Software Requirements Specification for Software Engineering: subtitle describing software

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Contents

Revision History

Date	Version	Notes
October 3	1.0	PK & JS added Functional Requirements 9.4,9.5,9.6,
October 3	1.0	Pk & JS added sections 1,3,5

1 Purpose of the Project

1.1 User Business

The project being outlined in this document is an at-home bilingual speech assessment system with video and audio analysis features. The system is designed to provide clear guidance to parents when administering the assessment to their children, in an environment where speech-language pathologists (SLPs) are unavailable. By streamlining the assessment process, the project aims to provide a convenient and comprehensive solution for SLPs to assess and support their patients' speech and language development remotely.

1.2 Goals of the Project

1.2.1 **Intuitive Parent Interface:** The system must provide an intuitive interface that helps parents administer language assessments effectively. It should be easy to navigate with clear and meaningful symbols, and it must provide real-time feedback to ensure parents are aware their interactions are being processed throughout the assessment.

1.2.2 **Engaging Child Interaction:** The system must feature an engaging interface for children to keep them attentive during the assessment. The design should be simple yet visually appealing, using colors and images to attract the child's attention to the questions and selections, ensuring that children remain engaged throughout the assessment.

1.2.3 **Reliable Assessment Data for SLPs:** The system must provide reliable and accurate assessment data for speech-language pathologists (SLPs) by capturing additional contextual data. This includes identifying background interference, signs of bias, and potential test complications. The system should also filter out noise and detect multiple users to prevent external guidance from affecting the assessment results.

1.2.4 **Data Security:** The system must ensure that all sensitive health and personal data is securely stored and accessed. It should implement a strong security protocol to securely store, retrieve, and manage sensitive data, ensuring the privacy and confidentiality of the users.

1.2.5 **Cross-Platform Compatibility:** The system must provide cross-platform compatibility, ensuring that it functions seamlessly across

different devices and screen sizes. It should be accessible to both parents and children, rendering correctly on all screen formats, whether on phones, tablets, or desktops.

2 Stakeholders

2.1 Client

Insert your content here.

2.2 Customer

Insert your content here.

2.3 Other Stakeholders

Insert your content here.

2.4 Hands-On Users of the Project

Insert your content here.

2.5 Personas

Insert your content here.

2.6 Priorities Assigned to Users

Insert your content here.

2.7 User Participation

Insert your content here.

2.8 Maintenance Users and Service Technicians

Insert your content here.

3 Mandated Constraints

3.1 Solution Constraints

3.1.1 The platform must be accessible as a website to provide ease of access to users without requiring special software installations.

3.1.2 The platform must adhere to HIPAA or relevant data protection regulations to ensure patient data privacy and security.

3.1.3 Access to the platform must be restricted to authorized users, with secure authentication processes in place.

3.1.4 The system must be capable of scaling to accommodate an increasing number of users and growing data storage needs as the client expands.

3.1.5 The platform must support assessment sessions of up to at least 30 minutes to align with standard telehealth consultation times.

3.1.6 The platform must support adaptable video and audio quality based on internet bandwidth, ensuring clarity and reliability during assessments.

3.1.7 The platform must comply with WCAG 2.1 accessibility standards, making it accessible to users with varying needs.

3.1.8 Patient records must be retained for a minimum of 7 years from the last visit or at least 1 year after the patient turns 18, whichever is longer, in accordance with California law.

3.2 Implementation Environment of the Current System

3.2.1 The platform's hosting environment must meet HIPAA-compliance standards to ensure data security.

3.2.2 The development framework must support scalable, secure, and efficient web application development, compatible with existing technical infrastructure.

3.3 Partner or Collaborative Applications

3.3.1 The platform must be capable of exporting data as an Excel file, allowing for easy sharing, analysis, and compatibility with other systems that clinicians may use for data processing.

3.4 Off-the-Shelf Software

3.4.1 There are no mandated off-the-shelf software constraints.

3.5 Anticipated Workplace Environment

3.5.1 The platform must be compatible across a range of devices, including desktops, tablets, and mobile phones.

3.6 Schedule Constraints

3.6.1 The proof-of-concept shall be complete and demonstrated between Nov. 11-22, 2024.

3.6.2 Revision 0 of the project shall be complete and demonstrated between February 3-14, 2025.

3.6.3 The final product shall be complete and demonstrated between March 24-30, 2025.

3.7 Budget Constraints

3.7.1 The project budget must not exceed $750 CAD.

3.8 Enterprise Constraints

3.8.1 There are no mandated enterprise constraints.

4 Naming Conventions and Terminology

4.1 Glossary of All Terms, Including Acronyms, Used by Stakeholders involved in the Project

Insert your content here.

