Software Requirements Specification for Software Engineering

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Contents

Revision History

Table 1: Revision History (Part 1)

Date	Vers.	Contributors	Notes
10/03/24	1.0	Mitchell Weingust, Parisha Nizam	Added: • FR 9.1 • FR 9.2 • FR 9.3
10/03/24	1.1	Promish Kandel, Jasmine Sun-Hu	Added: • FR 9.4 • FR9.5 • FR 9.6 • Section 1 • Section 3 • Section 5
10/04/24	1.2	Mitchell Weingust, Parisha Nizam	Added: • NFR 11 • NFR 13 • NFR 15 • NFR 17
10/04/24	1.3	Jasmine Sun-Hu	Added: • NFR 10 • NFR 14 • NFR 16
10/05/24	1.4	Promish Kandel	Added: • NFR 12
10/06/24	1.5	Mitchell Weingust, Parisha Nizam	Added: • Section 2 • Section 4

Table 2: Revision History (Part 2)

Date	Vers.	Contributors	Notes
10/09/24	1.6	Jasmine Sun-Hu	Added: • Scope of the Work: Current Situation • Costs 6.1 • Costs 23
10/09/24	1.7	Mitchell Weingust	Added: • Section 8 • Section 18
10/10/24	1.8	Mitchell Weingust	Added: • Section 8 • Section 19
10/11/24	1.9	Jasmine Sun-Hu	Added: • Section 6.4 • Traceability Matrix • References
10/11/24	1.10	Promish Kandel	Added: • Section 20 • Section 24 • Section 25 • Formal Specification
10/11/24	1.11	Parisha Nizam	Added: • Section 21 • Section 22 • Section 26 • Traceability Matrix
10/11/24	1.12	All	Added: • Reflection • Minor edits

Table 3: Revision History (Part 3)

Date	Vers.	Contributors	Notes
11/07/24	1.13	Mitchell Weingust	Implemented Peer Review Feedback: • Won't Fix - Use Case Diagram • Personalization and Internationalization Requirements • Won't Fix - Clearly define user roles and permissions
12/24/24	1.14	Jasmine Sun-Hu	Implemented Peer Review Feedback: • Refactor Work Context Model • Expanding on Constraints • Cultural Requirements and Cost Calculation • Appearnace Requirements
03/23/25	2.0	Mitchell Weingust	Fixed: • Revision History Formatting
03/23/25	2.1	Mitchell Weingust	Implemented TA Feedback: • Minor spelling errors Assessmenet
03/23/25	2.2	Mitchell Weingust	Implemented TA Feedback: • Figure 5: "User" should be "Use"
03/23/25	2.3	Mitchell Weingust	Fixed: • Changed page numbering from roman to arabic
03/23/25	2.4	Mitchell Weingust	Fixed: • Formatting with section/page spacing

Table 4: Revision History (Part 3)

Date	Vers.	Contributors	Notes
03/23/25	2.5	Mitchell Weingust	Implemented TA Feedback: • Added table numbers and captions to all tables, and mentioned in text
03/23/25	2.6	Mitchell Weingust	Updated: • Dates and deadlines to reflect actual timeline
03/23/25	2.7	Mitchell Weingust	Implemented TA Feedback: • Fixed MS-MR1 to be easier to test. Fit criterion is concrete and measurable
03/23/25	2.8	Mitchell Weingust	Implemented TA Feedback: • Fixed identifying template used and changes made

1 Purpose of the Project

The purpose of the project is explored in the following section. This includes user business and goals of the project.

In addition, this document is based on the Volere Requirements Specification Template [1]. This document adheres to the standards of this template, exactly as given by the course instructor, as modifications indicates a loss of some of the advantage of a standardized template. As a result, the document's template has not been modified. Any non-applicable sections have been stated accordingly, without removal.

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

- This project's client is Researcher, Clinician Assistant, Professor at the University of Southern California, Dr. Yao Du.
- Another stakeholder is this project's supervisor, Dr. Irene Ye Yuan, Assistant Professor in the Department of Computing and Software at McMaster University.

2.2 Customer

- This project's customers are Clinicians (SLPs) who work with children that have speech difficulties.
- Another one of the project's customers are the children with speech difficulties who take language assessments.
- Another one of the project's customers are the parents of children with speech difficulties.

2.3 Other Stakeholders

- Data Analysts may be another stakeholder, if they decide to review and analyze the data.
- Society is another important stakeholder to consider, as the system being developed is impactful for workers and technological developments in the healthcare field. As well, as this is a healthcare application, the safety of society must be taken into account to ensure the project. In addition, important cultural sensitivities and their appropriate contexts must be considered for the system to prevent unintentional offensiveness.

2.4 Hands-On Users of the Project

Hands-on users for this project include the parents of children that have speech difficulties, as well as the children themselves, who need to take language assessments.

In addition, speech language pathologists are important hands-on users for this project as they are assessing the assessment results, assessing children's performances, and keeping track of the children's improvements overtime.

2.5 Personas

User Profile:
Name: Paul Blart
Age: 42
Job: Mall Cop
Personality Traits: Caring, Strict, Empathetic, Impatient, Stubborn

Key Task Goals:

- Convenient access to healthcare technology for his family.
- Use a system that is easy for both him and his child to learn and use.
- Wants a system that is available for him to use at any time, as his job doesn't usually allow him to schedule in-person assessments easily.
- Cares about his family's safety and security, so he wants a system that will keep their healthcare and personal information confidential.

