

Project Report

FullStack

Mental Health Support Platform: A Comprehensive Architectural and Functional Analysis

Presented By:

Akshay Guleria – 23BCS10517

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Executive Summary

The Mental Health Support Platform is a comprehensive web-based solution designed to assist users in maintaining emotional wellness through guided exercises, anonymous counselor interactions, and personalized mood tracking. Developed as a full-stack application, the system leverages a modern technology stack to ensure a secure, scalable, and responsive user experience. The platform is built with **React** for a dynamic and intuitive user interface, **Spring Boot** for a robust and secure backend, **MongoDB** for flexible data handling, and **WebSocket** for real-time, low-latency communication.

Key features include secure user sessions facilitated by JSON Web Tokens (JWT), emotion-based journaling, and insightful mood analytics presented via interactive visualizations. The platform aims to bridge the gap between accessible mental health resources and technology-driven self-care solutions. Through its core functional modules—User Profiles, Chat with Counselor, Mental Exercises, and Mood Tracker—the platform provides a holistic approach to mental well-being. Future development will focus on AI-driven sentiment analysis, predictive wellness alerts, and seamless integration with wearable devices for holistic emotional health monitoring.

1. Architectural Dissection: From Monolithic to Real-Time Microservices

1.1 Architectural Overview

The Mental Health Support Platform employs a multi-layered architecture designed for scalability, security, and maintainability. This layered approach separates concerns, allowing

for independent development and deployment of each component. The architecture consists of the following key layers:

- **Frontend (React):** This layer is the user-facing part of the application. It handles all UI rendering, form validation, data visualization, and direct user interactions. By using a component-based framework like React, the UI is modular and highly responsive.
- **Backend (Spring Boot):** The backend serves as the core business logic and API gateway. It processes all API requests from the frontend, manages user authentication and authorization, and facilitates secure, real-time communication for the chat functionality. Spring Boot was chosen for its robust ecosystem, security features, and speed of development.
- **Database (MongoDB):** MongoDB, a NoSQL database, provides the flexible schema required for storing diverse data types, including user profiles, dynamic journaling entries, and real-time chat logs. Its document-based structure is ideal for the rapid iteration and evolving data models of a mental health application.
- **Real-Time Layer (WebSocket):** This dedicated layer ensures low-latency, persistent connections between the client and the server. WebSocket technology is crucial for providing a smooth, instantaneous communication channel for counselor-user chat sessions, eliminating the need for constant polling.

1.2 Core Components & MVC Pattern

The Spring Boot backend is structured around the Model-View-Controller (MVC) architectural pattern, which provides a clean separation of concerns:

- **Controller Layer:** This layer is responsible for handling incoming HTTP and WebSocket requests. It acts as the entry point for the application, routing requests to the appropriate service layer for processing. For example, a `UserController` would handle all requests related to user registration, login, and profile updates.
- **Service Layer:** The service layer encapsulates the core business logic. This is where complex operations like mood analytics, journaling recommendations, and secure session management are implemented. Services are loosely coupled and can be reused across different controllers.
- **Repository Layer:** This layer is responsible for data access. It interacts directly with the MongoDB database via Spring Data, providing an abstraction over database operations such as create, read, update, and delete (CRUD). This separation ensures that the service layer is not tightly bound to the specific database technology.

2. Tech Stack and Data Structure

Component	Technology Used
Frontend	React
Backend	Spring Boot
Database	MongoDB

Real-Time Communication	WebSocket
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2.1 Core Collections in MongoDB

The MongoDB database is organized into several key collections, each designed to store specific data relevant to the platform's functionality. The schema-flexible nature of MongoDB allows for easy addition of new fields and data types as the platform evolves.

