Project Report on

BlinkMe

**Minor Project**

Master of Computer Application

(Dual Degree)

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IPS Academy Indore

School of Computers

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2025

**Recommendation**

The Minor Project entitled **BlinkMe** submitted by **Siddharth Kar, Divyanshu Dwivedi, Megha More** is satisfactory account of the bona fide work done under my supervision is recommended towards Minor project of **MCA- Dual Degree VI Semester** by **RGPV Bhopal.**

Date: 28/05/25 Project Guide: Prof. Aftab Qureshi

Principal

IPS Academy Indore

School of Computers

**Acknowledgement**

The satisfaction that accompanies that the successful completion of any task would be incomplete without the mention of people whose ceaseless cooperation made it possible whose constant guidance and encouragement crown all efforts with success.

We are grateful to our guide **Prof. Aaftab Qureshi** for the guidance, inspiration and constructive suggestions that helpful us in preparation of this project.

We also thanks who have helped in successful completion of the project.

Date: 28/05/25 Siddharth Kar, Divyanshu Dwivedi, Megha More

Place: IPS Academy Indore 0810CA22DD57 | 0810CA22DD12 | 0810CA22DD32

MCA-Dual Degree VI Sem

**Minor Project Approval Sheet**

The Minor Project entitled **BlinkMe** submitted by **Siddharth Kar, Divyanshu Dwivedi, Megha More** is approved as Minor project of **MCA- Dual Degree VI Semester** by **RGPV Bhopal.**

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**(Internal Examiner) (External Examiner)**

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# Chapter 1: Introduction

## 1.1 Introduction

BlinkME is a comprehensive, full-stack end-to-end encrypted messaging application designed to replicate and enhance the core functionalities of popular messaging platforms like WhatsApp. Built using modern web technologies, BlinkME provides users with a secure, real-time communication platform that supports both individual and group messaging capabilities.

The application leverages cutting-edge technologies including React.js for the frontend, Spring Boot for the backend, and WebSocket (STOMP) protocol for real-time communication. Security is paramount in BlinkME, with JWT-based authentication ensuring user data protection and secure communication channels.

## 1.2 Problem Definition

In today's digital age, secure and reliable communication platforms are essential for personal and professional interactions. While numerous messaging applications exist, there is a continuous need for:

Secure, end-to-end encrypted communication systems

Real-time messaging capabilities with minimal latency

Comprehensive user management and privacy controls

Scalable group communication features

Media sharing with efficient storage solutions

Cross-platform compatibility and responsive design

## 1.3 Motivation

The motivation behind developing BlinkME stems from the need to create a robust messaging platform that combines security, functionality, and user experience. Key motivating factors include:

**Security Concerns:** With increasing cyber threats, users require messaging platforms with robust encryption and authentication mechanisms

**Real-time Communication:** The demand for instant, seamless communication in both personal and professional contexts

**Educational Purpose:** Gaining hands-on experience with full-stack development, real-time protocols, and modern web technologies

**Innovation Opportunity:** Implementing advanced features like user blocking, status management, and group administration

## 1.4 Objective

The primary objectives of the BlinkME project are:

**Primary Objectives:**

Develop a secure, end-to-end encrypted messaging application

Implement real-time communication using WebSocket (STOMP) protocol

Create an intuitive and responsive user interface

Establish robust user authentication and authorization systems

**Secondary Objectives:**

Implement comprehensive group chat functionality

Develop media sharing capabilities with efficient storage

Create user profile management with status and bio features

Implement user blocking and privacy management

Ensure scalable architecture for future enhancements

## 1.5 Proposed Solution

BlinkME addresses the identified problems through a comprehensive solution architecture:

**Backend Solution:**

**Spring Boot Framework:** Provides robust backend infrastructure

**JWT Authentication:** Ensures secure user authentication and session management

**WebSocket (STOMP):** Enables real-time bidirectional communication

**PostgreSQL Database:** Reliable data persistence and management

**Spring Security:** Comprehensive security framework implementation

**Frontend Solution:**

**React.js with Vite:** Modern, efficient frontend development

**Responsive Design:** Cross-device compatibility

**Real-time UI Updates:** Seamless user experience with instant message delivery

**Intuitive User Interface:** User-friendly design for enhanced usability

## 1.6 Platform Specification

**1.6.1 Hardware Specification**

**Minimum System Requirements:**

**Processor:** Intel Core i3 or AMD equivalent

**RAM:** 4 GB minimum, 8 GB recommended

**Storage:** 10 GB available disk space

**Network:** Broadband internet connection

**Development Environment:**

**Processor:** Intel Core i5 or higher

**RAM:** 8 GB minimum, 16 GB recommended

**Storage:** SSD with 20 GB available space

**Network:** High-speed internet connection

**1.6.2 Software Specification**

**Backend Requirements:**

Java 11 or higher

PostgreSQL Database Server

Maven Build Tool

Spring Boot Framework

IDE: IntelliJ IDEA or Eclipse **Frontend Requirements:**

Node.js (version 14 or higher) npm or yarn package manager

Modern web browser (Chrome, Firefox, Safari, Edge)

Code Editor: VS Code or similar

**1.6.3 Tools and Technology Backend Technologies:**

**Java:** Core programming language

**Spring Boot:** Application framework

**Spring Data JPA:** Data access layer

**Hibernate:** Object-relational mapping

**Spring WebSocket:** Real-time communication

**Spring Security:** Authentication and authorization

**JWT:** Token-based authentication

**PostgreSQL:** Relational database management

**Frontend Technologies:**

**React.js:** Frontend library

**Vite:** Build tool and development server

**HTML5/CSS3:** Markup and styling

**JavaScript (ES6+):** Client-side scripting

**SockJS:** WebSocket client library

**STOMP.js:** Simple Text Oriented Messaging Protocol **Development Tools:**

**Maven:** Build automation and dependency management

**Git:** Version control system **Postman:** API testing tool **pgAdmin:** PostgreSQL administration tool

## 1.7 Scope and Marketing

**Project Scope:**

BlinkME encompasses a complete messaging ecosystem with the following scope:

**Functional Scope:**

User registration and authentication

Real-time one-to-one messaging

Group chat creation and management

Media file sharing and storage

User profile customization

Status and bio management

User blocking and privacy controls

**Technical Scope:**

Full-stack web application development

Real-time communication implementation

* Database design and optimization

Security implementation and testing

Responsive frontend development

API design and documentation

**Marketing Potential:**

**Target Audience:** General users seeking secure messaging solutions

**Market Differentiation:** Focus on security, user experience, and feature completeness

**Scalability:** Architecture designed for growth and feature expansion

# Chapter 2: Background and Related Work

## 2.1 Existing System

**Current Messaging Applications:**

**WhatsApp:**

End-to-end encryption for messages

Group chat functionality

Media sharing capabilities

Status updates and profile management

Limitations: Proprietary platform, limited customization

**Telegram:**

Cloud-based messaging

Large group support

Bot integration

Security features with optional encryption

Limitations: Not fully end-to-end encrypted by default

**Signal:**

Strong focus on privacy and security

Open-source protocol

End-to-end encryption for all communications

Limitations: Smaller user base, limited features compared to mainstream apps

**Analysis of Existing Systems:**

Most existing messaging platforms focus on either security or feature richness, but rarely both. There's often a trade-off between user experience and security features. Additionally, many platforms are proprietary, limiting customization and transparency.

## 2.2 Proposed System

BlinkME addresses the limitations of existing systems by providing:

**Key Advantages:**

**Open Architecture:** Transparent implementation allowing for customization

**Balanced Approach:** Equal focus on security and user experience

**Modern Technology Stack:** Utilizing latest web technologies for optimal performance **Educational Value:** Clear documentation and structure for learning purposes

**System Features:**

Comprehensive user authentication with JWT

Real-time messaging with WebSocket implementation

Secure media sharing with server-side storage

Flexible group management system

Intuitive user interface with responsive design

Robust user privacy controls

## 2.3 Scope of Proposed System

**Immediate Scope:**

Complete messaging functionality (one-to-one and group)

User authentication and profile management

Media sharing capabilities

Basic group administration features

**Future Enhancement Scope:**

Voice and video calling integration

Advanced encryption protocols

Mobile application development

Message search and filtering capabilities

Integration with external services

Advanced analytics and reporting features

# Chapter 3: System Analysis and Design

## 3.1 Feasibility Study

**3.1.1 Technical Feasibility Technology Assessment:**

**Frontend Development:** React.js and Vite provide robust frontend development capabilities with excellent performance and developer experience

