Software Requirements Specification [SRS]

For DementiaInsight

Prepared by: Sophie Samuels, Khushi Patel, and Clarissa Barajas

CEN4010 - Principles of Software Engineering

Dr. Safak Kayikci

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Table of Contents

1 INTRODUCTION

1.1 Purpose

The purpose of this software requirement specifications (SRS) document for DementiaInsight is to provide a comprehensive document to outline the function and non-functional requirements of the application, to define the scope, features, user interactions, performance expectations, and constraints of the application, and to provide guidelines for the development, testing, and validation processes to ensure the product meets the needs of its intended users.

The purpose of this product is to assist care facilities and caregivers in assessing patients' cognitive and physical functioning levels using prompts aligned with the Cognitive Assessment Tool Guide. It is used to determine Allen cognitive levels through structured prompts, providing customized recommendations for care provision based on the assessment outcomes, particularly targeting support for clients with dementia.

Intended audiences include unskilled caregivers of and staff members directly managing aging adults with cognitive and/or physical declines.

1.2 Scope

DementiaInsight is an application designed for use on both mobile and web platforms.

The product *will* facilitate cognitive assessment based on Allen's Cognitive Disability Model, provide structured prompts to guide users through the assessment process, report Allen's cognitive levels based on user responses, offer customized care recommendations for self-care, leisure, and sensory needs, and be accessible on both mobile and web platforms.

The product *will not* serve as a diagnostic tool or criteria for dementia or other medical conditions, replace professional diagnostic assessments, provide medical treatment plans, nor guarantee outcomes from user interactions outside of the scope of cognitive assessment and recommendations.

The benefits of this product include enhanced care provision through evidence-based assessment of cognitive and physical functioning which enables customized care plans, provision of support and guidelines to caregivers who may not have access to specialized dementia training, and increased efficiency and accuracy of producing care support guidelines.

The objectives of this product include accuracy and reliability of patient assessment for cognitive and physical disability outcomes to allow evidence-based

practice outside of skilled services, production of customized care recommendations based on assessment outcomes, and ease of use through design of intuitive prompts and interfaces that are accessible to caregivers with varied levels of technical experience.

The goals of this product include business integration through seamless implementation within care facility practices to enhance care quality and efficiency, scalability through usage by facility multidisciplinary team care providers or individual caregivers outside of facilities, and impact on patient and caregiver quality of life by ensuring appropriate care interventions based on assessment outcomes.

1.3 Definitions, acronyms, and abbreviations

IEEE Definitions / Abbreviations

1.3.1 Code: In software engineering, computer instructions and data definitions expressed in a programming language or in a form output by an assembler, compiler, or other translator.

1.3.2 data: A representation of facts, concepts, or instructions in a manner suitable for com- munication, interpretation, or processing by humans or by automatic means.

1.3.3 delivery: Release of a system or component to its customer or intended user.

1.3.4 development testing: Formal or informal test- ing conducted during the development of a system or component, usually in the development environment by the developer.

1.3.5 functional Requirement: A requirement that specifies a function that a system or system component must be able to perform.

1.3.6 interface: A shared boundary across which two or more separate components of a computer system exchange information.

1.3.7 language: A systematic means of communicating ideas by the use of conventionalized signs, sounds, gestures, or marks and rules for the formation of admissible expressions.

1.3.8 usability: The ease with which a user can learn to operate, prepare inputs for, and interpret outputs of a system or component.

1.3.9 user interface (UI): The part of the system with which users directly interact, including screens, forms, and other graphical elements.

1.3.10 scalability: The capability of a system to handle growing amounts of work, or its potential to be enlarged to accommodate that growth.

1.3.11 validation: The process of evaluating software during or at the end of the development process to determine whether it satisfies specified requirements.

Non-IEEE Definitions / Abbreviations

1.3.12 Allen's Cognitive Disability Model: a model which places emphasis on the integration of the cognitive functional ability and the level of activities that clients are able and willing to perform. Each cognitive level consists of modes of performance, and the overall performance ranges from 0 (generalized reflexive actions) to 6 (normal functioning).