Collection	Key Fields	Description
UserProfiles	user_id, username, email, isAnonymous, preferences	Stores account details, user preferences, and a flag indicating whether the user is participating anonymously.
ChatSessions	session_id, user_id, counselor_id, messages, timestamp	Maintains encrypted logs of counselor-user conversations, including a unique session ID and timestamps for each message.
MoodTracker	mood_id, user_id, date, moodScore, notes	Captures daily mood scores on a numerical scale and stores associated journaling entries, allowing for sentiment analysis and trend tracking.
Exercises	exercise_id, type, description, completionStatus	Stores information about various mental wellness activities, including their type (e.g., breathing, meditation), a detailed description, and a flag to track user completion history.

3. Functional Modules: A Deep Dive

3.1 User Profiles and Authentication

The User Profiles module is the gateway to the platform. It provides a seamless and secure experience for users from the moment they sign up.

- Registration and Secure Authentication:** New users can create an account by providing a username and email. The system uses **JSON Web Tokens (JWT)** to ensure stateless authentication. Upon successful login, the server generates a unique JWT, which is then sent to the client and stored securely. This token is used to authenticate all subsequent API calls. Passwords are never stored in plain text; they are hashed using a robust algorithm like **BCrypt** to prevent security vulnerabilities.

- **Anonymous Participation:** For users who prioritize privacy, the platform offers a fully anonymous participation option. In this mode, a session is created without a persistent user profile, allowing the user to access basic features and chat with a counselor without revealing any personal information.

3.2 Real-time Chat with Counselor

This module is the heart of the platform's support system. It provides a secure and responsive channel for communication.

- **WebSocket Integration:** The chat feature is powered by WebSockets, which establish a persistent, full-duplex connection between the client and the server. This enables real-time messaging, eliminating the delay associated with traditional HTTP-based polling.
- **End-to-end Encryption:** To ensure the confidentiality of sensitive communications, all chat messages are encrypted. The platform can employ a layered encryption strategy, including TLS/SSL for data in transit and potential client-side encryption for messages at rest, although the latter adds complexity.

3.3 Mental Exercises

The Mental Exercises module provides a curated library of activities to help users manage their emotional well-being.

- **Guided Activities:** The platform offers a variety of guided exercises, including mindfulness meditation, deep breathing exercises, and cognitive behavioral therapy (CBT) based thought reframing. Each exercise is designed to be accessible and easy to follow.
- **Progress Tracking:** Users can track their progress and completion history for each exercise. This data is stored in the `Exercises` collection and provides a visual representation of their dedication to self-care, which can be highly motivating.

3.4 Mood Tracker and Analytics

This module empowers users to monitor their emotional state and gain insight into their mental health trends.

- **Daily Mood Logging:** Users can log their daily mood on a numerical scale or by selecting from a range of emojis. This simple act of logging helps them become more aware of their emotional fluctuations.
- **Journaling Feature:** The module includes a journaling feature where users can write about their feelings, thoughts, and experiences. This data is linked to their mood scores, creating a rich dataset for personal reflection.
- **Interactive Visualizations:** The platform uses **React** to render interactive charts and graphs based on the MoodTracker data. Users can view their mood trends over time, identify patterns, and correlate their emotional state with specific events or entries from their journal. This data visualization is crucial for self-discovery and a better understanding of one's mental state.

4. Development Methodology & Project Management

The project was managed using the **Agile** methodology, specifically the **Scrum** framework. This approach allowed for a flexible and iterative development process, ensuring that the team could respond quickly to changing requirements and user feedback.

- **Sprints:** The project was divided into a series of short, two-week development cycles called sprints.
- **User Stories:** Features were defined as user stories (e.g., "As a user, I want to be able to log my daily mood so I can track my emotional state over time").
- **Daily Stand-ups:** The development team held brief daily meetings to discuss progress, challenges, and plans for the day, ensuring alignment and early identification of roadblocks.
- **Sprint Reviews and Retrospectives:** At the end of each sprint, the team reviewed the completed work and reflected on the process to identify areas for improvement.

This methodology ensured that development was focused, efficient, and aligned with the project's goals.

5. Security and Privacy Measures

Given the sensitive nature of the data handled by the platform, security and privacy are paramount.