**Backend Development:** Spring Boot offers comprehensive framework support for enterprise-level applications

**Real-time Communication:** WebSocket (STOMP) protocol is well-established for real-time messaging applications

**Database Management:** PostgreSQL provides reliable, scalable data storage solutions

**Technical Challenges and Solutions:**

**Real-time Synchronization:** Resolved through proper WebSocket implementation and message queuing

**Security Implementation:** Addressed through JWT authentication and Spring Security integration

**Scalability Concerns:** Mitigated through efficient database design and optimized query structures

**Conclusion:** The project is technically feasible with the chosen technology stack and team expertise.

**3.1.2 Economical Feasibility Development Costs:**

**Software Costs:** Minimal, utilizing open-source technologies

**Hardware Costs:** Standard development machines sufficient

**Training Costs:** Leveraging existing team knowledge and free online resources

**Operational Costs:**

**Hosting Costs:** Moderate, depending on user base and server requirements

**Maintenance Costs:** Low to moderate, primarily developer time

**Licensing Costs:** Minimal, using open-source components

**3.1.3 Operational Feasibility**

**User Acceptance:**

Familiar interface design based on popular messaging applications

Intuitive user experience with minimal learning curve

Comprehensive feature set meeting user expectations

**System Integration:**

Standalone application with potential for future integrations

Standard web technologies ensuring broad compatibility

Responsive design supporting multiple devices

**Maintenance and Support:**

Well-documented codebase for easy maintenance

Modular architecture allowing for independent component updates

Clear separation between frontend and backend for targeted improvements

**Conclusion:** The system is operationally feasible with high potential for user adoption and easy maintenance.

## 3.2 Non-Functional Requirements

**Performance Requirements:**

**Response Time:** Messages should be delivered within 100ms under normal conditions

**Throughput:** System should support concurrent users with minimal performance degradation **Scalability:** Architecture should accommodate growing user base

**Security Requirements:**

* **Authentication:** Secure user login with JWT token management
* **Data Protection:** Encrypted data transmission and secure storage
* **Privacy:** User blocking and privacy control features

**Reliability Requirements:**

* **Availability:** 99.5% uptime target for production deployment

**Error Handling:** Comprehensive error management and user feedback

**Data Integrity:** Consistent data storage and retrieval

**Usability Requirements:**

**User Interface:** Intuitive, responsive design

**Accessibility:** Support for users with different abilities

**Cross-Platform:** Compatible across different devices and browsers

## 3.3 Functional Requirements

**User Management:**

User registration and login functionality

Profile creation and management

Status and bio customization

**Messaging Features:**

Real-time one-to-one messaging

Group chat creation and participation

Message history and persistence

Media file sharing and display

**Group Management:**

Group creation (public and private)

Member addition and removal

Admin role management

Join request handling

**Privacy and Security:**

User blocking functionality

Message encryption

Secure file sharing

Privacy settings management

## 3.4 Design

**System Architecture:**

BlinkME follows a client-server architecture with clear separation between frontend and backend components:

**Frontend (Client):**

React.js application with component-based architecture

State management for user interface and application data

WebSocket client for real-time communication

HTTP client for REST API communication

**Backend (Server):**

Spring Boot application with RESTful API design

WebSocket server for real-time messaging

JWT-based authentication service

Database access layer with JPA/Hibernate

**Database Design:**

The database schema includes the following main entities:

**Users:** User account information and profiles

**Messages:** Individual message records

**Groups:** Group chat information and metadata

**GroupMembers:** Many-to-many relationship between users and groups

**MediaFiles:** File storage metadata and references

**API Design:**

RESTful APIs for:

User authentication and management

Group operations

Media file handling

User preferences and settings

WebSocket endpoints for:

Real-time message delivery

Group chat communication

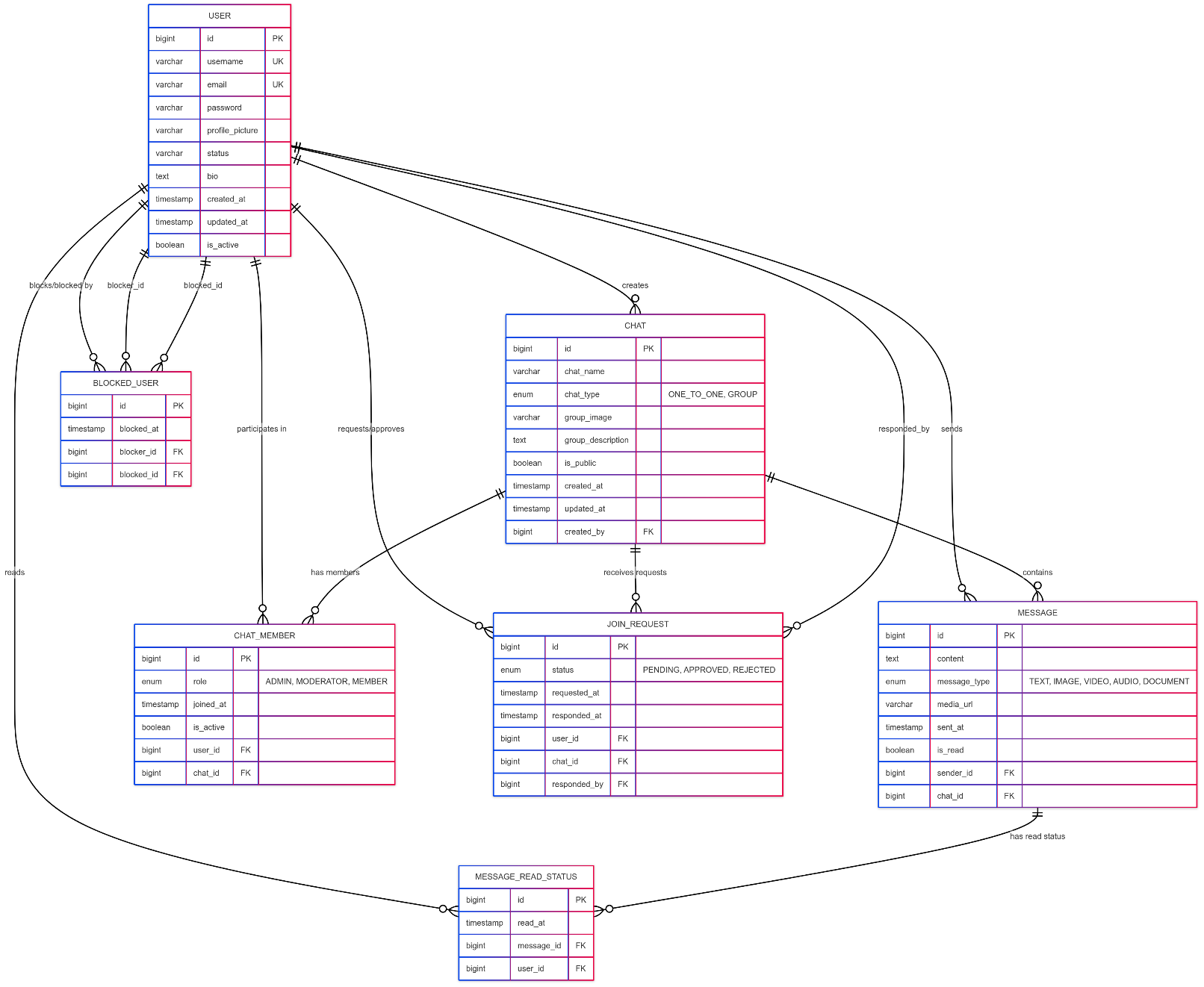
Online status updates

* Typing indicators

# Chapter 4: ER Diagram

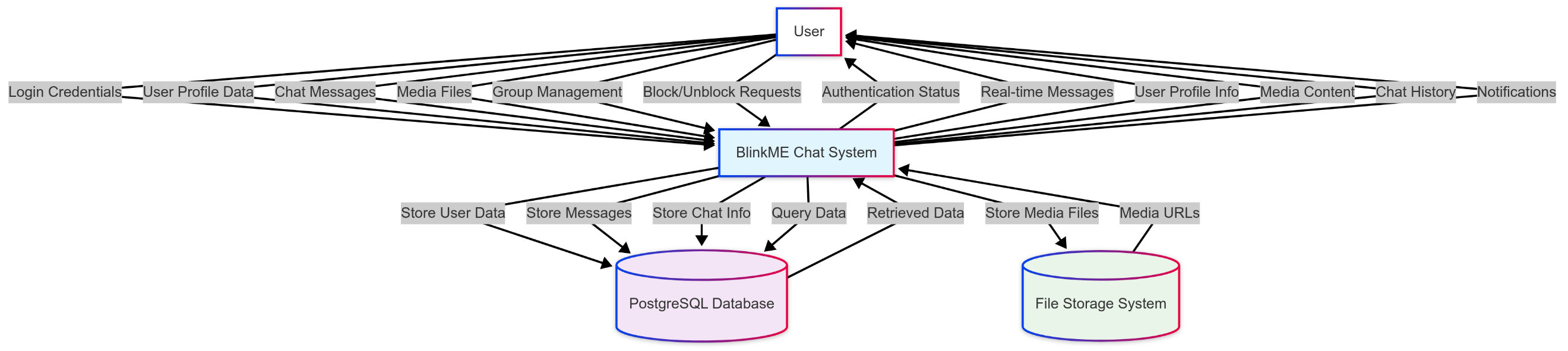
## Entity Relationship Diagram

The BlinkME database schema consists of the following main entities and their relationships:

