Shadow Wellness Platform - Requirements Specification

Version: *1.0*
Date: *July 21, 2025*
Project: *Shadow - Privacy-First Open Source Wellness Platform*

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1. Executive Summary

Shadow is a privacy-first, open-source wellness platform designed for solo professionals who demand complete control over their personal data. The system unifies data streams from Linux laptops, Android devices, and wearables through a decentralized, peer-to-peer architecture that processes all data locally without cloud dependencies.

Core Principles:

- ***Privacy by Design:*** *All data processing occurs locally on user devices*
- ***Offline-First Architecture:*** *Full functionality without internet dependency*
- ***User Sovereignty:*** *Complete control over data collection, storage, and sharing*
- ***Open Source Foundation:*** *Community-driven development and transparency*

2. Privacy & Security Requirements

2.1 Data Privacy & Control

FR-001: *The system* ***MUST*** *process all user data locally on each device ("edge processing") unless explicit user consent is provided otherwise.*

FR-002: *The user* ***MUST*** *have explicit control over what data is collected, stored, shared, and deleted.*

FR-003: *The system* ***MUST*** *allow granular opt-in/opt-out for each data source and sensor.*

FR-004: *The system* ***MUST*** *provide the ability for users to export or purge personal data upon request.*

2.2 Data Security & Encryption

NFR-001: *All data at rest and in transit between devices* ***MUST*** *be encrypted using industry-standard encryption (AES-256 minimum).*

NFR-002: *Only authenticated and authorized devices* ***MAY*** *participate in data synchronization.*

NFR-003: *The system* ***MUST*** *log all access to sensitive data and configuration changes for auditability.*

NFR-029: *The system* ***MUST*** *implement secure device pairing and authentication mechanisms.*

NFR-030: *The system* ***MUST*** *support security auditing and vulnerability scanning capabilities.*

NFR-031: *All network communications* ***MUST*** *use TLS 1.3 or higher encryption standards.*

NFR-032: *The system* ***MUST*** *implement secure key management and rotation for device authentication.*

2.3 Compliance & Privacy Standards

NFR-004: *The system* ***MUST*** *comply with relevant data privacy regulations (GDPR, CCPA) where applicable.*

NFR-033: *All privacy policies and data handling practices* ***MUST*** *be transparent and easily accessible to users.*

NFR-034: *The system* ***MUST*** *provide mechanisms for users to understand and control automated decision-making processes.*

3. System Architecture Requirements

3.1 Offline-First Architecture

FR-005: *The system **MUST** function fully offline for all core features.*

FR-006: *The system **MUST** handle device connection/disconnection gracefully without data loss.*

FR-007: *The system **MUST** store all collected data reliably with support for automatic recovery.*

NFR-005: *All core features **MUST** be available offline; cloud services are optional and not required for operation.*

NFR-006: *The system **MUST** support automatic recovery and resumption after crashes or interruptions.*

3.2 Peer-to-Peer Communication

FR-029: *The system **MUST** support automatic device discovery and direct peer-to-peer synchronization.*

FR-030: *The system **MUST** dynamically pool processing and storage resources across connected devices.*

FR-031: *The system **MUST** ensure synchronization transmits only new or changed data to optimize bandwidth and battery usage.*

NFR-014: *Data synchronization between devices **SHOULD** complete within 3 seconds for typical daily data volumes.*

3.3 Extensibility & Integration Framework

FR-032: *The system **MUST** support a plugin-based architecture for sensors and analytics modules.*

FR-033: *The system **MUST** provide well-documented APIs for third-party device and application integration.*

FR-034: *The system **MUST** allow community contributions for new device agents, analytics modules, and UI components.*

NFR-015: *The system **MUST** support addition of new data sources, devices, and sensors without requiring major architectural changes.*

NFR-016: *APIs and integration points* ***MUST*** *remain stable and backward-compatible across minor releases.*

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4. Device Integration Requirements

4.1 Linux Laptop Integration

FR-008: *The system* ***MUST*** *track active applications, window focus, and productivity workflows.*

FR-009: *The system* ***MUST*** *monitor typing speed, mouse activity, idle times, and work session patterns.*

FR-010: *The system* ***MUST*** *gather system health data (CPU, memory, battery, resource utilization).*