Motivations/Frustrations:

- Paul is motivated by caring for his child, and wants the best support for them.
- Paul is encouraged to find a system that his child can easily navigate, so it does not stress them out or make their lives more difficult.
- Paul is frustrated by systems that take too long to load.
- Paul is frustrated by systems that are not easy to use, as he often has to dedicate long periods of time to learn new technology.
- Paul doesn't like changing his routine, so he wants to find a system that works for him, and stick with it.

- Paul is motivated to find a system that will best help his child so he can see how their language understanding improves over time.

Quote:
'Man, technology is so hard! I love my kid, but I am so busy. My kid doesn't like going in person to speak with clinicians. I need a solution that will make them feel more comfortable. I wish there was a way to track their progress, so I can see how they're improving.'

2.6 Priorities Assigned to Users

1. Children (who take learning assessments)
2. Parents and SLPs
3. Researcher (Dr. Yao Du)
4. Supervisor (Dr. Irene Ye Yuan)
5. Society

2.7 User Participation

- Parents

  No input necessary.

- Children (who take learning assessments)

  No input necessary.

- SLPs

  No input necessary.

- Researcher (Dr. Yao Du)

  Occassional input, communication is managed through the project's supervisor.

- Supervisor (Dr. Irene Ye Yuan)

  Frequent input, with minimum weekly checkins to ensure the project is within scope and on-track.

- Society

  No input necessary.

2.8 Maintenance Users and Service Technicians

N/A

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.

Rationale: A web-based platform maximizes accessibility for users across various devices, and prevents installation of external software which could be a barrier of entry.

Fit Criterion: The platform must run without requiring the installation of external software, and display with visual consistency across at least 3 different browsers.

3.1.2 The platform must adhere to HIPAA or relevant data protection regulations to ensure patient data privacy and security [2].

Rationale: Compliance with HIPAA will maintain trust that sensitive data is protected for patients and users of the website.

Fit Criterion: A HIPAA compliance audit must confirm data encryption, user authentication and data storage adhere to HIPAA

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

Rationale: This ensures data privacy and prevents data breaches from unauthorized users.

Fit Criterion: The platform must require secure authentication of all users, and testing must confirm there are no unauthorized access vulnerabilities found before deployment.

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.

Rationale: Scalability ensures the system can handle future growth without degrading performance

Fit Criterion: Load testing must demonstrate the system can support 200 concurrent users without performance degradation

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

Rationale: Telehealth sessions often last for extended periods of time, the platform should maintain uninterrupted functionality.

Fit Criterion: System testing must confirm that the platform can maintain video and audio recordings for at least 30 minutes without any interruptions or crashes.

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

Rationale: A smooth and consistent performance improves user experience.

Fit Criterion: Testing must confirm that video and audio streams automatically adjust quality within a bandwidth range of 0.5 Mbps to 5 Mbps without freezing or loss of synchronization.

3.1.7 The platform must comply with WCAG 2.1 accessibility standards, making it accessible to users with varying needs [3].

Rationale: The project is focused around children with speech difficulties, meeting accessibility standards is necessary to ensure the platform is usable by the user base.

Fit Criterion: A WCAG compliance audit must confirm adherence to at least Level AA standards.

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 [4].

Rationale: Keeping records for the specified duration ensures compliance with legal obligations and supports continuous care.

Fit Criterion: System audits must confirm patient records are kept for the required amount of time and the data can be archived securely beyond the active period

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 [2].

Rationale: A compliant hosting environment is important for protecting sensitive data.

Fit Criterion: An infrastructure compliance review must confirm that the hosting environment meets encryption, access control, and logging requirements for HIPAA.

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

Rationale: A compatible framework is important to ensure scalability and security, and also reduces technical overhead.

Fit Criterion: The website must achieve a response time of less than 300ms for 95% of requests and pass security evaluations with no more than one low severity vulnerability identified during testing.

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.

Rationale: Universally accepted format files make any integration with third party systems and enables flexible data handling.

Fit Criterion: Testing must confirm that exported files retain all data fields and formatting accurately when opened in Excel.

3.4 Off-the-Shelf Software

3.4.1 N/A. 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.

Rationale: Device compatibility ensures users can access the platform from their preferred device, enhancing accessibility and convenience.

Fit Criterion: Testing must confirm that the platform is fully functional and displays correctly on devices with screen sizes ranging from 4" to 27".

3.6 Schedule Constraints

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

Rationale: Required by the Capstone course instructors.

Fit Criterion: Proof-of-concept must be operational and ready for demonstration by Nov. 11, 2024.

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

Rationale: Required by the Capstone course instructors.

Fit Criterion: Revision 0 must incorporate feedback and meet all baseline requirements by February 3, 2025.

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

Rationale: Required by the Capstone course instructors.

Fit Criterion: The final product must be operational and meet all specifications, verified through testing and stakeholder acceptance by March 24, 2025

3.7 Budget Constraints

3.7.1 The project budget must not exceed $750 CAD.

Rationale: Staying within budget ensures the project remains financially feasible.

Fit Criterion: Financial tracking must confirm that total expenses do not exceed $750 CAD throughout the project lifecycle.