1.3.13 Allen Cognitive Levels (ACL): Each Allen Cognitive Level (ACL) provides a description of the patient's level of occupational functioning and his/her ability to perform familiar activities, as well as to learn new ones. Each proceeding cognitive level in Allen's model is cumulative. For example, a patient with the cognitive ability to perform at Level 3 would also be assumed to have the abilities required for Levels 1 and 2.

1.3.14 boolean: data type, a form of data with only two possible values (usually "true" and "false");

1.3.15 Cognitive Assessment Tool Guide: A tool designed to help identify a person's cognitive status through focused, skilled observations.

1.3.16 dementia capable care (DCC): is an evidence-based dementia and behavior program designed for health care workers that makes a sustainable impact.

1.3.17 outcome: Result or determination of an individual's cognitive functioning based on the structured assessment using Allen's Cognitive Disability Model.

1.3.18 prompt: Questions or statements presented to the user for response.

1.3.19 unskilled: not having or requiring special skill or training pertaining to dementia capable care.

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1.5 Overview

The next chapter, the Specific Requirements section, of this document provides a comprehensive overview of the external interface requirements as well as functional and non-functional requirements which are essential for the development of the application. It is written primarily for the developers and is intended to describe in detail the technical specifications and functional aspects of the product.

2 SPECIFIC REQUIREMENTS

2.1 External Interface Requirements

2.1.1 User Interfaces

The mobile interface characteristics shall support responsive design principles, allowing adaptation to varied screen sizes and screen orientations commonly seen on smartphones and tablets.[6] The layout of the user interface shall prioritize ease of navigation and logical flow, facilitating straightforward access to assessment prompts. Visual aspects shall include clear and high-contrast text labels and high readability fonts to prevent barriers to visual impairments. The interactions shall require touch-friendly controls and gestures for efficiency of interaction.[8] The interface shall comply with accessibility standards to ensure ease of use for individuals with disabilities.[4]

The web platform interface characteristics shall support multiple browsers and screen resolutions, in compliance with responsive web design principles.[9] The page layouts shall include consistent elements including a header, a footer, and navigation tools present in each page. The content of each page shall have a logical structure to guide users through the assessment process. Visual aspects shall include clear and high-contrast text labels and high readability fonts to prevent barriers to visual impairments.[4] Navigation menus shall facilitate easy transitions between different sections.

For both mobile and web platform interfaces, error messages shall clearly explain what the issue is in simple terms that a range of users can understand. The error messages shall clarify the specific problem to avoid vague feedback. Each error message shall be actionable in the sense that it provides a suggestion to the user to

resolve the issue or proceed with the assessment. The format and style of error messages shall be consistent across the program. Error messages shall be validated through usability testing to ensure they are effective in assisting users to both understand and resolve issues.[9]

2.1.2 Hardware Interfaces

DementiaInsight shall support mobile devices running on iOS version 12 and above and Android version 12 and above. The application shall utilize device-specific capabilities including touch screen interface tap and swipe for user interaction and data capturing. It shall ensure compatibility with various screen sizes and orientations across different devices.[6,9]

DementiaInsight shall be compatible with standard web browsers including but not limited to Google Chrome, Safari, Microsoft Edge, and Firefox. The application shall utilize HTML5, CSS3, and JavaScript to provide an interactive and dynamic interface for web platform users. It shall ensure compatibility with various screen sizes, screen resolutions, and browser versions to provide a consistent user experience.[6]

The application shall adhere to accessibility standards to ensure access to the functionalities of the application for users with disabilities.[4]

2.1.3 Software Interfaces

Software Products

Name	MySQL
Mnemonic	DMBS
Specification number	*TBD
Version number	8.4
Source	Oracle Corporation

The data management system, MySQL, shall be used as the primary backend database for DementiaInsight. It shall store and manage user data which includes but is not limited to patient assessments, cognitive levels, and care recommendations. The interface is defined and well-documented in the MySQL 8.4 Reference Manual which is openly available for review.[8,13]

Name	iOS
Mnemonic	OS
Specification Number	N/A
Version Number	iOS 12
Source	Apple Incorporated

Name	Android
Mnemonic	OS
Specification number	N/A
Version number	12
Source	Google LLC