5 Relevant Facts And Assumptions

5.1 Relevant Facts

5.1.1 The project is subject to healthcare privacy laws like HIPAA, ensuring that patient data is securely stored and managed.

5.1.2 The client has requested a web-based platform, indicating a preference for accessibility without the need for specialized software installations.

5.1.3 The platform will have two primary user roles. The clinicians who perform assessments and review results and the parents who administer the assessment to their children who are the patients.

5.2 Business Rules

5.2.1 Only authorized users (clinicians) can access patient data.

5.2.2 Patient records must be retained for at least 7 years from the last visit, or 1 year after the patient turns 18, whichever is longer, to comply with California state law.

5.2.3 The platform must comply with WCAG 2.1 to ensure it is accessible to users with disabilities.

5.2.4 All patient data must be encrypted both in transit and at rest to maintain confidentiality and meet regulatory standards.

5.2.5 The platform must generate reports based on assessment data, which can be reviewed and stored within the system

5.2.6 Video and audio recordings must automatically adjust to optimize based on internet bandwidth, ensuring quality without excessive buffering or latency.

5.3 Assumptions

5.3.1 All users of the system have reliable internet connections that can support telehealth video sessions.

5.3.2 All patient data will be stored on servers located in regions that comply with healthcare data residency regulations.

5.3.3 The platform is assumed to be accessible from various devices (desktops, tablets, mobile phones), though it may perform optimally on desktops.

5.3.4 Assessments will not exceed 30 minutes per session to fit standard telehealth consultation times.

5.3.5 It is assumed that users (both clinicians and patients) have a basic level of comfort with using web applications and online communication tools.

5.3.6 The platform may need to accommodate additional users and storage demands as the client scales its telehealth services over time.

6 The Scope of the Work

6.1 The Current Situation

Insert your content here.

6.2 The Context of the Work

Insert your content here.

6.3 Work Partitioning

Insert your content here.

6.4 Specifying a Business Use Case (BUC)

Insert your content here.

7 Business Data Model and Data Dictionary

7.1 Business Data Model

Insert your content here.

7.2 Data Dictionary

Insert your content here.

8 The Scope of the Product

8.1 Product Boundary

Insert your content here.

8.2 Product Use Case Table

Insert your content here.

8.3 Individual Product Use Cases (PUC's)

Insert your content here.

9 Functional Requirements

9.1 Authentication

A1: Description.
Insert formal Specification
Rationale: Insert Rational
Fit criterion: Insert criterion here

9.2 System Setup

SS1: Description.
Insert formal Specification
Rationale: Insert Rational
Fit criterion: Insert criterion here

9.3 User Interactions and Question Handling

UIQH1: Description.
Insert formal Specification

Rationale: Insert Rational
Fit criterion: Insert criterion here

9.4 Data Collection and Storage

FR-DCS1: The database shall store multimedia files including video, audio, and structured data for each session.
Insert formal Specification
Rationale: Video and audio files will provide extra information such as parent interference and other forms of bias/ cheating on the assessment.
Fit criterion: The system must successfully store and retrieve at least 1GB of video, audio and structured data per session without any data corruption.

FR-DSC2: The system shall not store any personally identifiable textual information (e.g., patient name, address, or medical record number) in the database.
Insert formal Specification
Rationale: To maintain privacy and ensure compliance with data protection regulations such as HIPAA, identifying textual information must be excluded from storage in the database.
Fit criterion: An automated process shall verify and confirm that 100% of records in the database accessible by clinicians are anonymized and contain no identifying textual information.

FR-DSC3: The database shall group all stored data by a unique user identifier to ensure data can be linked to specific users without storing identifiable information.
Insert formal Specification
Rationale: Using a unique user identifier allows for data organization and retrieval by patient without compromising patient privacy, supporting the requirement for anonymized data storage.
Fit criterion: The system must assign a unique identifier to every user and confirm through testing that 100% of session data is properly grouped and retrievable under that identifier, with no misassociated data.

9.5 Video and Audio Data Analysis

FR-VADA1: The analysis model shall have access to the video and audio recordings of each session.
Insert formal Specification
Rationale: The data contains essential visual and auditory information that can help clinicians efficiently assess any speech-related disturbances and non-verbal cues.
Fit criterion: The model must successfully retrieve and process video data from 100% of completed assessment sessions without encountering data access errors.