3.8 Enterprise Constraints

3.8.1 N/A. 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

The glossary of all terms are featured in Table 5 below.

Table 5: Naming Conventions and Terminology

Terms	**Definition**
SLP	Speech Language Pathologist
HIPAA	Health Insurance Portability and Accountability Act [2]
WCAG	Web Content Accessibility Guidelines [3]
ML	Machine Learning
PUC	Product Use Case
FR	Functional Requirement
NFG	Non-Functional Requirement
BUC	Business Use Case
TB	Terabyte

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 [2].

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 [3].

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 uploading video and audio recordings to the database.

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 with working microphone and camera, though it may perform optimally on desktops.

5.3.4 Assessments will not exceed 30 minutes per session to fit standard telehealth assessment 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

Currently, speech language assessments for bilingual children with speech difficulties require in-person visits, which can be logistically challenging for families and clinicians. While there are some existing telehealth solutions, they are much more generalized and there are no existing solutions specifically for the unique needs of bilingual children with speech difficulties such as a platform that offers assessments in multiple languages. There is a need for a remote online solution where parents can administer language assessments to their children while minimizing the bias the parent may introduce during the assessment.

Additionally, clinicians currently store all unprocessed data on excel files which can be tedious, disorganized, and require extra time from the clinician to go through. A solution that tracks the remote assessment responses and generates a report from processed data will save the clinician or SLP significant time. Moreover, a solution that tracks the interactions between the user and the interface which can detect points of bias or disturbance can help a clinician review an assessment session and either accept the remote assessment results with confidence or recognize where points of bias occur.

6.2 The Context of the Work

The diagram below models the high level interactions within the system as well as with any external systems.

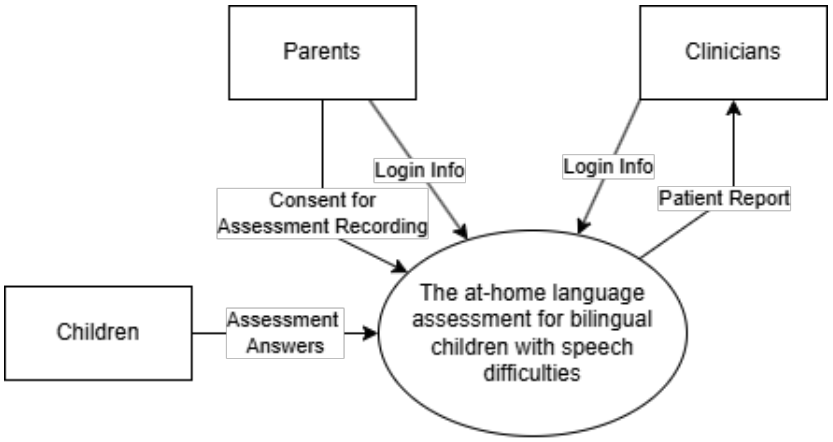

Figure 1: Context of the Work

All incoming and outgoing data to and from the database will be processed through the backend server first, the arrows are drawn directly for a simpler high-level diagram.

6.3 Work Partitioning

Table 6 and Table 7 feature work partitioning of the project's business use cases.

Table 6: Work Partitioning of BUC

Event Name	**Input/Output**	**Summary**
Provide Display Report	IN: Display Report	Give a report of all sessions
Provide Assessment answer	IN: Completed Assessment	Give a list of all the answers picked for a current session assessment
Provide Record Assessment	IN: Record Assessment	Give a video recording taken form the current assessment
Display Report	OUT: View Report	Display report for all sessions when requested by clinician
Store Video Recording	OUT: Video Recording	Send video recording to be stored in the database
Store Audio Recording	OUT: Audio Recording	Send audio recoridng to be stored in the database
Store Assessment Data	OUT: Assessment Data	Send assessment data for the current session to be stored in the database
Store User Profile Information	OUT: User Profile Information	Send user profile information for the current user to be stored in the database
Store Report Infromation	OUT: Store Report	Send report information with timestamps to be stored in the database

Table 7: Work Partitioning of BUC (Part 2)

Event Name	**Input/Output**	**Summary**
Do Video Analysis	IN: Assessment Data, Video Recording/ OUT: Analysis Results	Given assessment data and video recording, analyze the data and send the results back
Do Audio Analysis	IN: Assessment Data, Video Recording/OUT: Analysis Results	Given assessment data and video recorind, analyze the data and send the results back

6.4 Specifying a Business Use Case (BUC)

The following is a sequence diagram for the Video Analysis process. The business use case will be triggered by the user interacting with the system when they submit an assessment. The output will be the video analysis detecting and identifying any disturbances during the assessment and details such as the related assessment question, answer, and timestamp.