Both iOS and Android operating systems shall provide the platforms necessary for running DementiaInsight on their respective mobile devices. These systems shall manage hardware and provide functionality essential for running the application. The iOS operating system user interface is defined and well-documented within the Apple developer files API Collection.[3] The Android operating system user interface is defined and well-documented within the Android open source project files for Android Interface Definition Language (AIDL) overview.[2]

2.1.4 Communications Protocols

Hypertext transfer protocol secure (HTTPS) shall be utilized by the application to ensure secure communication between DementiaInsight clients using both mobile and web platforms and to allow communication with backend servers. Through Secure Sockets Layer (SSL) and Transport Layer Security (TLS) shall be used to guarantee data integrity and confidentiality over the internet. Digital certificates, also known as SSL certificates, shall be used to create an encrypted connection between a user's computer or browser and a server or website. TLS is an updated version of SSL which provides a higher level of security.[9,11]

Network communication between DementiaInsight components and external servers is made possible using Transmission Control Protocol/Internet Protocol (TCP/IP), which enables messaging between computer equipment and application applications over a network. It is made to ensure that data and messages are successfully sent over networks and to send packets across the internet.[8,12]

For mobile devices running DementiaInsight, Wireless Fidelity (Wi-Fi) provides wireless network connectivity, permitting the usage of local area network (LAN) communication over wireless radio frequencies.[16]

2.2 Functional Requirements

The system shall provide validation for inputs as users respond to assessment prompts to ensure they meet necessary formats and ranges.[5] This will ensure all user responses are valid and acceptable parameters as defined in the Allen Cognitive Disability Model.

The system shall guide users through a logical and structured sequence of prompts for assessment based on Allen's cognitive levels. Prompts shall start at the lowest possible cognitive level (Level 1) and progress to the highest possible cognitive level (Level 6).[1]

The system shall facilitate effective response to abnormal situations. Overflow situations in the context of user response exceeding predefined limits shall be handled by displaying corresponding error messages and implementation of measures to prevent loss of data during input. Communication facilities shall remain stable with backend servers through implementation of HTTPS protocols to maintain secure transmission of data.[11] When network interruptions are encountered, data buffering shall take place to allow upload once reconnected, preventing the loss of data. Error handling and recovery shall be managed through provision of informative and consistent error messages, prompts to guide through recovery of the assessment process to allow resumption of activity, and the support team shall be informed of any critical errors encountered.[6]

The system shall maximize user compatibility in response to parameters selected by the user to allow a customized experience for both assessment and recommendations based on individual preferences and needs.

The system shall collect data to produce a report of cognitive level and recommended care provision strategies, ensuring the reports correspond with the input provided by the user to ensure the reports are accurate and meaningful.[14] The system shall implement predefined algorithms and / or rules to transition assessment data into standardized Allen cognitive levels. This entails implementing the conversion formulas

obtained from Allen's Cognitive Disability Model to convert user input into actionable outputs for caregivers and support staff members.[15]

2.3 Non-Functional Requirements

2.3.1 Reliability

The system shall have a strong error handling mechanism in place to identify problems while the application is operating, record all identified errors for future reference, and handle errors correctly by either safely terminating the program or making an effort to troubleshoot them. To ensure continuation of services, the system shall initiate recovery operations as soon as an error occurs. In addition, when stress circumstances change, for example, during peak user hours or during periods of higher demand for data processing, the system must continue to operate reliably.[6]

2.3.2 Availability

The system shall be available 24/7 for any critical functions. The user shall be informed of scheduled maintenance windows for updates to the applications.

2.3.3 Security

The system shall encrypt all sensitive data transferred across the network using industry-standard protocols to prevent unauthorized access. To preserve confidentiality, personally identifiable information (PII) held in a database must be encrypted using industry-standard techniques. For users login, the system shall use multi-factor authentication (MFA), requiring at least two forms of identification. To effectively handle security concerns, there shall exist monitoring procedures in place to track suspicious activity, including system logins and network traffic.[9] The system must also abide by the requirements of the Health Insurance Portability and Accountability Act (HIPAA) with regards to the handling and storage of protected health information (PHI).[4]

The development teams shall implement best coding practices and guidelines to limit vulnerabilities of the application code.