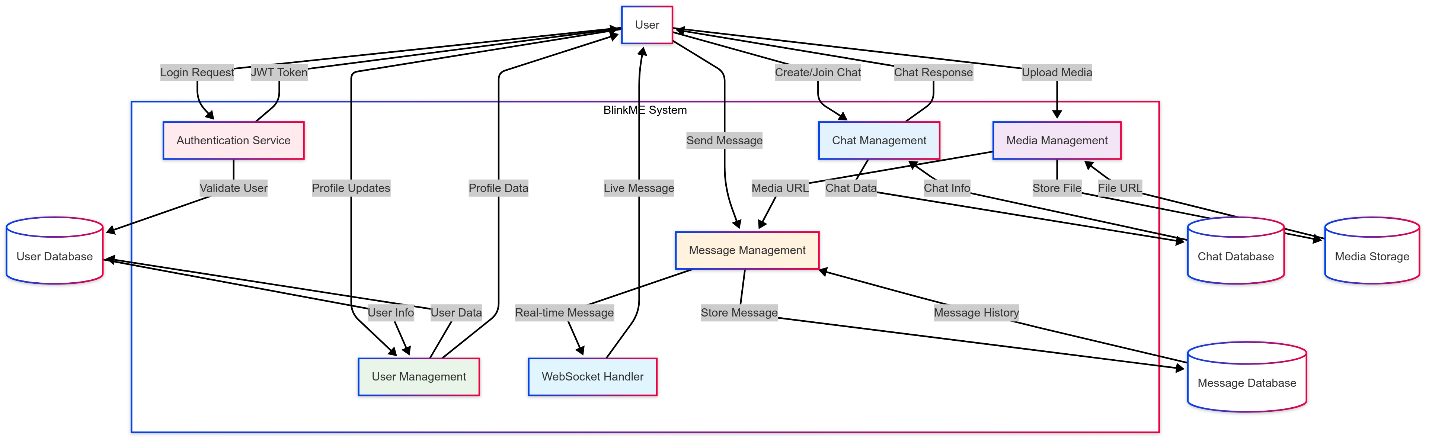


# Chapter 5: Data Flow Diagram

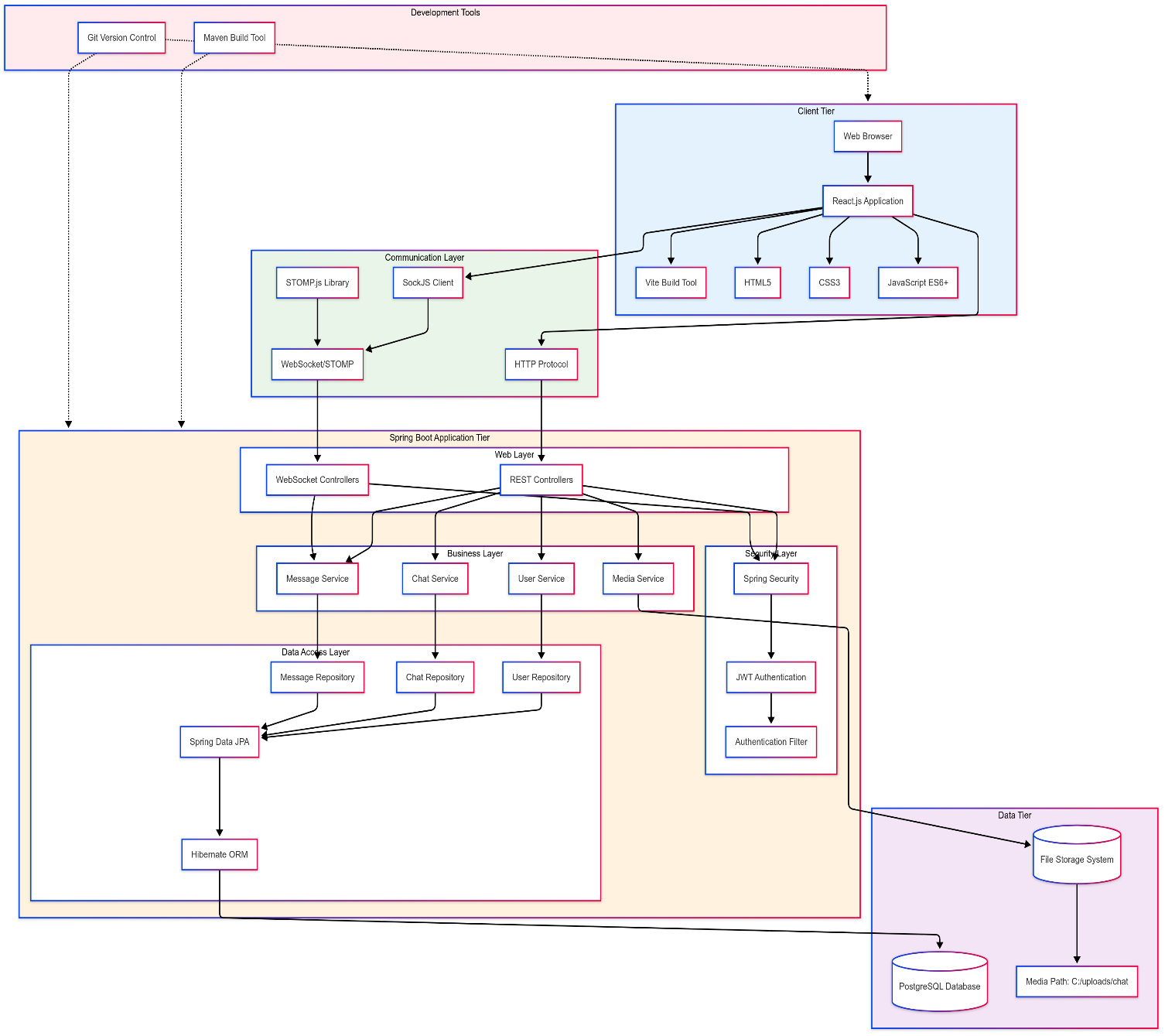
## Level 0 DFD (Context Diagram)



