.5. Sequence Diagram

https://1drv.ms/u/c/cd7169125e303623/IQCf2X4KSV0yRrt_M-9aUvL-ASnc6TtlZRH5t_IDT9HKSOs


User
Web Frontend (React)
Mobile App (Android)
Backend API (Spring Boot)
AuthService & JwtUtil
Database (MySQL/H2)
Registration Flow (Conflict Example)
1 Input account details
2 POST /api/auth/register
3 register(RegisterRequest)
4 findByEmail(email)
alt
[Email Already Exists]
5 User Object
6 Throw UserAlreadyExistsException
7 409 Conflict
8 Show "Email already exists"
[New User]
9 null
10 encode(password)
11 save(User)
12 generateToken(subject)
13 AuthResponse
14 200 OK + Set-Cookie: token
15 Redirect to Dashboard
Login Flow (Mobile Client)
16 Input credentials
17 POST /api/auth/login
18 login(AuthRequest)
19 findByEmail(email)
alt
[Invalid Credentials]
20 null or wrong password
21 Throw InvalidCredentialsException
22 401 Unauthorized
23 Show error message
[Correct Credentials]
24 User Object
25 generateToken(subject)
26 AuthResponse (JWT)
27 200 OK { token: "JWT..." }
28 Save token to DataStore
29 Show Dashboard
Session Validation
30 GET /api/auth/validate (with Cookie)
31 JwtAuthenticationFilter: check token
alt
[Token Invalid or Expired]
32 401 Unauthorized
33 Redirect to Login
[Token Valid]
34 findByEmail(username)
35 User details
36 200 OK (User Profile JSON)
37 Display Welcome Message
Logout Flow
38 Click Logout
39 POST /api/auth/logout
40 200 OK (Clear-Cookie)
41 Clear user state
42 Redirect to Login

6. Appendices

[1] System Integration & Architecture Course, "System integration and architecture," *Scribd*, Feb. 01, 2026. [Online]. Available: https://fr.scribd.com/document/559863705/System-Integration-and-Architecture-P1.

[2] "Chapter 1 - Introduction to system integration and architecture," *SlideShare*, Feb. 01, 2026. [Online]. Available: https://www.slideshare.net/slideshow/chapter-1-introduction-to-system-integration-and-architecturepdf/263057894.

[3] "What is enterprise application integration? - EAI explained," *AWS*, Feb. 01, 2026. [Online]. Available: https://aws.amazon.com/what-is/enterprise-application-integration/.

[4] IBM, "What is enterprise application integration?," *IBM Think*, Feb. 01, 2026. [Online]. Available: https://www.ibm.com/think/topics/enterprise-application-integration.

[5] NareshIT, "How full stack Java projects work: Frontend, backend & database," *NareshIT Blogs*, Feb. 01, 2026. [Online]. Available: https://nareshit.com/blogs/inside-a-full-stack-java-project-how-frontend-backend-and-database-work-together.

[6] Simform, "Mobile application architecture: Layers, types, principles, factors," *Simform Blog*, Feb. 01, 2026. [Online]. Available: https://www.simform.com/blog/mobile-application-architecture/.

[7] Techstack, "Exploring modern web app architectures: Trends and best practices for 2026," *Techstack Blog*, Feb. 01, 2026. [Online]. Available: https://tech-stack.com/blog/modern-application-development/.

[8] AWS, "What is middleware?," *AWS*, Feb. 01, 2026. [Online]. Available: https://aws.amazon.com/what-is/middleware/.

[9] OWASP, "Mobile app authentication architectures," *OWASP Mobile Application Security*, Feb. 01, 2026. [Online]. Available: https://mas.owasp.org/MASTG/0x04e-Testing-Authentication-and-Session-Management/.

[10] Droidcon, "The complete guide to offline-first architecture in Android," *Droidcon*, Dec. 16, 2025. [Online]. Available: https://www.droidcon.com/2025/12/16/the-complete-guide-to-offline-first-architecture-in-android/.