FR-VADA2: The analysis model shall identify speech disturbances, including interruptions, parental assistance on the assessment, or other irregularities in the background.
Insert formal Specification
Rationale: Detecting disturbances is critical for accurate assessment of speech disorders without bias so that clinicians and speech language pathologists can accurately provide diagnosis and treatment.
Fit criterion: The model must accurately identify and log at least 95% of speech disturbances from a set of test videos, validated against human observations.

FR-VADA3: The system shall flag detected disturbances and associate them with specific timestamps in the video recordings.
Insert formal Specification
Rationale: Flagging disturbances and marking the exact points where they occur enables clinicians and speech-language pathologists to quickly review the relevant portions of the assessment, reducing the time needed for manual analysis.
Fit criterion: For each session, the model must accurately attach time stamps to disturbances identified in VADA2 with at least 95% accuracy.

9.6 Data Processing and Display

FR-DPD1: The system shall retrieve processed assessment results from the database for report generation.
Insert formal Specification
Rationale: In order to generate reports, the system must access and extract the necessary data from the database, ensuring that all relevant assessment information is included.
Fit criterion: The system shall successfully retrieve all assessment data without errors within 10 seconds of a query being made.

FR-DPD2: The system shall automatically generate a comprehensive report based on the retrieved assessment data, including flagged occurrences, timestamps, and patient performance metrics.
Insert formal Specification
Rationale: Automatically generating a report provides a streamlined process for clinicians to review the patient's performance, saving time on manual data compilation.
Fit criterion: The report must include all of the required data for each session, and must be generated within 10 seconds of the request.

FR-DPD3: The system shall display the generated report in a user-friendly format, accessible through the platform's interface.
Insert formal Specification
Rationale: Clinicians need to be able to easily view and interpret the report to assess patient progress and determine next steps for therapy.
Fit criterion: The report must be displayed within the clinician's dashboard, formatted with charts and tables where applicable, and fully load within 10 seconds.

FR-DPD4: The system shall store the generated report in the database, linked to the corresponding patient's unique user identifier.
Insert formal Specification
Rationale: Storing the report ensures that clinicians can access previous assessment results, enabling them to track patient progress over time.
Fit criterion: The report must be stored in the database with a unique identifier and timestamp, and be retrievable for at least 7 years after creation.

FR-DPD5: Clinicians shall be able to securely access previously generated reports from the database at any time.
Insert formal Specification
Rationale: Clinicians need on-demand access to reports to monitor progress and make informed treatment decisions during follow-up sessions.
Fit criterion: Clinicians must be able to access 100% of stored reports within 10 seconds.

10 Look and Feel Requirements

10.1 Appearance Requirements

Insert your content here.

10.2 Style Requirements

Insert your content here.

11 Usability and Humanity Requirements

11.1 Ease of Use Requirements

Insert your content here.

11.2 Personalization and Internationalization Requirements

Insert your content here.

11.3 Learning Requirements

Insert your content here.

11.4 Understandability and Politeness Requirements

Insert your content here.

11.5 Accessibility Requirements

Insert your content here.

12 Performance Requirements

12.1 Speed and Latency Requirements

NFR-PSLR1: The system shall load web pages within 3 seconds of navigating to it.
Rationale: Fast page loading is critical for maintaining user engagement and reducing user frustrations during the assessment process.
Fit criterion: The web pages must completely be loaded with all functionalities within the 3 seconds of navigation on a standard broadband internet connection.

NFR-PSLR2: The system must maintain video and audio recording latency of less than 1 second to support accurate data capture for speech assessment.
Rationale: Having high latency could lead to desynchronization between audio and video, causing errors in the timestamps or making it difficult for speech-language pathologists (SLPs) to analyze the recordings properly.
Fit criterion: The difference between a user's actions and the corresponding recording playback should not exceed 1 second.

NFR-PSLR3: The system must ensure that all video recordings are captured in a resolution of at least 720p.
Rationale: A minimum resolution of 720p is necessary to ensure the video can be accurately processed through visual analysis tools. Lower resolutions may not capture sufficient detail, potentially leading to skewed data and inaccurate assessments for clinicians.
Fit criterion: All video's captured and processed must have a minimum resusoltion of 720p.

NFR-PSLR4: The system must process the data from a session and generate a report within 10 seconds, ensuring quick feedback to users (this requirement is satisfied when FR-DPD2 is fulfilled).
Rationale: Generating the assessment reports for clinicians under 10 seconds is essential for maintaining a smooth workflow. Long delays in report generation could cause unnecessary waiting times and reduce the system's perceived

efficiency and user engagement.
Fit criterion: Upon request by clinician, the system must generate a comprehensive report of a the sessions requested within 10 seconds

12.2 Safety-Critical Requirements

N/A.