2.3.4 Maintainability

The system shall be structured in a modular format so that distinct functionalities can be included in each piece of code, utilizing clear and well-documented interfaces to allow standalone development, testing and maintenance procedures.[7]

The development team shall follow the most current standards and guidelines to ensure the application's code is clear and consistent. Unit testing and integration testing shall be implemented to validate individual modules and the interactions of multiple modules to monitor the outcomes of any presented changes. Continuous monitoring of systems performance metrics shall be used to identify and manage performance concerns.[7,9]

2.3.5 Portability

The application shall be developed and maintained with programming languages known for portability across a variety of platforms; these languages shall include HTML5, CSS, JavaScript. Python may also be used for server-side development, given its portability.[9]

With the primary components of the application written with HTML5, CSS, and JavaScript, there is no specific compiler to consider for their implementation. The development team shall implement best practices and current standards for coding to limit compatibility issues among different browsers. The code shall also be tested on a variety of mobile and web browser platforms to ensure it works as intended.[7]

The application shall be compatible with iOS version 12 and Android version 12 and higher operating systems to allow implementation of the application on a variety of modern operating systems.

2.3.6 Performance

The application shall support a minimum of 500 terminals concurrently accessing the system during timeframes of peak usage. The application shall support a minimum of 250 users simultaneously logged in and actively performing assessments and / or review of customized recommendations. The application shall handle up to 250,000 patient records to include assessment results by date, customized recommendations by date, and historical data of the patient profiles with efficient data retrieval capabilities.

The application shall demonstrate a processing time for 95% of assessment submission and processing, data updates, and output of recommendations in less than 2 seconds under standard operating conditions.

2.4 Design Constraints

The application must comply with HIPAA regulations and standards as set for confidentiality and security of patient health information.[4] It also must comply with all applicable health information protection standards of other countries if and when the application is approved for use in countries outside of the United States. Accessibility

standards must also be met to ensure usability for individuals with varied disabilities or impairments.

The design of the application must consider the hardware typically used by caregivers and support staff within and outside of care facilities to ensure efficient performance. The application must also support multiple operating systems and mobile platforms to provide accessibility to its intended audience. Scalability concerns must be considered in the product design to allow future growth in the amount of users and volume of data without interruption to performance.[6,7]

The application must be in compliance with IEEE and other design standards to ensure consistency, usability, and accessibility across devices and technological skill levels. When updates to the program are made, version control practices must be followed to ensure consistent and traceable changes that have been made.[6,7]

3 ADDITIONAL MATERIAL

Cognitive Assessment Tool Guide Document

Cognitive Assessment Tool Guide
Resident/Client
Performed By:
Room#:
Date:

This tool is designed to help identify a person's cognitive status through focused, skilled observations and to support the Allen Cognitive Assessment Battery and the Adapted FAST. Check each statement below that is true. The person may be functioning at the highest stage in which the majority of boxes were checked. Remember, always factor in comorbidities that may impact function. Once this document is completed, continue assessments to verify the results using the Allen Battery, Adapted FAST, Global Deterioration Scale (GDS), or other associated tools as needed.

Allen Level 1 - Crosswalk: GDS Stage 7/Adapted FAST Stage 8/End Stage
- *The person can make sounds or vocalizations.*
- *The person can move his limbs in response to stimulation, even if minimal.*
- *The person can turn her head in response to stimulation.*
- *The person can make facial movement in response to stimulation.*

** Consider validating these observations with sensory stimulation.*
Allen Level 2 - Crosswalk: GDS Stage 6 or 7/ Adapted FAST Stage 7/Late Stage
- *The person can say at least one word.*
- *The person can sit unsupported, or stand, or take a few steps during transfers, and/or walk.The person can make large body movements like raising arm to push through a sleeve, or hitting a balloon, kicking a ball, etc.*
- *With hands-on cueing, the person can hold a finger food or cup and bring it to her mouth.*

** Consider validating these observations with the RTI-E and sensory stimulation.*
Allen Level Low 3 - Crosswalk: GDS Stage 6/Adapted FAST Stage 6/Low Middle Stage