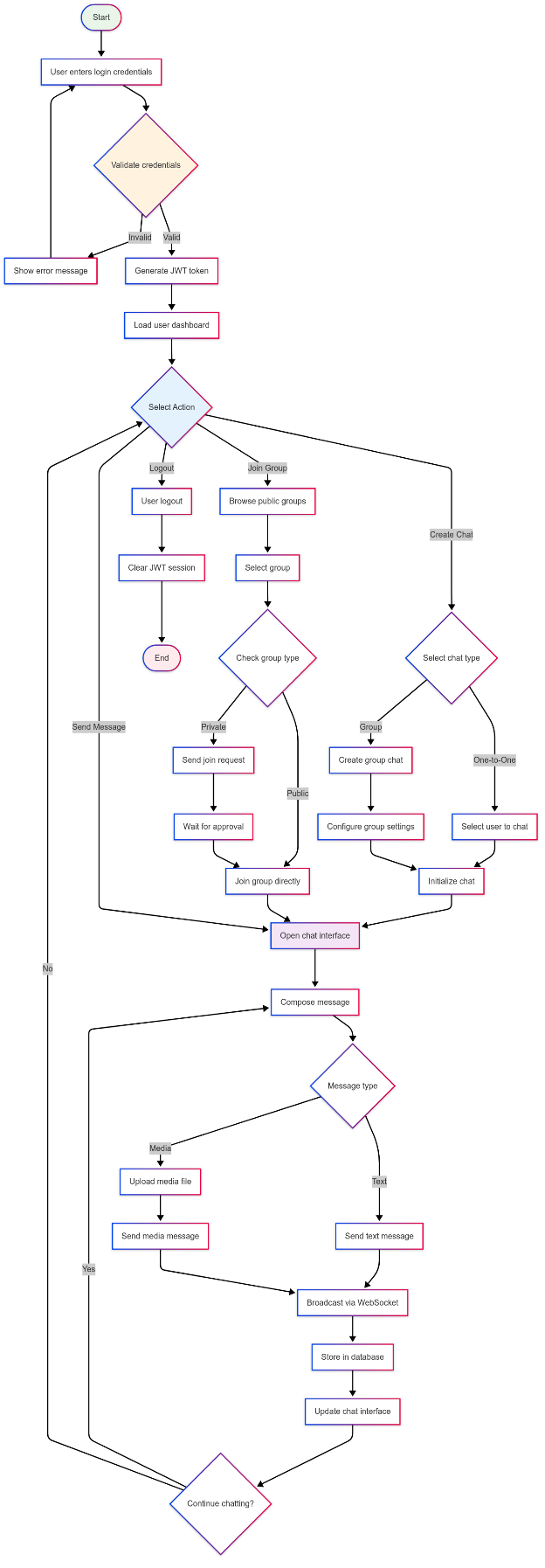
## Level 1 DFD



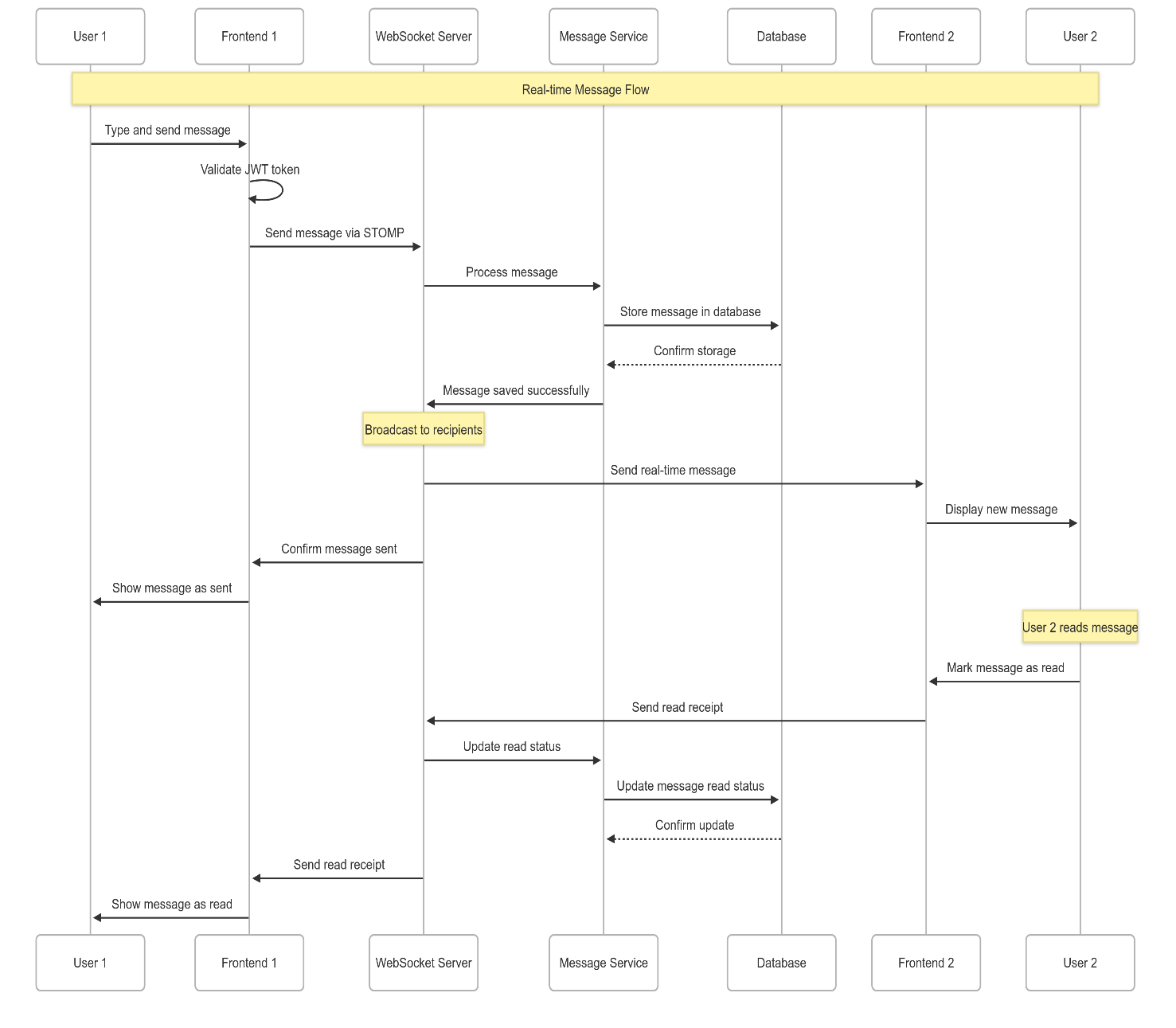
## System Architecture



## Activity Diagram



## Sequence Diagram



# Chapter 6: Implementation

## 6.1 Implementation

**Backend Implementation:**

**Spring Boot Application Structure:**

src/main/java/com/blinkme/

├── BlinkMeApplication.java

├── config/

│ ├── WebSocketConfig.java

│ ├── SecurityConfig.java

│ └── CorsConfig.java

├── controller/

│ ├── AuthController.java

│ ├── MessageController.java

│ ├── GroupController.java

│ └── UserController.java

├── model/

│ ├── User.java

│ ├── Message.java

│ ├── Group.java

│ └── GroupMember.java

├── repository/

│ ├── UserRepository.java

│ ├── MessageRepository.java

│ └── GroupRepository.java

├── service/

│ ├── UserService.java

│ ├── MessageService.java

│ ├── GroupService.java

│ └── AuthService.java

└── security/

├── JwtAuthenticationFilter.java

├── JwtTokenProvider.java

└── UserPrincipal.java

**Key Implementation Features:**

JWT token-based authentication

WebSocket configuration for real-time messaging

RESTful API endpoints for all major operations

File upload handling for media sharing

Database integration with JPA/Hibernate

**Frontend Implementation:**

**React Application Structure:**

/

│ ├── Auth/

│ │ ├── Login.jsx

│ │ └── Register.jsx

│ ├── Chat/

│ │ ├── ChatWindow.jsx

│ │ ├── MessageList.jsx

│ │ └── MessageInput.jsx

│ ├── Groups/

│ │ ├── GroupList.jsx

│ │ ├── GroupChat.jsx

│ │ └── GroupManagement.jsx

│ └── Profile/

│ ├── UserProfile.jsx

│ └── ProfileSettings.jsx

├── services/

│ ├── apiService.js

│ ├── websocketService.js

│ └── authService.js

├── utils/

│ ├── constants.js

│ └── helpers.js

└── App.jsx

**Key Implementation Features:**

Component-based architecture with React hooks

WebSocket integration for real-time updates

State management for application data

Responsive design with CSS modules

File upload functionality for media sharing

## 6.2 History and Features

**Development Timeline:**

1. **Phase 1:** Project planning and architecture design
2. **Phase 2:** Backend API development and database setup
3. **Phase 3:** Frontend component development
4. **Phase 4:** WebSocket integration for real-time features
5. **Phase 5:** Security implementation and testing
6. **Phase 6:** UI/UX refinement and bug fixes

**Key Features Implemented:**

Secure user authentication with JWT

Real-time messaging using WebSocket (STOMP)

