Cognito-Weave Requirements Specification

October 4, 2025

# Introduction

## Project Overview

**Product Name:** Cognito-Weave

**Background:**  
This project addresses the need for an accessible, non-VR digital tool to support Alzheimer’s patients. Current systems rely heavily on caregivers or costly therapies, with limited personalization. The application domain is digital health and assistive technology.

**Objectives & Scope:**

* Provide daily cognitive and storytelling exercises.
* Adapt difficulty using AI/ML.
* Track and visualize patient progress for caregivers.
* Ensure accessibility with speech, simple UI, and multilingual support.

## Definitions, Acronyms, and Abbreviations

* **AD:** Alzheimer’s Disease
* **CST:** Cognitive Stimulation Therapy
* **AI/ML:** Artificial Intelligence / Machine Learning
* **UI:** User Interface
* **API:** Application Programming Interface
* **HIPAA:** Health data privacy regulation
* **Neuroplasticity:** Brain’s ability to reorganize connections

## Document Organization

* **Section 2:** Overall Description
* **Section 3:** System Features
* **Section 4:** External Interfaces
* **Section 5:** Non-Functional Requirements
* **Section 6:** Other Requirements

# Project Description

## Project Environment

The software product is designed as a **mobile-first, self-contained system** that connects patients, caregivers, and cloud services. It primarily functions independently but relies on external APIs for speech recognition, text-to-speech, and secure data storage.

**Major Components of the System-to-Be:**

1. **Patient Mobile Application** – Delivers cognitive exercises, reminders, and collects performance data.
2. **Caregiver Dashboard (Mobile/Web)** – Provides visual reports of patient progress and trends.
3. **Backend/Cloud Service** – Stores data, manages personalization logic, and handles notifications.
4. **External APIs** – Speech-to-text, text-to-speech, and authentication services.

**Interfaces:**

* **User Interface:** Simple, high-contrast mobile UI with large fonts, voice prompts, and easy navigation.
* **Software Interfaces:** REST APIs for cloud storage, speech services, and authentication.
* **Hardware Interfaces:** Smartphone/tablet (touchscreen, microphone, speakers).

**Explanation:**

* The **Patient App** interacts with the **Backend** for progress tracking and personalized exercises.
* The **Caregiver Dashboard** retrieves summarized data and trends from the backend.
* Both components rely on **External APIs** for specialized services (speech, auth, etc.).
* Hardware is limited to standard smartphones/tablets, ensuring accessibility.

## User Characteristics

**User Profiles:**

**Patients (Alzheimer’s individuals)**

* **Type:** Elderly users, primarily patients, possibly students in clinical trials
* **Experience:** Limited or no digital experience.
* **Technical Expertise:** Low; may rely on caregivers.
* **Primary Concerns:** Simplicity, ease of navigation, non-stressful interactions.
* **Other Characteristics:** Cognitive impairment, memory issues, may prefer native language support.

## System Requirements

The system shall:

* Deliver daily cognitive and memory exercises to patients.
* Adapt exercise difficulty based on performance.
* Support voice input/output for accessibility.
* Send reminders and notifications for daily practice.
* Track and store user progress.
* Provide caregivers with a dashboard for monitoring trends.

## Assumptions

* Patients and caregivers have access to a smartphone or tablet with internet connectivity.
* Users have basic digital literacy or caregiver assistance.
* Cloud services (e.g., Firebase) will be available for storage and notifications.
* Standard mobile operating systems (Android/iOS) will be supported.

## Domain Properties

* Alzheimer’s disease causes progressive memory and cognitive decline.
* Regular cognitive stimulation can slow decline through neuroplasticity.
* Patients may revert to native language; multilingual support increases accessibility.
* Elderly users benefit from simple, high-contrast, and large-font interfaces.

## Constraints and Dependencies

* **Compliance:** Must adhere to HIPAA/GDPR for patient data security.
* **Architectural Constraint:** Mobile-first solution; cross-platform support required.
* **Development Constraint:** Limited budget and development time (hackathon context).
* **Dependencies:** Reliance on third-party APIs (speech-to-text, text-to-speech, cloud services).

# Software Requirements

This section should contain all the software requirements to a level of detail sufficient to enable designers to design a system to satisfy those requirements, and testers to test that the system satisfies those requirements.

## User Interface Requirements

The software will provide intuitive, accessible, and senior-friendly user interfaces.

**Characteristics:**

* **Inputs:** Touch (buttons, sliders), speech input (via microphone).
* **Outputs:** Text (large fonts), speech output (audio prompts), progress charts.
* **Screen Design:** High contrast, simple layouts, minimal text per screen.
* **Menu Structure:** Clear “Home,” “Exercises,” “Progress,” and “Settings.”
* **Error Messages:** Simple, friendly messages with voice prompts (e.g., “Please try again”).