◦ *The person can hold and use familiar objects such as a fork or spoon, hairbrush, toothbrush, bingo chip, crayon, or walker, even for a brief period.*

◦ *The person can follow a one-step direction with verbal cues, visual demonstration and/or hands-on cues, to be sequenced through the steps of a simple, familiar activity (e.g., brush teeth, dress, perform a simple craft or play a simple game.*

** Consider validating these observations with the RTI-E, ACLS, placemat test, or other ADM project.*

Allen Level High 3 - Crosswalk: GDS Stage 6/Adapted FAST Stage 6/High Middle Stage

◦ *The person can follow a one-step direction with verbal cues only to be sequenced through the steps of a simple, familiar activity (e.g., brush teeth, dress, perform a simple craft, or play a simple game).*

◦ *Without cues, the person can note effects of her work such as looking in the mirror to check how she looks when combing her hair, feeling his face when shaving to see if a particular area has been shaved, moving from one spot to another when brushing her teeth or washing her face.The person can do simple sorting, such as sorting green blocks from red blocks, spoons from forks, red socks from black socks, etc.*

** Consider validating these observations with the RTI-E, ACLS, placemat test, or other ADM project.*

Allen Level Low 4 - Crosswalk: GDS Stage 5/Adapted FAST Stage 5/Low Early Stage

◦ *If you place clothing on the bed and say "get dressed," the person can put all of the clothes on without step-by-step assist/cues (can sequence self through every step and know when she's done).*

◦ *If you laid out all of the supplies to brush teeth, shave, or wash face, the person can do every step of these tasks without step-by-step assist/cues (can sequence self through every step and know when he's done).*

◦ *The person can remember the goal of a simple, familiar game such as bingo, dice, or a card game.*

◦ *The person can use/refer to a sample during a craft activity (e.g., if in a craft activity with the goal to duplicate a holiday ornament, the person will look at the sample ornament, after directed to do so, throughout the activity in an attempt to match).*

** Consider validating these observations with the RTI-E, ACLS, placemat test, or other ADM project.*

Allen Level High 4 - Crosswalk: GDS Stage 4/Adapted FAST Stage 4/High Early Stage The person can follow a schedule using clocks, watches, and calendars independently to get to appointments or activities at the appropriate time.

When doing a leisure activity such as a craft, the person can match the sample exactly, without cues, and/or

ask to personalize the craft.

◦ *The person can do ADLs independently with good quality (e.g., shoes on the correct feet, buttons aligned, clothes are neat) and select own clothing appropriately (e.g., match for season, color, event, etc.).*

◦ *The person can change clothes at appropriate times and brush teeth, wash face, and shave each day without any reminders/cues.*

◦ *The person can scan his environment to find necessary supplies. For example, looks for a toothbrush if it's not in plain sight, looks for a remote when it's not in plain sight, looks for a beverage when it's not in plain sight, etc.*

** Consider validating these observations with the RTI-E (unfamiliar task focus), ACLS, or ADM projects.*

Allen Level 5 - Crosswalk: GDS Stage 3/Adapted FAST Stage 3/Mild Cognitive Impairment (MCI)

◦ *The person can learn something new (e.g., using a new/different appliance, using an inhaler, or playing a new game) with demonstrated directions from another person.*

◦ *The person can perform familiar IADLs (e.g., simple cooking and laundry) independently.*

** Consider validating these observations with the RTI-E (unfamiliar task focus), ACLS, or ADM projects.*

Allen Level 6 - Crosswalk: GDS Stage 1 or 2/Adapted FAST Stage 1 or 2/ Normal Cognition

• The person can learn something new (e.g., using a new/different appliance, using an inhaler, or playing a new game) independently and without demonstration (i.e., the person may follow written instructions or use past experience to figure something out).The person can independently anticipate potential problems and hazards (e.g., opens the window for ventilation before using a cleaning product with fumes). The person can think/plan ahead to avoid errors (e.g., reads the directions and checks for all of the necessary parts before putting together a piece of furniture).
** Consider validating these observations with the RTI-E (unfamiliar task focus), ACLS, or ADM projects.*