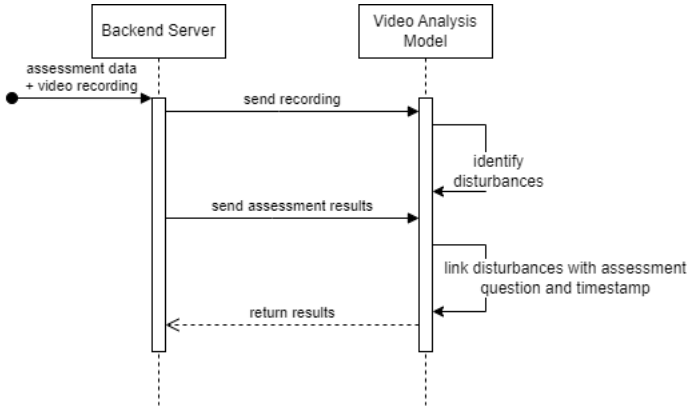

Figure 2: BUC Video Analysis Sequence Diagram

7 Business Data Model and Data Dictionary

7.1 Business Data Model

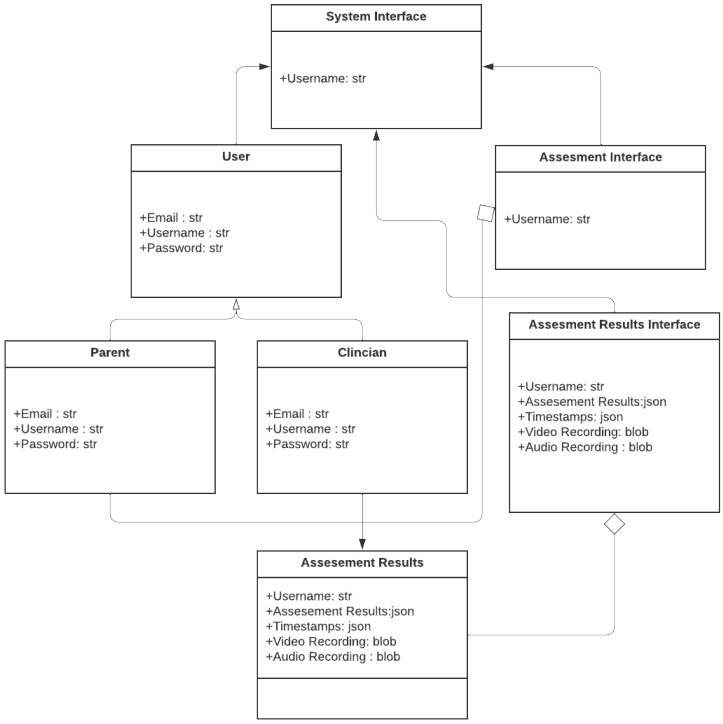

Figure 3: UML Diagram of System's Data Layout

7.2 Data Dictionary

This section contains the project's data dictionary, which is featured in Table 8.

Table 8: Descriptions of Data Elements in Model

Name	**Type**	**Content**
System Interface	Interface	Encompasses entire system that a user can view, using username
User	Parent Class	User Content
Parent	Class	Parent Content
Clinician	Clinician Class	Clinician Content
Email	Attribute	Login email
Username	Attribute	Unique Login Username
Password	Attribute	Unique Password
Assessment Results	Class	Stores Result data from assessments
Assessment Results	Attribute	Stores data from assessment questions (selected answers and results) in a json
Timestamps	Attribute	Stores timestamp data at each question starting point in a json
Video Recording	Attribute	Video Recordings of assessment is stored as blob
Audio Recording	Attribute	Audio Recordings of assessment is stored as blob
Assessment Results Interface	Interface	Stores assessment data and displays to clinicians
Assessment Interface	Interface	Displays view for parent to learn, and complete assessment with child