[11] GeeksforGeeks, "Sequence diagrams - Unified Modeling Language (UML)," *GeeksforGeeks*, Feb. 01, 2026. [Online]. Available:

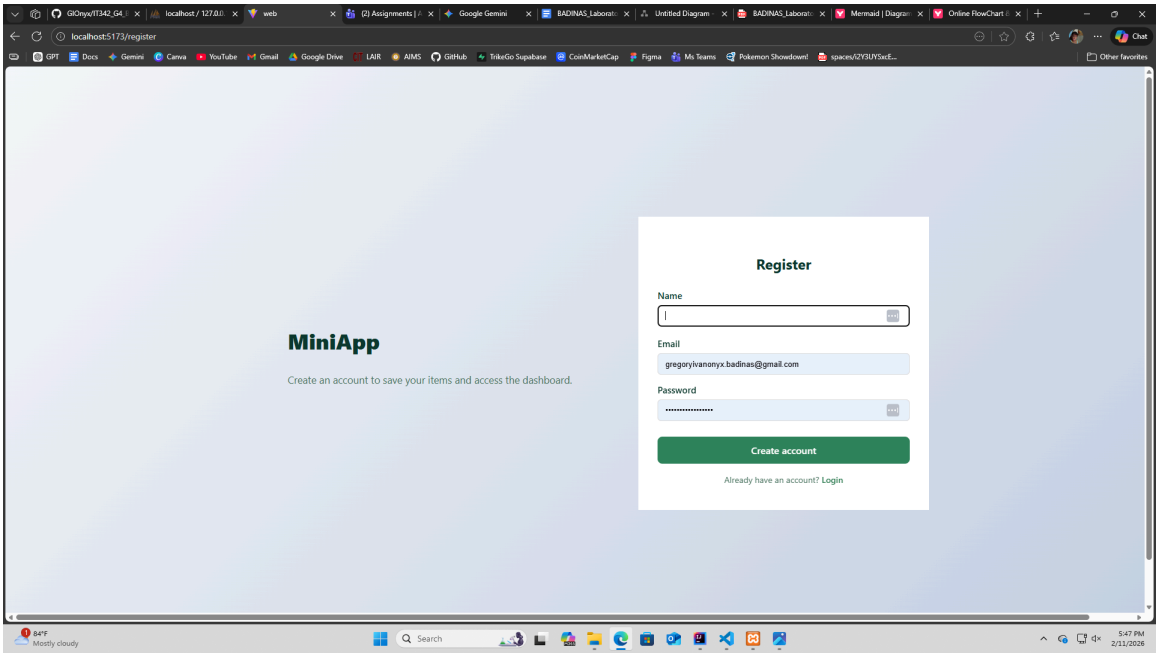
https://www.geeksforgeeks.org/system-design/unified-modeling-language-uml-sequence-diagrams/.

[12] OneUptime, "How to document REST APIs with OpenAPI," *OneUptime Blog*, Jan. 27, 2026. [Online]. Available: https://oneuptime.com/blog/post/2026-01-27-openapi-documentation/view.