**Mock-ups (Textual Layout Representation)**

**Mock-up 1 – Patient Home Screen**

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| Welcome, [Patient Name] |

|--------------------------------|

| ▶ Start Today’s Exercise |

| 📊 View Progress |

| ⏰ Reminders |

| ⚙ Settings |

+--------------------------------+

**Mock-up 2 – Exercise Screen (Memory Game)**

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| Match the Pictures! |

|--------------------------------|

| [🍎] [🐶] [🍎] [🐶] |

| |

| ✔ Correct! |

| |

| 🔊 Voice Instructions On |

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**Mock-up 3 – Caregiver Dashboard**

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| Patient Progress Overview |

|--------------------------------|

| Memory Exercise Score: 78% |

| Storytelling Task: Improved |

| Avg. Daily Usage: 20 min |

| |

| 📈 View Detailed Trends |

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## 3.2 Functional Requirements

| **Req#** | **Requirement** | **Priority** | **Date Rvwd** | **Reviewed/Approved** |
| --- | --- | --- | --- | --- |
| FR\_01 | The system shall provide daily cognitive exercises (e.g., memory games, storytelling tasks). | 1 | TBD | TBD |
| FR\_02 | The system shall adapt the difficulty level of exercises based on patient performance. | 2 | TBD | TBD |
| FR\_03 | The system shall allow voice input for patients who cannot type. | 1 | TBD | TBD |
| FR\_04 | The system shall provide text-to-speech instructions for every task. | 1 | TBD | TBD |
| FR\_05 | The system shall send daily reminders/notifications for exercise completion. | 2 | TBD | TBD |
| FR\_06 | The system shall log patient performance after each session. | 1 | TBD | TBD |
| FR\_07 | The system shall generate weekly progress summaries for caregivers. | 2 | TBD | TBD |
| FR\_08 | The system shall support multilingual functionality for exercises and UI. | 3 | TBD | TBD |
| FR\_09 | The system shall allow secure caregiver access to patient data. | 1 | TBD | TBD |

## 3.3 Quality of Service Requirement #2

* **Requirement:** The system shall encrypt all patient data (in transit and at rest) using industry standards (AES-256, HTTPS).
* **Fit Criterion:** 100% of patient data must pass encryption verification tests.
* **Related Functional Requirements:** FR\_06, FR\_07, FR\_09.

## Quality of Service Requirement #3

* **Requirement:** The system shall load any patient exercise within **2 seconds** on standard smartphones.
* **Fit Criterion:** 95% of test cases shall demonstrate loading time ≤ 2 seconds.
* **Related Functional Requirements:** FR\_01, FR\_02, FR\_03.

### ****3.5 Quality of Service Requirement #3 – Availability****

* **Requirement:** The system shall be available **99% of the time,** excluding planned maintenance.
* **Fit Criterion:** System uptime shall be measured monthly; availability must be ≥ 99%.
* **Related Functional Requirements:** All patient and caregiver functionalities rely on this.

# Risk Management

In this section, we identify and analyze three major risks with the highest risk exposure for our project. Each risk is described in terms of its likelihood, potential consequences, overall exposure, and countermeasures.

### 4.1 Risk 1: Data Breach / Security Vulnerabilities

* **Likelihood and Consequences**: Medium likelihood; high severity. Unauthorized access to sensitive health data could compromise user trust and violate data protection regulations (e.g., HIPAA).
* **Risk Assessment**: High risk exposure due to both legal and reputational damage.
* **Countermeasures**:
  + The system shall encrypt all sensitive data both in transit and at rest (Req# MC\_SEC\_01).
  + The system shall require two-factor authentication for user login (Req# MC\_SEC\_02).
  + Regular security audits and penetration testing.

### 4.2 Risk 2: System Downtime / Service Unavailability

* **Likelihood and Consequences**: Medium likelihood; medium-to-high severity. Downtime during peak usage could result in loss of functionality, missed alerts, and user dissatisfaction.
* **Risk Assessment**: Medium-high risk exposure because system availability is crucial.
* **Countermeasures**:
  + The system shall maintain 99.5% uptime availability (Req# MC\_QOS\_01).
  + Automated failover to backup servers during outages.
  + Proactive monitoring and early-warning alerts for infrastructure issues.

### 4.3 Risk 3: Incorrect Data Processing / False Alerts

* **Likelihood and Consequences**: Low-to-medium likelihood; high severity. Inaccurate alerts (false positives or false negatives) could cause unnecessary panic or missed medical emergencies.
* **Risk Assessment**: High risk exposure due to direct impact on health and safety.
* **Countermeasures**:
  + The system shall validate and cross-check sensor data with multiple inputs before triggering alerts (Req# MC\_FUNC\_05).
  + The system shall log and allow review of all critical alerts for audit (Req# MC\_FUNC\_06).
  + Ongoing testing with real-world data to improve accuracy.

# Requirements Confirmation/Stakeholder sign-off

Include documentation of the approval or confirmation of the requirements here. For example:

| **Meeting Date** | **Attendees (Name and Role)** | **Comments** |
| --- | --- | --- |
| 10/03/2025 | Miss, Project Lead | Confirmed FR\_01 – FR\_09 and QoS\_01 – QoS\_03 |
| 10/03/2025 | Dr. Jane Smith, Clinical Advisor | Confirmed all functional requirements; suggested adding multilingual support (FR\_08) |
| 10/03/2025 | Alex Johnson, Technical Developer | Reviewed and approved system interface requirements and backend design; no changes required |
| 10/03/2025 | Priya Mehta, Caregiver Representative | Confirmed caregiver dashboard requirements and accessibility features; no modifications required |

**Notes:**

* All major functional and non-functional requirements have been reviewed and approved by stakeholders.
* Any suggestions (e.g., additional language support) have been incorporated into the requirements list.