8 The Scope of the Product

8.1 Product Boundary

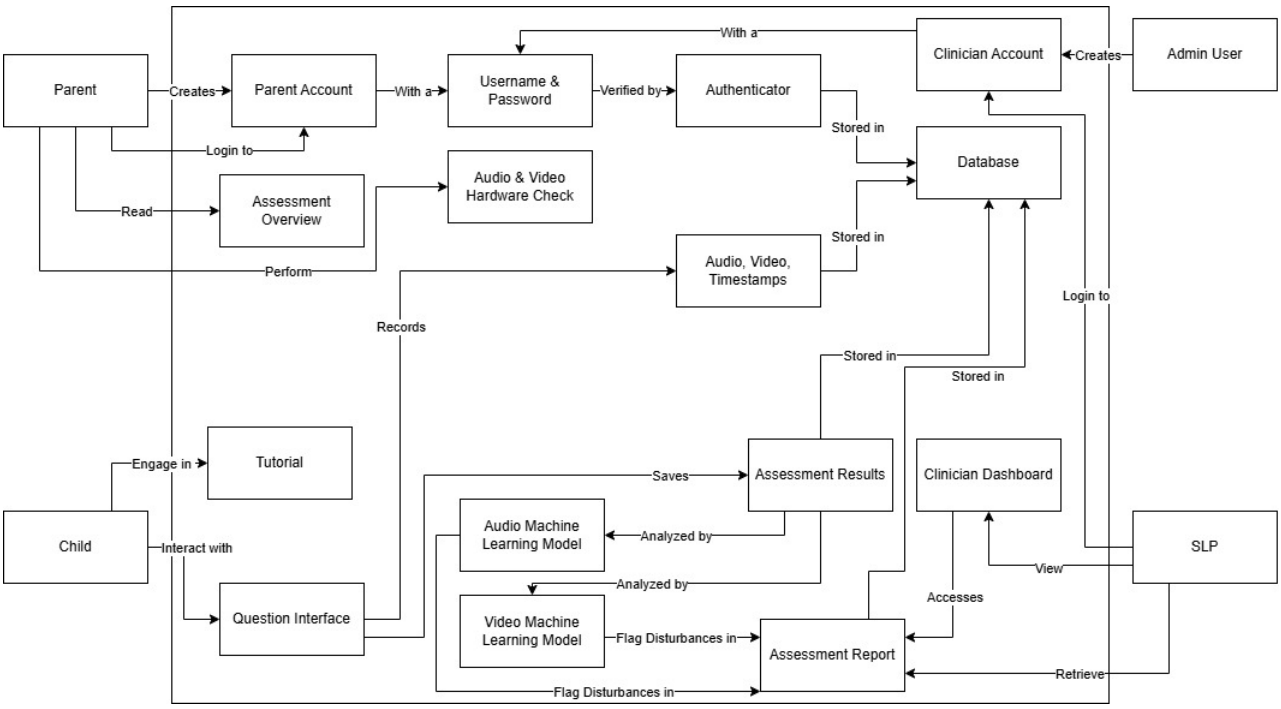

Figure 4: Boundary Diagram

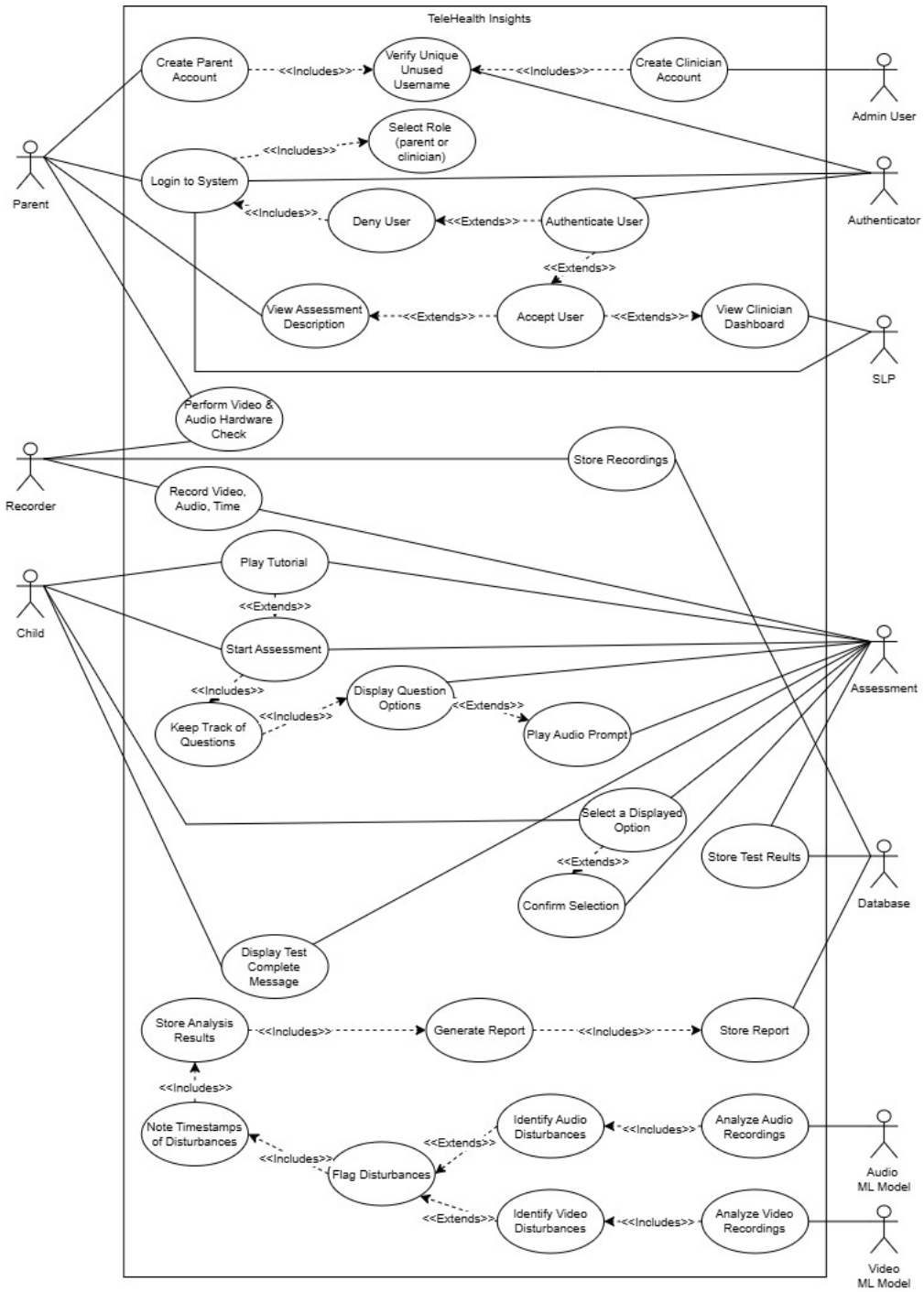

Figure 5: Use Case Diagram

8.2 Product Use Case Table

The project's product use case table is featured in Table 9, Table 10, and Table 11 below.