FR-011: *The system* ***MUST*** *detect work/break cycles and context switching patterns.*

FR-012: *The system* ***MUST*** *collect ambient light and sound level data when hardware is available.*

FR-013: *The system* ***MUST*** *integrate with popular calendars and task management applications.*

4.2 Android Mobile Integration

FR-014: *The system* ***MUST*** *collect app usage statistics, screen time, and notification interaction patterns.*

FR-015: *The system* ***MUST*** *gather physical context data including step counting, movement recognition, and location-based insights.*

FR-016: *The system* ***MUST*** *collect environmental context data including ambient light, sound levels, and temperature when available.*

FR-017: *The system* ***MUST*** *synchronize health data with compatible mobile health and wellness applications.*

4.3 Wearable Device Integration

FR-018: *The system* ***MUST*** *collect physiological data including heart rate, HRV, SpO2, skin conductance, and skin temperature from supported wearables.*

FR-019: *The system* ***MUST*** *detect and analyze sleep architecture including deep sleep, REM sleep, light sleep phases, and sleep interruptions.*

FR-020: *The system* ***MUST*** *track physical activity including steps, activity types, and posture monitoring.*

FR-021: *The system* ***MUST*** *provide biometric feedback, stress detection, and deliver smart interventions (vibration alerts, breathing reminders).*

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5. Intelligence & Analytics Requirements

5.1 Data Fusion & Correlation

FR-022: *The system* ***MUST*** *correlate and fuse data from multiple devices to generate advanced contextual insights.*

FR-023: *The system* ***MUST*** *provide adaptive and personalized recommendations based on individual user patterns and behaviors.*

5.2 Predictive Analytics & Interventions

FR-024: *The system* ***MUST*** *support predictive analytics for stress levels, sleep quality optimization, and optimal break timing.*

FR-025: *The system* ***MUST*** *deliver contextual interventions and notifications across all connected devices.*

5.3 Performance Standards for Analytics

NFR-007: *The system* ***SHOULD*** *process and display real-time data and insights with minimal latency (<500ms for user interactions).*

NFR-008: *The system* ***SHOULD*** *support concurrent data collection and processing from multiple devices without noticeable performance degradation.*

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6. User Experience Requirements

6.1 User Interface & Dashboard

FR-026: *The system* ***MUST*** *provide a unified dashboard aggregating data and insights from all connected devices.*

FR-027: *The system* ***MUST*** *support real-time notifications, reminders, and actionable feedback delivery.*

FR-028: *The system* ***MUST*** *allow users to input manual check-ins, mood tracking, and custom notes.*

6.2 Usability & Interaction Design

NFR-009: *The user interface* ***MUST*** *be intuitive, consistent, and user-friendly across all supported platforms.*

NFR-010: *The system* ***MUST*** *provide clear, immediate feedback for all user actions and system events.*

NFR-011: *The system* ***MUST*** *offer comprehensive onboarding experience and contextual in-app guidance.*

6.3 Accessibility & Localization

NFR-012: *The system* ***SHOULD*** *support localization for multiple languages and regional preferences.*

NFR-013: *The system* ***SHOULD*** *be accessible to users with disabilities in accordance with WCAG 2.1 AA standards.*

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7. Performance & Reliability Requirements

7.1 Performance Standards

NFR-017: *The system **SHOULD** handle increasing numbers of users and devices in a peer-to-peer mesh with minimal performance degradation.*

NFR-018: *Memory usage per device **SHOULD** not exceed 512MB during normal operation.*

NFR-019: *Battery impact on mobile devices **SHOULD** be less than 5% of total daily battery consumption.*

7.2 Reliability & Availability

NFR-020: *The system **MUST** be robust against individual device failures and unexpected shutdowns, ensuring zero data loss.*

NFR-021: *System uptime **SHOULD** exceed 99.9% during normal operation conditions.*

NFR-022: *Mean time to recovery (MTTR) from system failures **SHOULD** be less than 2 minutes.*

7.3 Scalability Requirements

NFR-035: *The system **SHOULD** support compliance reporting and audit trail generation for regulatory requirements.*

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8. Development & Maintenance Requirements