Group chat functionality with admin controls

Media file sharing with server storage

User profile management with status updates

User blocking and privacy controls

**6.3 Application**

**Use Cases:**

**Personal Communication:** Individual users messaging privately

**Team Collaboration:** Groups for project coordination

**Social Networking:** Public groups for community building

**File Sharing:** Document and media distribution

**Status Updates:** Sharing current status and availability

**Target Users:**

Students and educational institutions

Small to medium-sized businesses

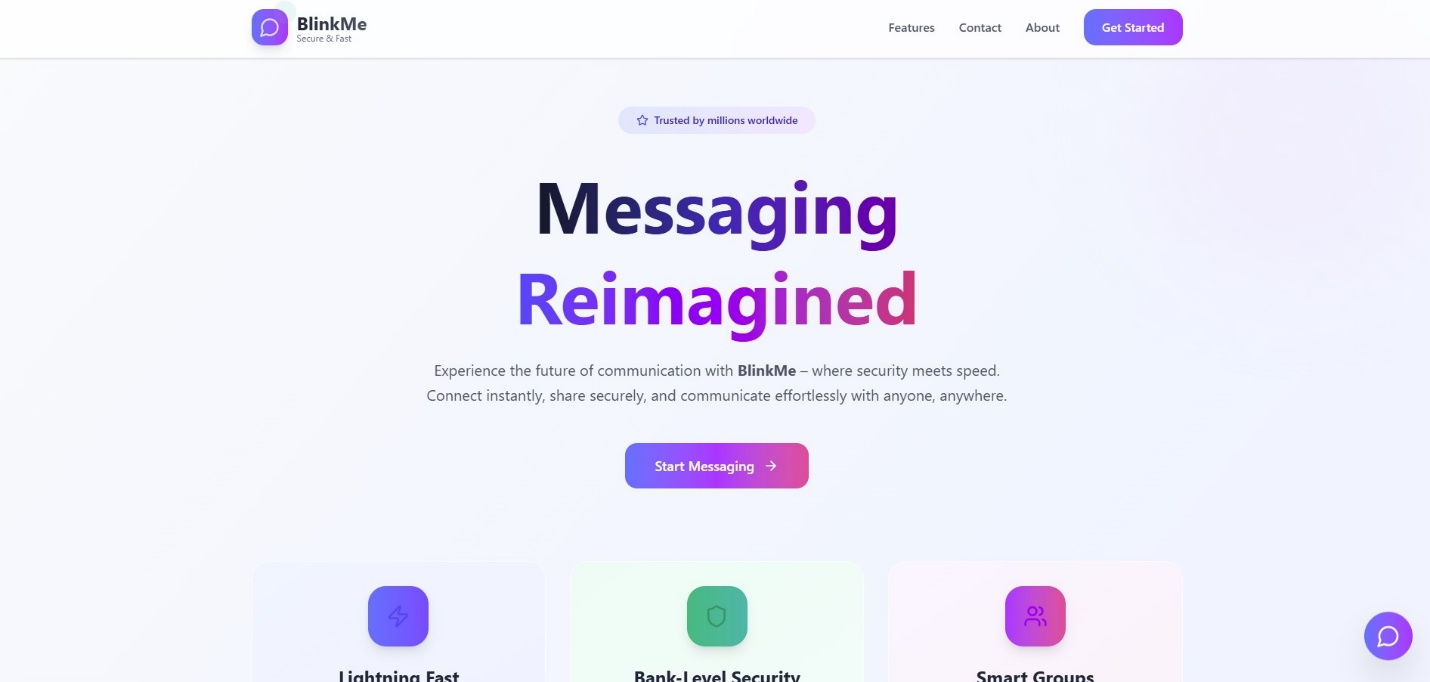
Social groups and communities

Privacy-conscious users seeking secure communication

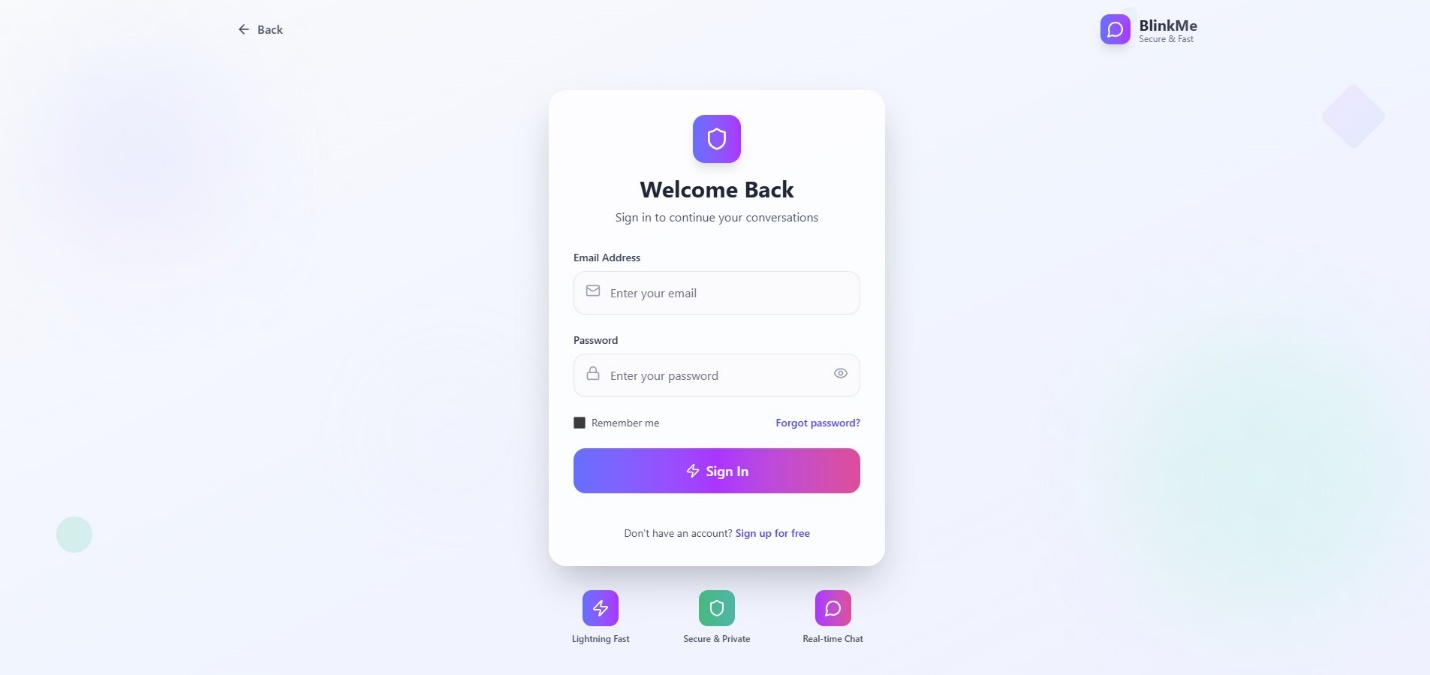
## 6.4 Screenshots with Detail

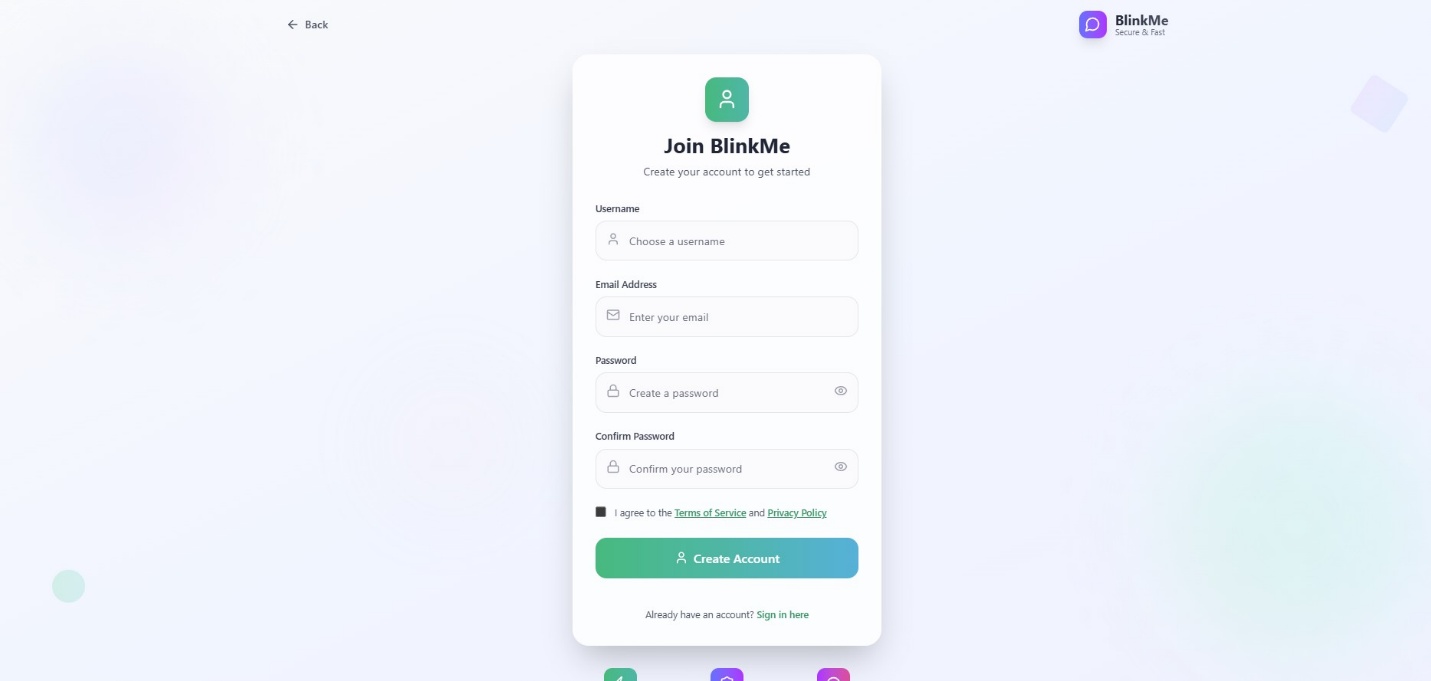
*Note: Actual screenshots would be included in the final report showing:*