Table 9: Account Management and Authentication Use Cases

PUC No.	**PUC Name**	**Actor(s)**	**Input(s)**	**Output(s)**
PUC-01	Create Parent Account	Parent	Username & Password	
PUC-02	Verify Unique Unused Username	Parent & Authenticator	Username	Account Created or Failure Message
PUC-03	Create Clinician Account	Admin User & Authenticator	Username & Password	
PUC-04	Login to System	Parent & Authenticator & SLP	Username & Password	
PUC-05	Select Role	Parent & SLP	Role Selection	
PUC-06	Deny User	Parent & Authenticator & SLP		Login failure message
PUC-07	Authenticate User	Authenticator	Username & Password	
PUC-08	Accept User	Authenticator		Go to View Assessment Description or View Clinician Dashboard

Table 10: Assessment Execution Use Cases

PUC No.	**PUC Name**	**Actor(s)**	**Input(s)**	**Output(s)**
PUC-09	View Assessment Description	Parent		Display Assessment Description
PUC-10	View Clinician Dashboard	SLP		Display Clinician Dashboard
PUC-11	Perform Video & Audio Hardware Check	Parent & Recorder	Sound Input & Video Input	Confirmation Message or Repeat Procedure
PUC-12	Store Recordings	Recorder & Database	Audio Recordings & Video Recordings	
PUC-13	Record Video, Audio, Time	Recorder & Assessment	Video Recordings & Audio Recordings & Timer	
PUC-14	Play Tutorial	Child & Assessment	Click Play Tutorial Button	Plays Tutorial
PUC-15	Start Assessment	Child & Authenticator	Click Start Assessment Button	Go to First Question
PUC-16	Keep Track of Questions	Assessment	Click Confirm Selection	Question Number
PUC-17	Display Question Options	Assessment		Display Options
PUC-18	Play Audio Prompt	Assessment		Plays Audio
PUC-19	Select a Displayed Option	Child & Assessment	Select Option	Highlight Option
PUC-20	Confirm Selection	Child & Assessment	Select Confirm Selection	Go to Next Question or Test Complete
PUC-21	Display Test Complete Message	Child & Assessment	Select final Confirm Selection	Display Message
PUC-22	Store Test Results	Assessment & Database	Test Results	Store Results

Table 11: Data Analysis and Reporting Use Cases

PUC No.	**PUC Name**	**Actor(s)**	**Input(s)**	**Output(s)**
PUC-23	Analyze Audio Recordings	Audio ML Model	Audio Recording	Analyzed Recording Data
PUC-24	Identify Audio Disturbances	Audio ML Model	Analyzed Recording Data	List of disturbances
PUC-25	Analyze Video Disturbances	Video ML Model	Video Recording	Analyzed Recording Data
PUC-26	Identify Video Disturbances	Video ML Model	Analyzed Recording Data	List of disturbances
PUC-27	Flag Disturbances	Audio ML Model & Video ML Model	List of disturbances	Timestamp Markers
PUC-28	Note Timestamp of Disturbance	Audio ML Model & Video ML Model	Timestamp Markers	Report Data
PUC-29	Store Analysis Results	Audio ML Model & Video ML Model & Database	Report Data	Analysis Results
PUC-30	Generate Report	Database	Analysis Results	Assessment Report
PUC-31	Store Report	Database	Assessment Report	Store Report

8.3 Individual Product Use Cases (PUC's)

PUC-01. Create Parent Account
Precondition: None
Trigger: Parent selects 'Create Account'
Outcome: Parent is brought to screen to Create Account with their information
Postcondition: Parent's account creation is passed to authenticator to be verified

PUC-02. Verify Unique Unused Username
Precondition: Parent or Admin user creates a new account
Trigger: User types in their preferred account username for creating their account
Outcome:

- User's account is created
- User needs to select a unique username

Postcondition: User is logged into their newly created account

PUC-03. Create Clinician Account
Precondition: Clinician goes to their admin user to request account creation
Trigger: Admin user creates a new clincian account
Outcome: Clinician's account creation is verified by authenticator
Postcondition: Clinician's account is created

PUC-04. Login to System
Precondition: User is on login screen
Trigger: User selects login button from home screen
Outcome:

- User logs into their account
- Authenticator denies user (incorrect credentials)

Postcondition: User enters system logged into their account

PUC-05. Select Role
Precondition: User is on login screen
Trigger: User selects their role (choosing between parent or clinician)
Outcome: User's permissions are set depending on chosen role
Postcondition: Role is selected for login

PUC-06. Deny User
Precondition: Authenticator could not authenticate user with their credentials
Trigger: User entered incorrect credentials for their account
Outcome: User is returned to the login screen
Postcondition: User is denied entry into their account

PUC-07. Authenticate User
Precondition: User attempted to login to their account
Trigger: User entered their login information on login screen
Outcome: Authenticator verifies against account details stored in system
Postcondition:

- If user input correct credentials, user is accepted
- If user input incorrect credentials, user is denied

PUC-08. Accept User
Precondition: User login information has been verified by the Authenticator
Trigger: User successfully inputs correct account information
Outcome:

- If user is a clinician, user is brought to clinician dashboard
- If user is a parent, user is brought to view assessment description and details

Postcondition: User is logged into their account in the system

PUC-09. View Assessment Description
Precondition: User successfully logs into the system as a parent
Trigger: User is verified by the authenticator upon logging in
Outcome: Assessment description details are displayed on screen
Postcondition: User goes to assessment description screen