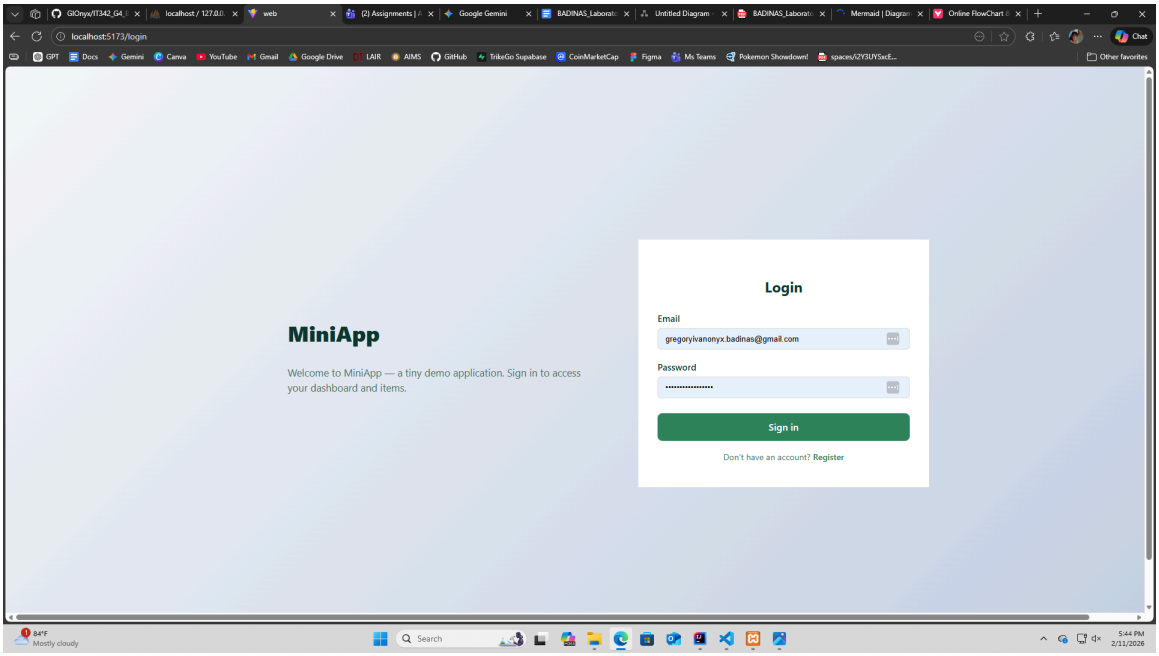
Screenshots

2) Final UI Screenshots

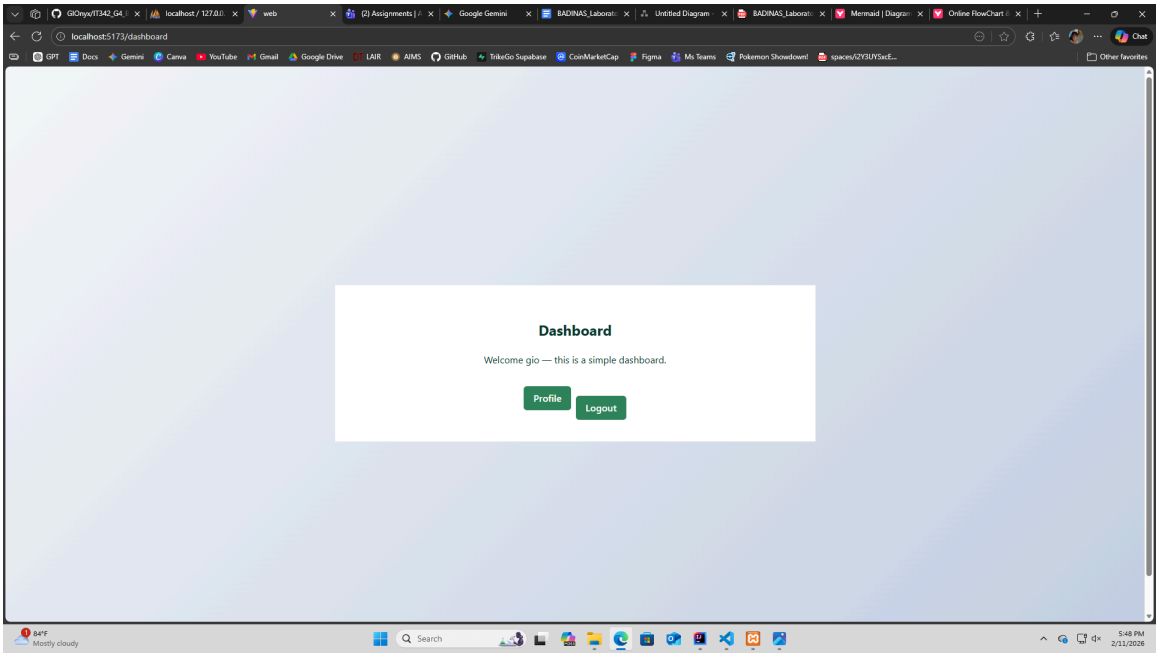