12.3 Precision or Accuracy Requirements

NFR-PPAR1: The system must achieve a audio analysis accuracy of at least 95% to ensure reliable assessment results for clinicians.
Rationale: It is imporant that the audio analysis accuracy has a high percision rate. Without this level of percision, clinicians could be mislead by inaccurate results affecting the quality of diagnosis and subsequent treatment.
Fit criterion: The speech analysis results will consistently reflect a minimum accuracy rate of 95%.

NFR-PPAR2: The system must detect video disturbances with an accuracy of at least 90% to minimize the impact of visual issues on the assessment data.
Rationale: Detecting video disturbances with 90% accuracy ensures that visual data remains reliable and helps clinicians get accurate data.
Fit criterion: The system will report video disturbance detection rates that meet or exceed 90%.

NFR-PPAR3: The system must ensure that timestamp accuracy is within 1 second to align recorded events with real-time actions for precise analysis.
Rationale: Timestamp accuracy within 1 second ensures that all speech and video events are synchronized precisely, which is essential for accurate analysis of the timing and sequence of interactions. A larger discrepancy could result in data misalignment, skewing the overall assessment and potentially missing critical events.
Fit criterion: Timestamps recorded during assessments will consistently align within a 1-second window, verifying that all events are accurately synchronized.

NFR-PPAR4: The system must guarantee 100% accuracy in the assessment answer key to ensure correct evaluation of responses provided by users.
Rationale: Any errors in the answer key could lead to misinterpretation of a child's abilities or progress, undermining the purpose of the assessment.
Fit criterion: The assessment answer key will be manually be verified to ensure that ti contatins no inaccuracies, ensuring complete correctness of answers.

NFR-PPAR5: The system must ensure that all questions are 100% relevant to the purpose of the platform to maintain focus on accurate speech and language assessment.
Rationale: Ensuring that all questions are fully relevant to the platform's purpose guarantees that the assessment focuses only on aspects critical to speech and language development. Irrelevant questions could confuse users and divert attention from important areas.
Fit criterion: All assessment questions will be manual reviewed to confirm that they align perfectly with the platform's objectives.

12.4 Robustness or Fault-Tolerance Requirements

NFR-PRFTR1: The system must manage errors effectively and provide clear feedback to users when issues occur
Rationale: Proper error handling prevents user confusion and improves the user experience. Without it, users may not understand what went wrong, leading to frustration.
Fit criterion: The system must display error messages for at least 95% of common user errors.

NFR-PRFTR2: The system must implement data backup and recovery processes to protect user data and assessment results.
Rationale: Effective backup and recovery ensure that user data is not lost during a system failure. Data loss could disrupt assessments and treatment plans.
Fit criterion: The system must back up data on the first of every month within a 4hr timeframe.

NFR-PRFTR3: The system must validate inputs to accept only specified

formats during user interactions.
Rationale: Strict input validation prevents errors and enhances data integrity. It also protects the system from malicious inputs that could cause issues.
Fit criterion: The system must reject 100% of invalid inputs and display appropriate error messages to users.

12.5 Capacity Requirements

NFR-PCR1: The system must accommodate a minimum of 2000 user accounts at launch.
Rationale: Supporting at least 2000 user accounts ensures the system meets initial demand and allows for growth in user adoption.
Fit criterion: The system must successfully manage 2000 user accounts at deployment without stability issues.

NFR-PCR2: The system must have the capacity to store a minimum of 10TB of data each year.
Rationale: Storing 10TB of data annually ensures that all user data and assessment results are preserved and accessible for analysis and reporting. This capacity is essential for maintaining comprehensive records over time.
Fit criterion: The database must have 10TB of allocated space at the start of every year.

NFR-PCR3: The system must support a minimum of 400 concurrent users simultaneously and have the capability to scale to accommodate more users as demand increases.
Rationale: Supporting 400 concurrent users is necessary to handle peak usage times effectively. The ability to scale ensures that performance remains stable as user demand grows.
Fit criterion: The system must maintain stable performance levels (e.g throughput, error rate) while supporting 400 concurrent users.

12.6 Scalability or Extensibility Requirements

NFR-PSER1: The system must support the addition of new user accounts without compromising performance.