1. **Landing Page**

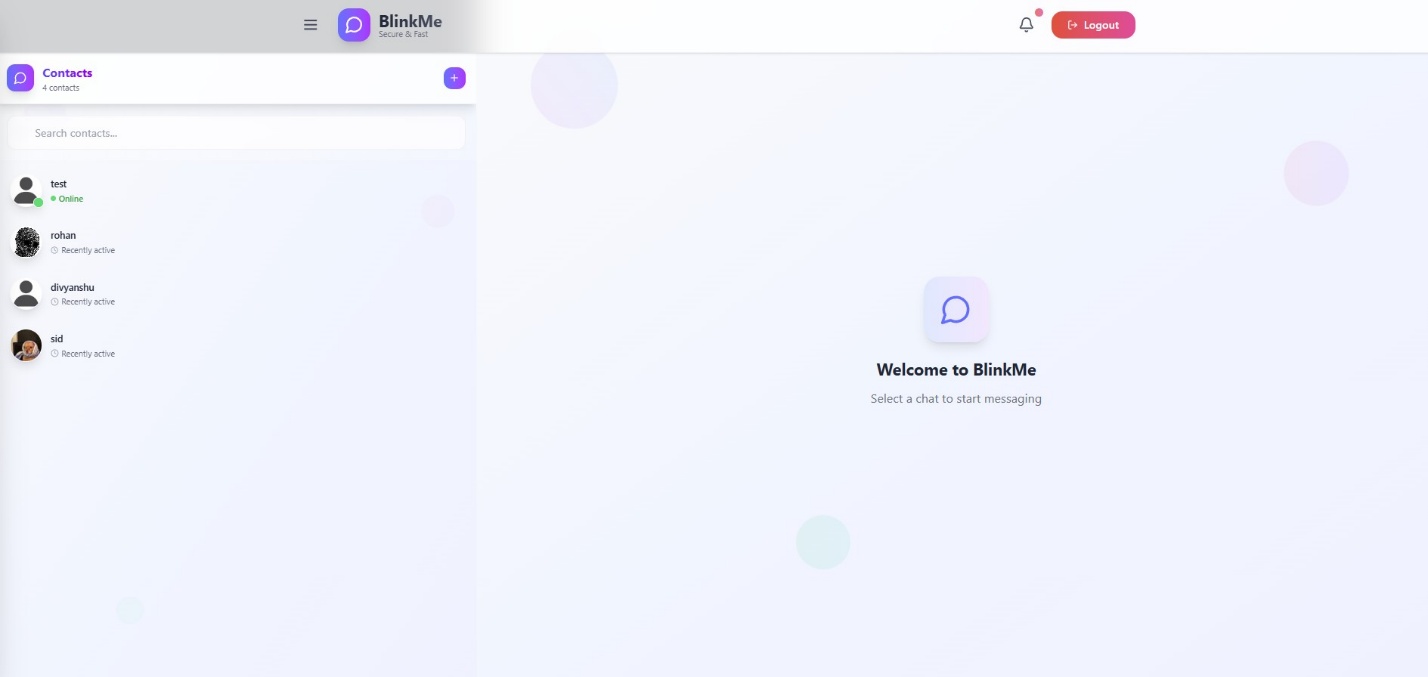


1. **Login/Register Page**

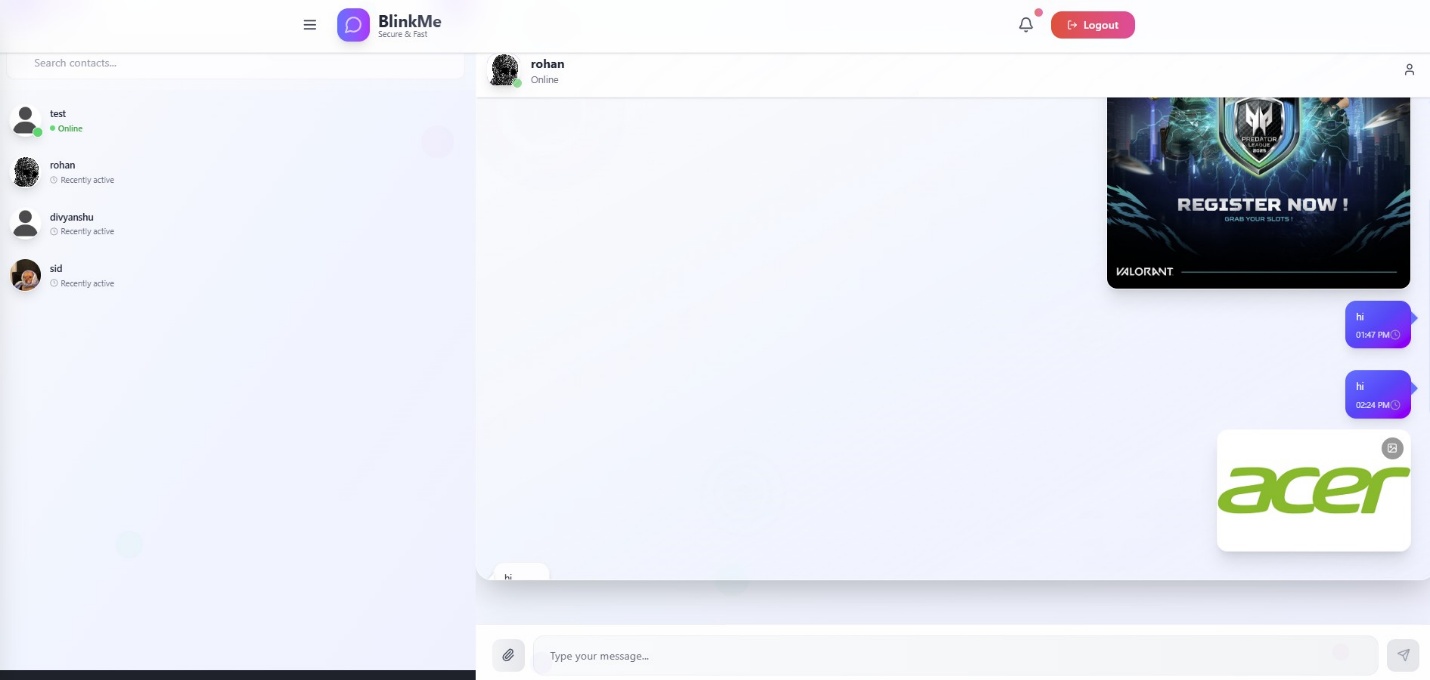




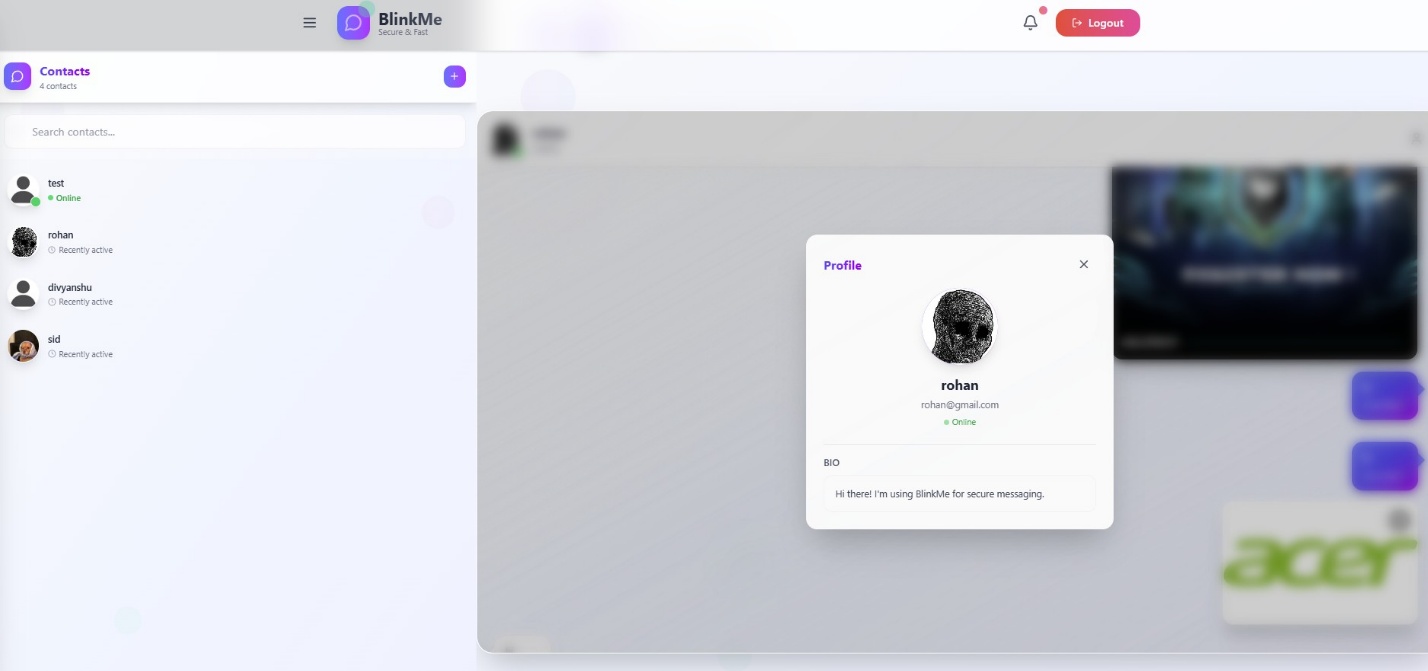
1. **Main Chat Page**



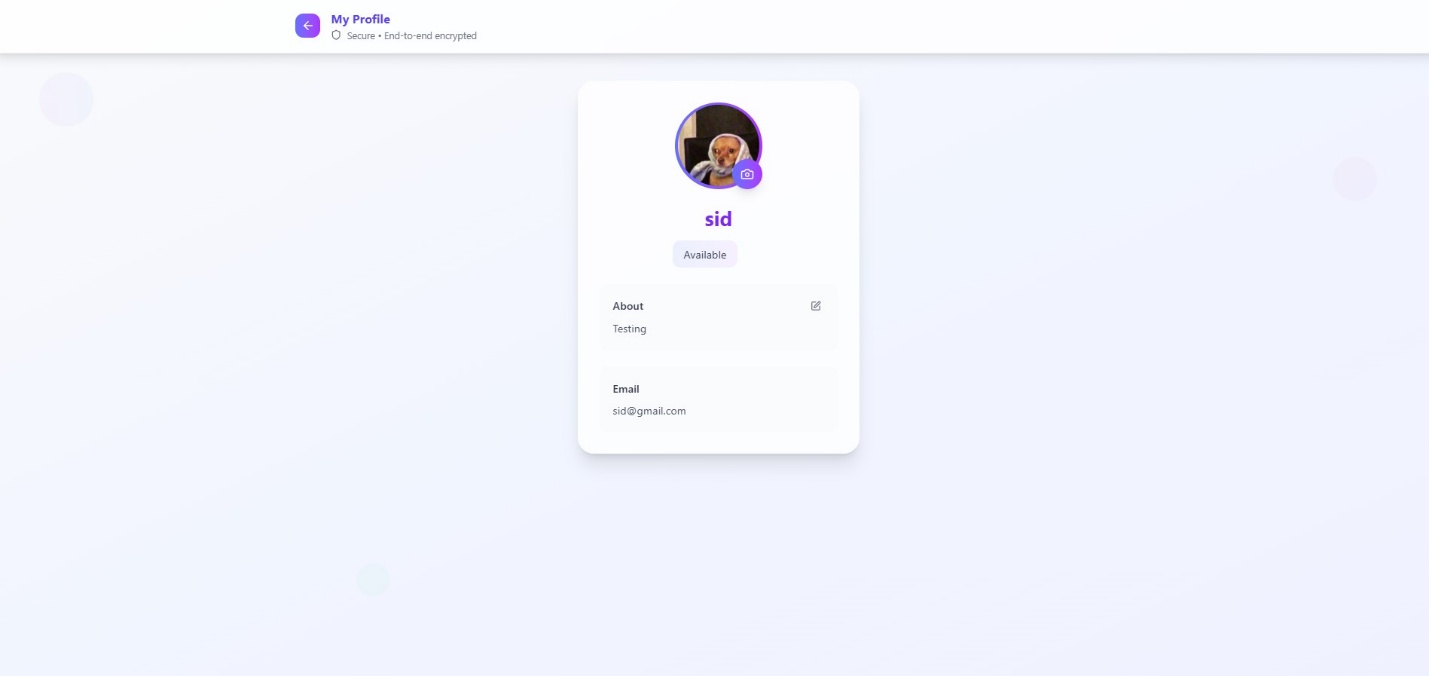
1. **User Chat Page**



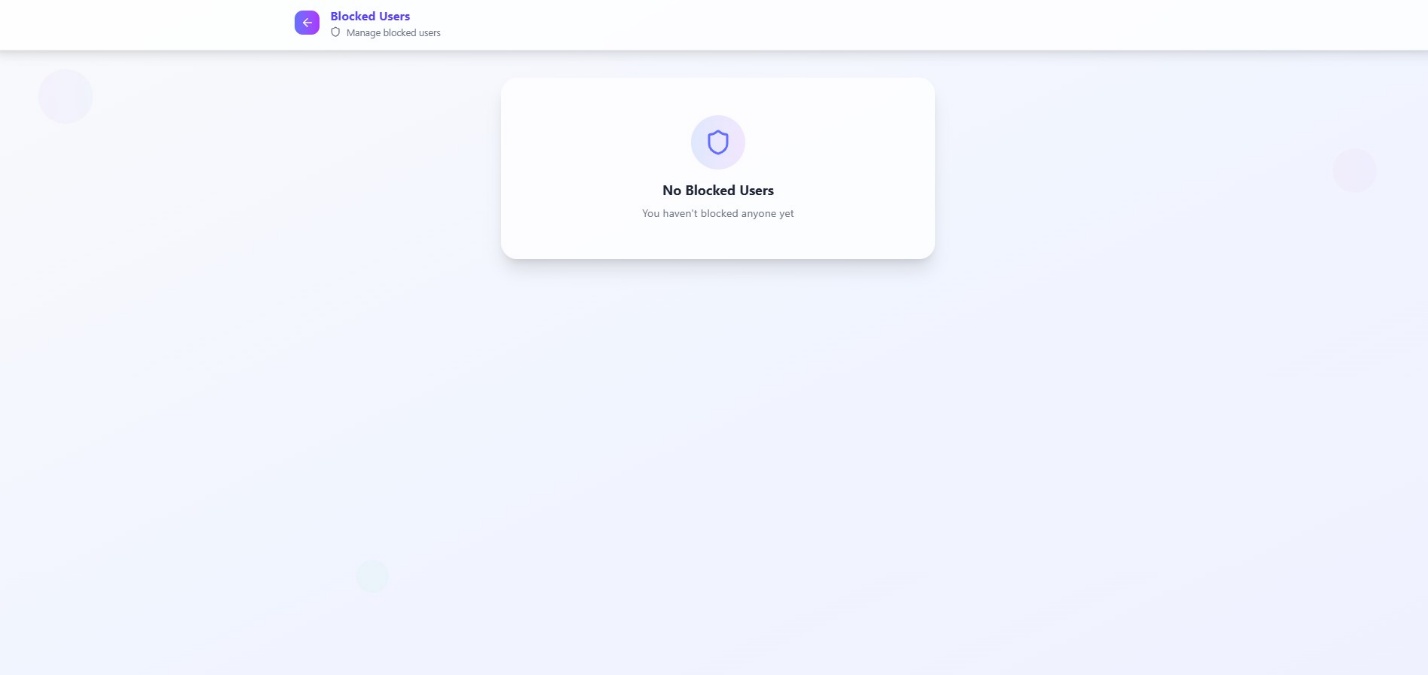
1. **User Profile Page**



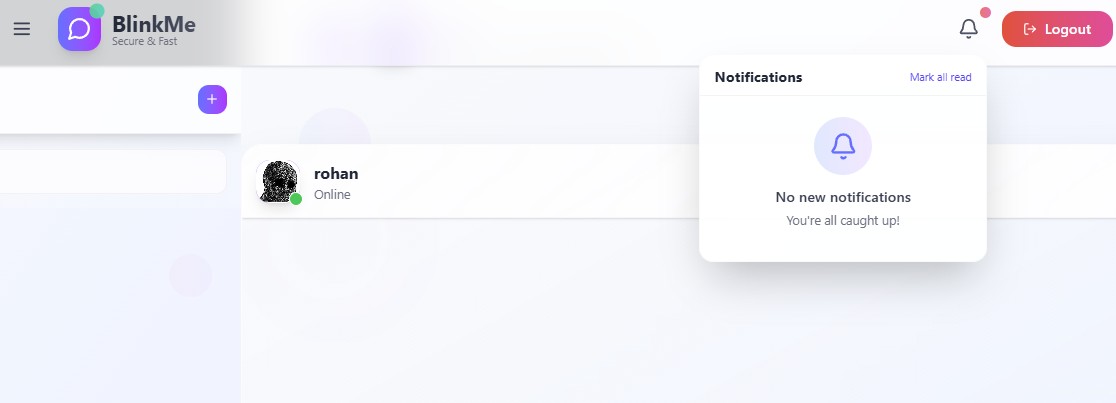
1. **My Profile Page**



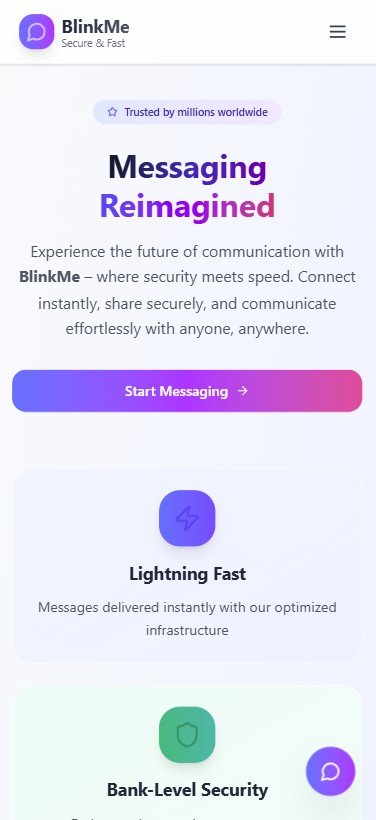
1. **BlockList Page**



1. **Notification Panel**



1. **Landing Page Mobile**



# Chapter 7: Testing

## 7.1 Test Steps

**Unit Testing:**

1. **Backend API Testing** Test individual REST endpoints

Validate JWT token generation and verification

Test database operations and data integrity

1. **Frontend Component Testing** Test React component rendering

Validate user interaction handling

Test state management and data flow

1. **Integration Testing**

Test frontend-backend communication

Validate WebSocket connections

Test file upload and media sharing

**System Testing:**

1. **Functional Testing**

Verify all features work as specified

Test user workflows end-to-end

Validate security measures

1. **Performance Testing**

Test system response times

Evaluate concurrent user handling

Monitor resource usage

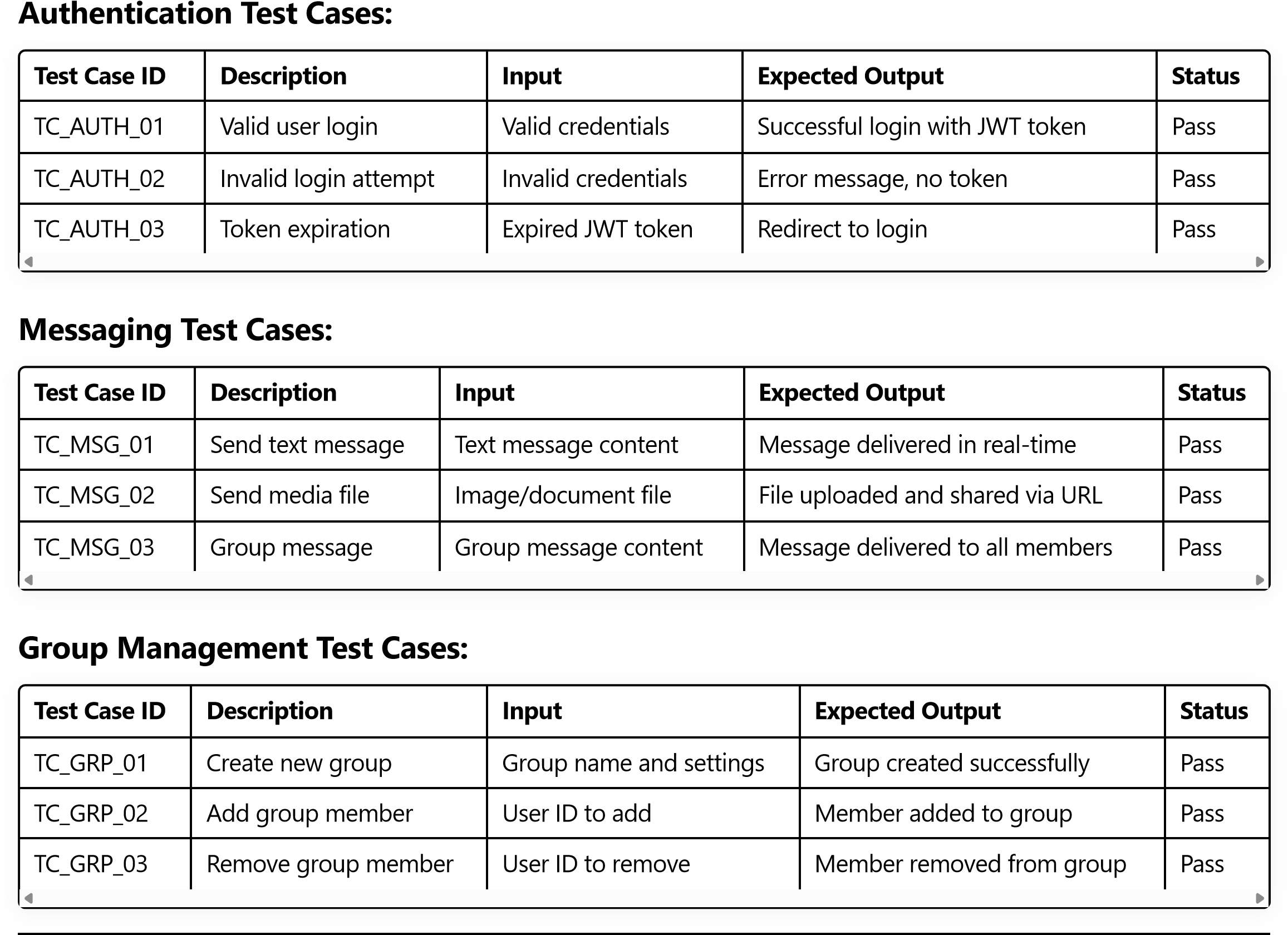
1. **Security Testing**

Test authentication mechanisms

Validate data encryption

Test access controls and permissions

**7.2 Test Cases**



# Chapter 8: Database Description

## 8.1 List of Tables

**Primary Tables:**

1. **users** - Stores user account information
2. **groups** - Stores group chat information
3. **messages** - Stores all message records
4. **group\_members** - Junction table for user-group relationships
5. **blocked\_users** - Stores user blocking relationships
6. **media\_files** - Stores metadata for uploaded media files

**Secondary Tables:**

1. **user\_sessions** - Tracks active user sessions
2. **group\_join\_requests** - Manages group join requests
3. **message\_read\_status** - Tracks message read status

**8.2 Structure of Tables**

**Users Table:**

CREATE TABLE users ( user\_id SERIAL PRIMARY KEY, username VARCHAR(50) UNIQUE NOT NULL, email VARCHAR(100) UNIQUE NOT NULL, password\_hash VARCHAR(255) NOT NULL, profile\_picture\_url VARCHAR(255), status\_message VARCHAR(200), bio TEXT, created\_at TIMESTAMP DEFAULT CURRENT\_TIMESTAMP, last\_active TIMESTAMP, is\_online BOOLEAN DEFAULT false

);

**Groups Table:**

sql

CREATE TABLE groups ( group\_id SERIAL PRIMARY KEY, group\_name VARCHAR(100) NOT NULL, description TEXT, group\_type VARCHAR(20) CHECK (group\_type IN ('public', 'private')), created\_by INTEGER REFERENCES users(user\_id), created\_at TIMESTAMP DEFAULT CURRENT\_TIMESTAMP, group\_avatar\_url VARCHAR(255)

);

**Messages Table:**

sql