8.1 Code Quality & Architecture

NFR-023: *The system architecture **MUST** support modular updates and bug fixes without impacting unrelated components.*

NFR-024: *Source code **MUST** be well-documented and follow established software engineering best practices.*

NFR-025: *The system **SHOULD** include comprehensive automated tests achieving minimum 80% code coverage for critical components.*

8.2 Platform Support & Portability

NFR-026: *The system* ***SHOULD*** *run on major Linux distributions (Ubuntu 20.04+, Fedora 35+, Arch Linux).*

NFR-027: *The system* ***SHOULD*** *support Android versions 8.0 (API level 26) and above.*

NFR-028: *The system architecture* ***SHOULD*** *support easy adaptation to new hardware platforms and operating systems.*

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9. Documentation & Support Requirements

9.1 User Documentation

FR-035: *The system* ***MUST*** *provide comprehensive user documentation including setup guides, feature explanations, and troubleshooting resources.*

FR-037: *The system* ***MUST*** *include interactive onboarding tutorials for new users.*

9.2 Developer Documentation

FR-036: *The system* ***MUST*** *provide complete developer documentation including API references, plugin development guides, and architectural overviews.*

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10. Compliance & Governance Requirements

10.1 Regulatory Compliance

NFR-004: *The system* ***MUST*** *comply with relevant data privacy regulations (GDPR, CCPA) where applicable.*

NFR-033: *All privacy policies and data handling practices* ***MUST*** *be transparent and easily accessible to users.*

10.2 Transparency & Control

NFR-034: *The system* ***MUST*** *provide mechanisms for users to understand and control automated decision-making processes.*

NFR-035: *The system* ***SHOULD*** *support compliance reporting and audit trail generation for regulatory requirements.*

11. Requirement Priority Classification

Critical (P0) - Must Have

- ***Privacy & Security:*** *All privacy and data security requirements (FR-001 to FR-004, NFR-001 to NFR-004, NFR-029 to NFR-032)*
- ***Core Architecture:*** *Offline-first architecture (FR-005 to FR-007, NFR-005 to NFR-006)*
- ***Essential Integration:*** *Core device integration (FR-008 to FR-021)*
- ***Basic Interface:*** *Fundamental user interface (FR-026 to FR-028)*

High (P1) - Should Have

- ***Intelligence Engine:*** *Data fusion and analytics capabilities (FR-022 to FR-025)*
- ***P2P Communication:*** *Peer-to-peer synchronization (FR-029 to FR-031)*
- ***Performance:*** *Core performance requirements (NFR-007 to NFR-008, NFR-014)*
- ***Documentation:*** *Essential user and developer documentation (FR-035 to FR-037)*

Medium (P2) - Could Have

- ***Extensibility:*** *Advanced plugin and API features (FR-032 to FR-034)*
- ***Enhanced UX:*** *Accessibility and localization (NFR-012 to NFR-013)*
- ***Advanced Performance:*** *Enhanced performance and reliability metrics (NFR-017 to NFR-022)*

Low (P3) - Won't Have (This Release)

- ***Advanced Compliance:*** *Enhanced compliance and governance features (NFR-033 to NFR-035)*
- ***Platform Expansion:*** *Support beyond core Linux/Android/Wearable trio*

12. Success Criteria

12.1 Privacy Achievement

- ***100%*** *of user data processing occurs locally with zero involuntary cloud transmission*
- *Users can verify and audit all data collection and processing activities*

12.2 Functionality Achievement

- *Core wellness insights available within **48 hours** of initial device setup*
- *All three device types (laptop, phone, wearable) successfully integrated and communicating*

12.3 Performance Achievement

- *System operates smoothly with **<500ms** response times on target hardware*
- *Battery impact on mobile devices remains **<5%** of daily consumption*

12.4 Reliability Achievement

- ***Zero data loss** during normal operation and graceful degradation during device failures*
- *System recovery time **<2 minutes** after unexpected shutdowns*

12.5 Usability Achievement

- *New users can complete setup and receive first insights within **15 minutes***
- ***90%** user satisfaction rate in onboarding experience surveys*

This requirements specification serves as the foundation for Shadow's development, ensuring a privacy-first, user-controlled wellness platform that operates entirely under user sovereignty.