Rationale: User scalability is essential to accommodate growth in the user base and ensure consistent performance as more users engage with the platform.
Fit criterion: The system must effectively manage a user base increase of at least 10% annually while maintaining performance metrics defined in the capacity requirements.

NFR-PSER2: The system must handle increasing volumes of data without loss of performance or data integrity.
Rationale: Data scalability ensures that as the volume of stored data grows, the system can still process, retrieve, and manage this data efficiently. This is crucial for maintaining system reliability and providing accurate insights from the collected data.
Fit criterion: The system must manage a data increase of at least 10% annually.

NFR-PSER3: The system must expand processing capabilities to handle increased computational demands.
Rationale: Processing scalability is vital for ensuring that the system can efficiently perform analyses and computations as the number of users or the complexity of tasks increases. This prevents bottlenecks in data processing and ensures timely results for clinicians.
Fit criterion: The system must increase data processing capacity by at least 2% without impacting response times for data processing tasks.

12.7 Longevity Requirements

NFR-PLR1: The system must function reliably without significant malfunctions in the release build, even as further development and updates are implemented.
Rationale: Ensuring stability during ongoing development is crucial to maintain user trust and provide uninterrupted service. Any major malfunctions could lead to user frustration and potential loss of users, impacting the system's reputation.
Fit criterion: The system must demonstrate a failure rate of less than 1% in the release build during ongoing development, ensuring that users experience minimal disruptions.

NFR-PLR2: The system must be compatible with major operating systems, including Windows, Mac, Linux, Android, and iOS.
Rationale: Broad compatibility ensures that the system can reach a wider audience, providing access to users regardless of their device or operating system. This is essential for maximizing user engagement and satisfaction.
Fit criterion: The system must pass compatibility tests on all specified operating systems, with successful operation and user experience validated on each platform.

13 Operational and Environmental Requirements

13.1 Expected Physical Environment

Insert your content here.

13.2 Wider Environment Requirements

Insert your content here.

13.3 Requirements for Interfacing with Adjacent Systems

Insert your content here.

13.4 Productization Requirements

Insert your content here.

13.5 Release Requirements

Insert your content here.

14 Maintainability and Support Requirements

14.1 Maintenance Requirements

Insert your content here.

14.2 Supportability Requirements

Insert your content here.

14.3 Adaptability Requirements

Insert your content here.

15 Security Requirements

15.1 Access Requirements

Insert your content here.

15.2 Integrity Requirements

Insert your content here.

15.3 Privacy Requirements

Insert your content here.

15.4 Audit Requirements

Insert your content here.

15.5 Immunity Requirements

Insert your content here.

16 Cultural Requirements

16.1 Cultural Requirements

Insert your content here.

17 Compliance Requirements

17.1 Legal Requirements

Insert your content here.

17.2 Standards Compliance Requirements

Insert your content here.

18 Open Issues

Insert your content here.

19 Off-the-Shelf Solutions

19.1 Ready-Made Products

Insert your content here.

19.2 Reusable Components

Insert your content here.

19.3 Products That Can Be Copied

Insert your content here.

20 New Problems

20.1 Effects on the Current Environment

Insert your content here.

20.2 Effects on the Installed Systems

Insert your content here.

20.3 Potential User Problems

Insert your content here.

20.4 Limitations in the Anticipated Implementation Environment That May Inhibit the New Product

Insert your content here.

20.5 Follow-Up Problems

Insert your content here.

21 Tasks

21.1 Project Planning

Insert your content here.

21.2 Planning of the Development Phases

Insert your content here.

22 Migration to the New Product

22.1 Requirements for Migration to the New Product

Insert your content here.

22.2 Data That Has to be Modified or Translated for the New System

Insert your content here.

23 Costs

Insert your content here.

24 User Documentation and Training

24.1 User Documentation Requirements

Insert your content here.

24.2 Training Requirements

Insert your content here.

25 Waiting Room

Insert your content here.

26 Ideas for Solution

Insert your content here.

Appendix — Reflection

The information in this section will be used to evaluate the team members on the graduate attribute of Lifelong Learning. Please answer the following questions:

1. What knowledge and skills will the team collectively need to acquire to successfully complete this capstone project? Examples of possible knowledge to acquire include domain specific knowledge from the domain of your application, or software engineering knowledge, mechatronics knowledge or computer science knowledge. Skills may be related to technology, or writing, or presentation, or team management, etc. You should look to identify at least one item for each team member.

2. For each of the knowledge areas and skills identified in the previous question, what are at least two approaches to acquiring the knowledge or mastering the skill? Of the identified approaches, which will each team member pursue, and why did they make this choice?