Registration

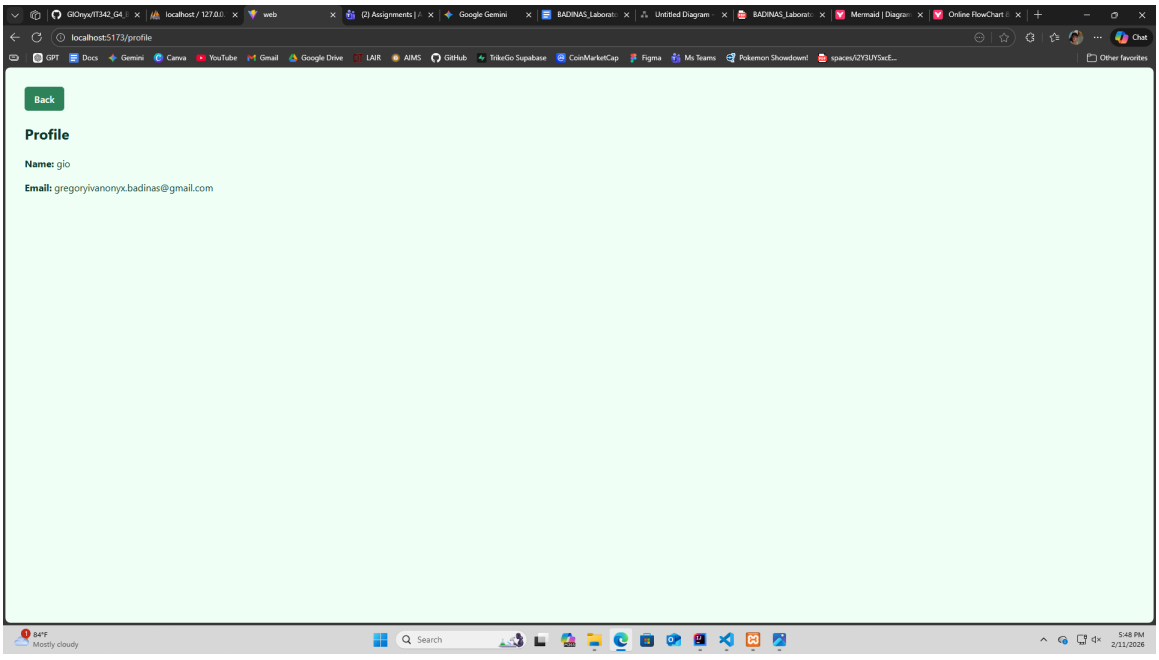


Log in

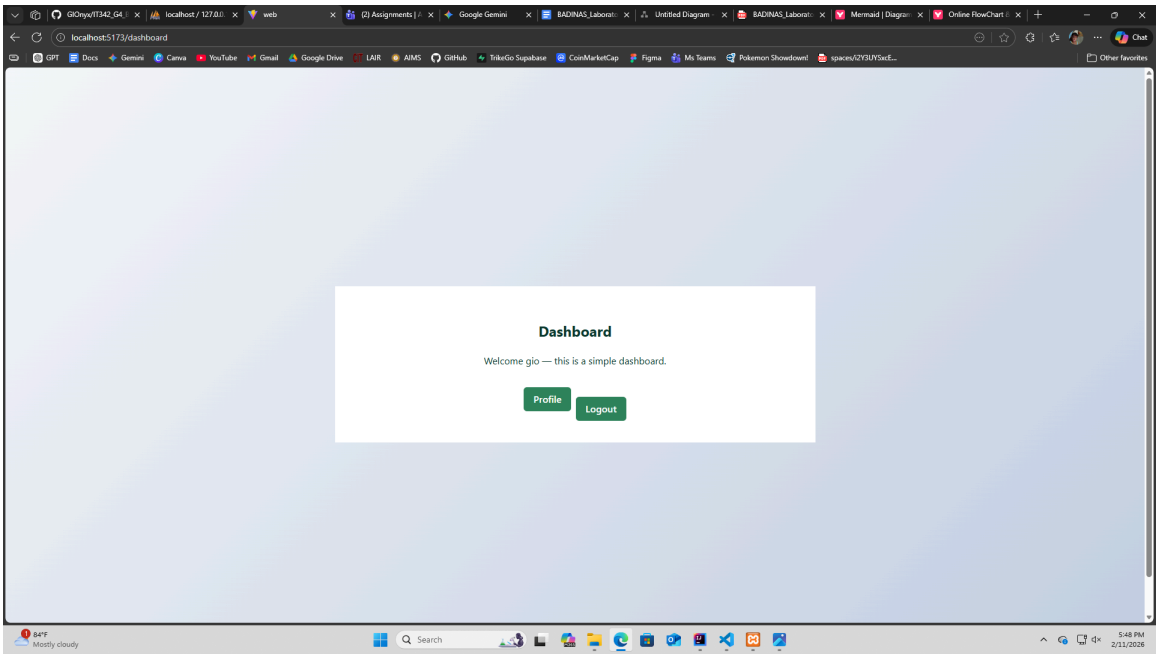