- **JSON Web Tokens (JWT):** JWTs are used for secure authentication. They are stateless, meaning the server does not need to store session information, which reduces the server's load and enhances scalability. Each JWT is signed with a secret key, ensuring its integrity and authenticity.
- **Role-Based Access Control (RBAC):** The platform employs a robust RBAC system to manage user permissions. This ensures that users can only access the features and data they are authorized to see.
 - **User:** Can access mental exercises, anonymous chat, and their own mood analytics.
 - **Counselor:** Can access all user-facing features and engage in chat with users.
 - **Admin:** Has full control over the platform, including the ability to manage user data, approve counselors, and configure system settings.

Action	User	Counselor	Admin
Access Mental Exercises	Y	Y	Y
Anonymous Chat	Y	Y	N/A
View Mood Analytics	Y	Y	Y
Manage User Data	N	N	Y

- **Data Encryption:** All sensitive data is encrypted, both at rest in the MongoDB database and in transit between the frontend and backend using **HTTPS/TLS**. This provides a crucial layer of protection against unauthorized access.

- **Input Validation & Sanitization:** The backend performs rigorous input validation on all data received from the frontend to prevent common web vulnerabilities like Cross-Site Scripting (XSS) and NoSQL injection.

6. Evaluation of Features and User Experience

The platform's success is evaluated on both functional and non-functional requirements, with a strong focus on user experience.

- **Real-Time Chat:** The use of **WebSocket** ensures that counselor-user interactions are seamless and lag-free, a critical component for effective communication in a support setting.
- **Mood Analytics:** The data visualizations are intuitive and provide immediate value, helping users identify patterns and triggers in their emotional state.
- **Journaling Recommendations:** By integrating journaling with mood data, the platform provides personalized recommendations for wellness activities, making the self-care journey more relevant and engaging.
- **Performance:** The combination of a lightweight React frontend and a powerful Spring Boot backend, backed by the flexible **MongoDB** database, results in a fast and responsive application that can handle a high volume of concurrent users.

7. Future Enhancements & Roadmap

The Mental Health Support Platform has a clear vision for the future, with a roadmap focused on leveraging emerging technologies to provide a more personalized and proactive support system.

- **Phase 1: AI & Personalization (Q3 2025)**
 - **AI-powered Sentiment Analysis:** Develop a machine learning model to analyze the tone and sentiment of journal entries, providing users with deeper insights and allowing the platform to offer more targeted recommendations.
 - **Predictive Wellness Alerts:** Based on AI analysis of a user's mood and journaling data, the system could proactively send alerts or recommend activities before a user's emotional state declines significantly.
- **Phase 2: Holistic Health Integration (Q4 2025)**
 - **Wearable Device Integration:** Partner with popular wearable brands to pull in health data like heart rate variability, sleep patterns, and activity levels. This data would provide a more complete picture of a user's stress and well-being.
 - **Enhanced User Dashboard:** Redesign the user dashboard to combine mood analytics, journaling insights, and wearable data into a single, comprehensive view of their emotional and physical health.
- **Phase 3: Advanced Communication & Monetization (Q1 2026)**

- **Video Counseling:** Integrate **WebRTC** to enable secure, real-time video counseling sessions between users and counselors, adding a new premium feature.
- **Gamification and Community Forums:** Introduce gamified elements (e.g., streaks for daily journaling) and peer-to-peer support forums to increase user engagement and foster a sense of community.
- **Multilingual Support:** Expand the platform's reach by adding support for multiple languages, making it accessible to a global audience.

8. Conclusion

The Mental Health Support Platform merges technology with well-being, offering a secure and engaging environment for emotional health management. By leveraging a robust architectural design and a modern technology stack, the project establishes a strong foundation for a solution that is both functional today and ready for future innovation. With real-time counseling, insightful analytics, and a clear roadmap for AI and wearable integration, the platform is well-positioned to make a meaningful impact on how individuals approach and manage their mental well-being. The project is a testament to how technology can be a powerful force in providing accessible, personalized, and proactive mental health support.