PUC-10. View Clinician Dashboard
Precondition: User successfully logs into the system as a clinician
Trigger: User is verified by the authenticator upon logging in
Outcome: Clinician dashboard is displayed on screen
Postcondition: User goes to clinician dashboard screen

PUC-11. Perform Video & Audio Hardware Check
Precondition: Parent read over the assessment details
Trigger: Parent selects setup video and audio hardware check
Outcome: Parent performs video and audio hardware check
Postcondition: Prompt to 'go to tutorial' is displayed on screen

PUC-12. Store Recordings
Precondition: User has completed the assessment
Trigger: User has confirmed their selection on the final question of the assessment
Outcome: Recording is stopped
Postcondition: Recording is saved in the database

PUC-13. Record Video, Audio, Time
Precondition: User has completed the video and hardware check
Trigger: User confirms start of the assessment
Outcome: Record the user's video, audio, and time
Postcondition: Recording has started

PUC-14. Play Tutorial
Precondition: Parent has completed video and audio hardware check
Trigger: User confirms they want to start the tutorial

Outcome: Tutorial plays on screen
Postcondition: User goes to tutorial screen

PUC-15. Start Assessment
Precondition: User has completed watching the tutorial
Trigger: User confirms they want to start the assessment
Outcome: Assessment starts
Postcondition: Go to first question

PUC-16. Keep Track of Questions
Precondition: Assessment has started
Trigger: Confirming selection after choosing from a question's options
Outcome: Displayed question information is updated
Postcondition: Go to corresponding question's screen

PUC-17. Display Question Options
Precondition: User started the assessment
Trigger: A new question is displayed on screen
Outcome: Corresponding question options are displayed on screen
Postcondition: Options are displayed on question's screen

PUC-18. Play Audio Prompt
Precondition: User is on a question page
Trigger: Question options are displayed
Outcome: Audio prompt is played
Postcondition: Remain on question page

PUC-19. Select a Displayed Option
Precondition: Question's corresponding audio has played for the user
Trigger: User selects amongst the options displayed
Outcome: Visually indicate the user's selected option
Postcondition: Remain on question page

PUC-20. Confirm Selection
Precondition: User selected an option
Trigger: User selects 'Confirm Selection'
Outcome:

- User goes to next question
- If this is the final question, display test completion message

Postcondition: User's selected option is saved

PUC-21. Display Test Complete Message
Precondition: User is on the final question
Trigger: User confirmed their option selection
Outcome: Test complete message is displayed
Postcondition: Go to test completion screen

PUC-22. Store Test Results
Precondition: Test is complete
Trigger: Test complete message has been displayed on screen
Outcome: Test results are stored in the database
Postcondition: Test results are available for future analysis and can be accessed by clinicians

PUC-23. Analyze Audio Recordings
Precondition: Audio recordings are stored in the database
Trigger: New recordings have been sent to the database
Outcome: Audio recordings are processed by the audio machine learning model
Postcondition: Audio recordings are available for identification of disturbances

PUC-24. Identify Audio Disturbances
Precondition: Audio recordings have been processed by the audio machine learning model
Trigger: New recordings have been analyzed

Outcome: Audio disturbances are identified
Postcondition: Identified audio disturbances are prepared to be flagged

PUC-25. Analyze Video Disturbances
Precondition: Video recordings are stored in the database
Trigger: New recordings have been sent to the database
Outcome: Video recordings are processed by the video machine learning model
Postcondition: Video recordings are available for identification of disturbances

PUC-26. Identify Video Disturbances
Precondition: Video recordings have been processed by the video machine learning model
Trigger: New recordings have been analyzed
Outcome: Video disturbances are identified
Postcondition: Identified video disturbances are prepared to be flagged

PUC-27. Flag Disturbances
Precondition: Audio and Video disturbances have been identified.
Trigger: New disturbances have been identified
Outcome: Disturbances are flagged for the clinician to review
Postcondition: Flagged disturbances are recorded

PUC-28. Note Timestamp of Disturbance
Precondition: Flagged disturbances have been recorded
Trigger: None
Outcome: Flagged disturbances are prepared for further review by clinicians
Postcondition: Timestamps of flagged disturbances are recorded and matched with recordings

PUC-29. Store Analysis Results
Precondition: Disturbances have been identified, flagged, and corresponding timestamps have been recorded

Trigger: Model has completed processing and analyzing recording
Outcome: Analysis results are stored as data for the clinician report
Postcondition: Analysis results are stored in the database

PUC-30. Generate Report
Precondition: Analysis results have been analyzed and processed
Trigger: All analysis results have been stored
Outcome: Clinician report is generated with data from the assessment analysis
Postcondition: Report is created to be stored in the database

PUC-31. Store Report
Precondition: Clinician report is generated
Trigger: None
Outcome: Report is available to be viewed and accessed by the clinician
Postcondition: Clinician report is stored in the database

9 Functional Requirements

9.1 Authentication

FR-A1. The system shall allow the user to choose between a Parent and or Clinician account prior to logging in.
Rationale: Users must be associated with the correct permissions determined by their role, which includes the level of information they have access to.
Fit criterion: Users must be able to directly select their account type prior to logging in.

FR-A2. The system shall allow a user to create a parent account with a unique username which does not exist in the database.
Rationale: Users must be able to create a unique account for parents to login for the assessment.
Fit criterion: Users cannot create accounts with usernames that already exist in the database.