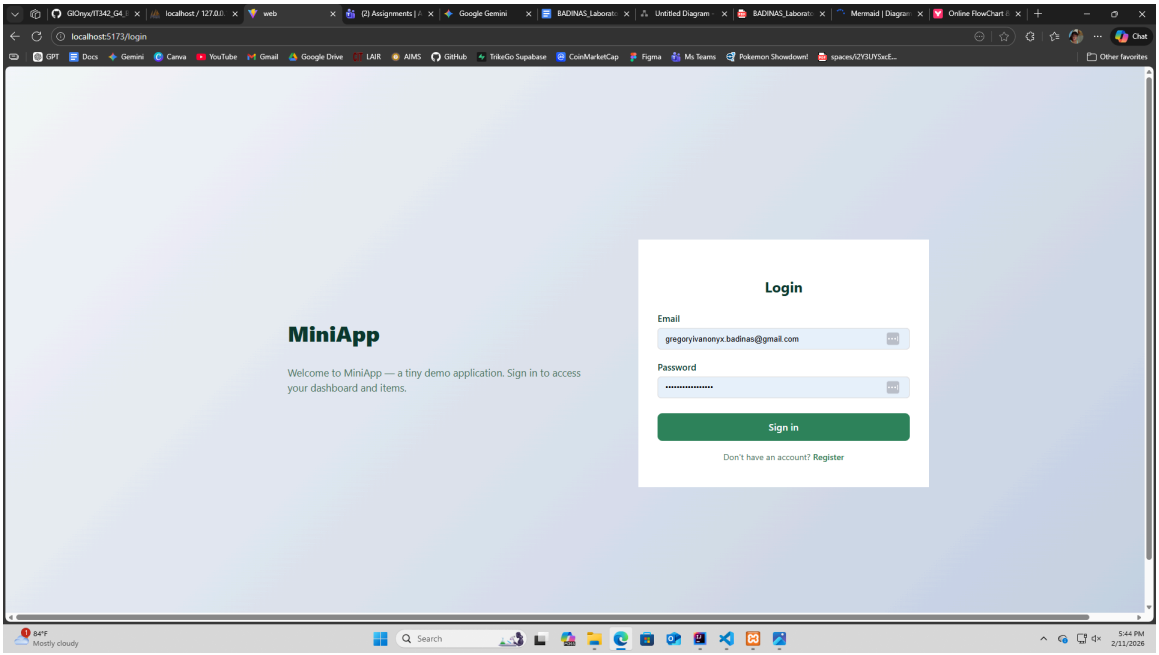
Profile/Dashboard





Log out redirection





3)Proof of Integration

Backend Logs