CREATE TABLE messages ( message\_id SERIAL PRIMARY KEY, sender\_id INTEGER REFERENCES users(user\_id), recipient\_id INTEGER REFERENCES users(user\_id), group\_id INTEGER REFERENCES groups(group\_id), message\_content TEXT, message\_type VARCHAR(20) DEFAULT 'text', media\_url VARCHAR(255), timestamp TIMESTAMP DEFAULT CURRENT\_TIMESTAMP, is\_read BOOLEAN DEFAULT false

);

**Group Members Table:**

sql

CREATE TABLE group\_members ( group\_member\_id SERIAL PRIMARY KEY, group\_id INTEGER REFERENCES groups(group\_id), user\_id INTEGER REFERENCES users(user\_id), role VARCHAR(20) DEFAULT 'member', joined\_at TIMESTAMP DEFAULT CURRENT\_TIMESTAMP,

UNIQUE(group\_id, user\_id)

);

**Blocked Users Table:**

sql

CREATE TABLE blocked\_users ( block\_id SERIAL PRIMARY KEY, blocker\_id INTEGER REFERENCES users(user\_id), blocked\_id INTEGER REFERENCES users(user\_id), blocked\_at TIMESTAMP DEFAULT CURRENT\_TIMESTAMP,

UNIQUE(blocker\_id, blocked\_id)

);

# Chapter 9: Conclusion and Discussion

## 9.1 Conclusion and Discussion

The BlinkME project has been successfully completed, achieving all primary objectives set at the beginning of the development process. The application provides a comprehensive messaging platform that combines security, functionality, and user experience in a modern web application.

**Key Achievements:**

**Successful Implementation:** All core features have been implemented and tested successfully

**Security Integration:** JWT-based authentication and secure data transmission have been established

**Real-time Communication:** WebSocket (STOMP) integration provides seamless real-time messaging

**User Experience:** Intuitive interface design with responsive functionality across devices

**Scalable Architecture:** Modular design allows for future enhancements and maintenance

**Technical Accomplishments:**

**Full-Stack Development:** Successful integration of React.js frontend with Spring Boot backend

**Database Design:** Efficient relational database schema with proper normalization

**Security Implementation:** Comprehensive security measures including authentication and authorization

**Performance Optimization:** Efficient message delivery and resource management

**Learning Outcomes:**

**Technology Mastery:** Enhanced proficiency in modern web development technologies

**Project Management:** Successful collaboration and task distribution among team members

**Problem Solving:** Resolution of technical challenges through research and innovation

**Documentation:** Comprehensive project documentation and code commenting

**Challenges Overcome:**

* **Real-time Synchronization:** Successfully implemented WebSocket communication for instant messaging
* **Security Integration:** Proper JWT implementation with Spring Security
* **File Handling:** Efficient media file upload and storage system
* **Cross-Platform Compatibility:** Responsive design ensuring functionality across different devices
  1. **Future Scope of the Project**

**Immediate Enhancements:**

**Voice and Video Calling:** Integration of WebRTC for multimedia communication

**Advanced Encryption:** Implementation of end-to-end encryption protocols

**Message Search:** Advanced search and filtering capabilities

**Notification System:** Push notifications for mobile and desktop

**Long-term Developments:**

**Mobile Applications:** Native mobile app development for iOS and Android

**Advanced Analytics:** User engagement and system performance analytics

**API Integration:** Third-party service integrations (social media, file storage)

**Artificial Intelligence:** Chatbot integration and message analysis

**Scalability Improvements:**

**Microservices Architecture:** Breaking down monolithic structure for better scalability

**Load Balancing:** Implementation of load balancers for high-traffic scenarios

**Caching Systems:** Redis integration for improved performance

**Container Deployment:** Docker containerization for easier deployment and scaling

**Commercial Potential:**

* **Custom Themes:** User interface customization options
* **Premium Features:** Advanced functionality for paid users
* **Multi-language Support:** Internationalization for global reach

## 9.3 Snapshots

*Note: In a complete report, this section would include actual screenshots of the application showing:*

1. **Application Dashboard:** Main interface with chat lists and navigation
2. **Real-time Messaging:** Active chat window with message exchange
3. **Group Management:** Group creation and administration interface
4. **User Profile:** Profile customization and settings page
5. **Mobile Interface:** Responsive design on mobile devices
6. **File Sharing:** Media upload and sharing functionality

## 9.4 References

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## 9.6 Appendix

**Appendix A: Installation Guide**

Detailed step-by-step installation instructions for setting up the development environment and deploying the application.

**Appendix B: API Documentation**

Complete API documentation including endpoint descriptions, request/response formats, and authentication requirements.

**Appendix C: Database Schema**

Comprehensive database schema with table relationships, indexes, and constraints.

**Appendix D: Configuration Files**

Sample configuration files for both development and production environments.

**Appendix E: Troubleshooting Guide**

Common issues and their solutions encountered during development and deployment.

**Appendix F: Performance Metrics**

System performance benchmarks and optimization recommendations.

**End of Report**

*This report represents the comprehensive documentation of the BlinkME messaging application project, completed as part of the IMCA 6th Semester Minor Project requirement.*