FR-A3. The system shall allow a user with admin privilege to create a clinician account with a unique username which does not exist in the database.
Rationale: Admin-Users must be able to create a unique account for clinicians to login to view assessment results. Clinicians need to be approved by Admin-Users to have a clinician account.
Fit criterion: Users cannot create clinician accounts, without admin access, with usernames that already exist in the database.

FR-A4. The system shall allow a user with a unique username to login with their corresponding password.
Rationale: Users must be able to login to their account to restrict others from accessing their assessment or assessment results.
Fit criterion: Users must be able to provide the corresponding password to their unique username to login and successfully enter the system.

FR-A5. The system shall allow a user to logout.
Rationale: Users must be able to logout of their account to restrict others from accessing their information.
Fit criterion: Users must be able to logout and successfully exit the system.

9.2 System Setup

FR-SS1. The system shall allow the user to preview information about the assessment.
Rationale: Users must be informed about relevant assessment information prior to starting the hardware checks.
Fit criterion: Users must be able to view information about the assessment upon logging in.

FR-SS2. The system shall allow a user to perform an audio hardware check.
Rationale: Users must be able to perform an audio equipment check to ensure their input and output audio devices are functioning.
Fit criterion: Users must be able to verify their audio devices are functioning with the system.

FR-SS3. The system shall allow a user to perform a video hardware check.
Rationale: Users must be able to perform an video equipment check to ensure their video capturing device is functioning.
Fit criterion: Users must be able to verify their video capturing device is functioning with the system.

FR-SS4. The system shall provide a tutorial for a user to learn the assessment process.
Rationale: Users must be able to walkthrough a tutorial to understand how to properly complete the assessment.
Fit criterion: Users must be brought to the tutorial upon completing the audio and video hardware checks.

FR-SS5. The system shall allow a user to start an assessment.
Rationale: Users must be able to decide when they start an assessment.
Fit criterion: Users must be brought to the first assessment question upon starting the assessment.

9.3 Assessment Interface

FR-AI1. The system shall record user's audio and video upon starting the assessment.
Rationale: The system must be able to collect audio and video recordings for future analysis.
Fit criterion: The system must indicate to the user that audio and video recordings are ongoing.

FR-AI2. The system shall play audio prompts at the beginning of each question.
Rationale: The system must be able to play the respective question's audio to answer the given question.
Fit criterion: The system must successfully play the respective question's audio upon entering a new question.

FR-AI3. The system shall display a question's options for a user to select.
Rationale: Users must be able to provide a response to the question's audio for future analysis.
Fit criterion: The system must display the question's respective options upon starting a new question.

FR-AI4. The system shall allow a user to select one of the displayed options.
Rationale: Users must be able to select their best option to answer the question.
Fit criterion: The system must indicate to the user their selected response.

FR-AI5. The system shall allow a user to confirm their selection.
Rationale: Users must be able to confirm their selection to proceed to the next stage.
Fit criterion: Users must be brought to the next stage upon confirming their selection.

FR-AI6. The system shall keep track of the user's current question.
Rationale: The system must be able to keep track of the time the user enters and exits each question, to synchronize with the audio and video recordings.
Fit criterion: The system must store the user's timestamps upon completing each question.

FR-AI7. The system shall inform the user about the assessment's completion.
Rationale: The system must inform the user of the test's completion to indicate they can exit the system.
Fit criterion: The user must be informed about the test's completion upon confirming the selection of the final question.

9.4 Data Collection and Storage

FR-DSC1. The database shall be able to store multimedia files including video, audio, and structured data files for each session.
Rationale: These file types are necessary to capture the full scope of the speech-language assessment, including patient responses and the structured data associated with each session (e.g., flagged occurrences, timestamps).
Fit criterion: The system must successfully store and retrieve at least 1GB of video, audio, and JSON data per session without data corruption.

FR-DSC2. The database shall store the video, audio, flagged occurrences (e.g., errors or critical moments during the assessment), and timestamps for each question during the assessment.
Rationale: Storing flagged occurrences and timestamps lets clinicians perform detailed analysis of patient responses and enables them to review specific moments of interest efficiently.
Fit criterion: The database shall include video and audio files for 100 percent of assessment sessions, and each recording must have flagged occurrences and timestamps associated with every question asked, retrievable via query.

FR-DSC3. The system shall not store any personally identifiable textual information (e.g., patient name, address, or medical record number) in the database.
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 [2].
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-DSC4. The database shall group all stored data by a unique user identifier to ensure data can be linked to individual users.
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 unassociated data.

FR-DSC5. The system shall store the generated report in the database, linked to the corresponding patient's unique user identifier.
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.

9.5 Video and Audio Data Analysis

FR-VADA1. The analysis model shall have access to the video and audio recordings of each session.
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.
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 have some relational indicator to the timestamp, the assessment question, and the user's answer.
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 timestamps, the question and the user answer 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.
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 generate a comprehensive report based on the retrieved assessment data, including flagged occurrences, timestamps, and patient performance metrics.
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 through the platform's interface.
Rationale: Clinicians need to be able to view and interpret the report to assess patient progress to determine next steps for the patient.
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. Clinicians shall be able to access previously generated reports from the database.

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.

Formal Specification

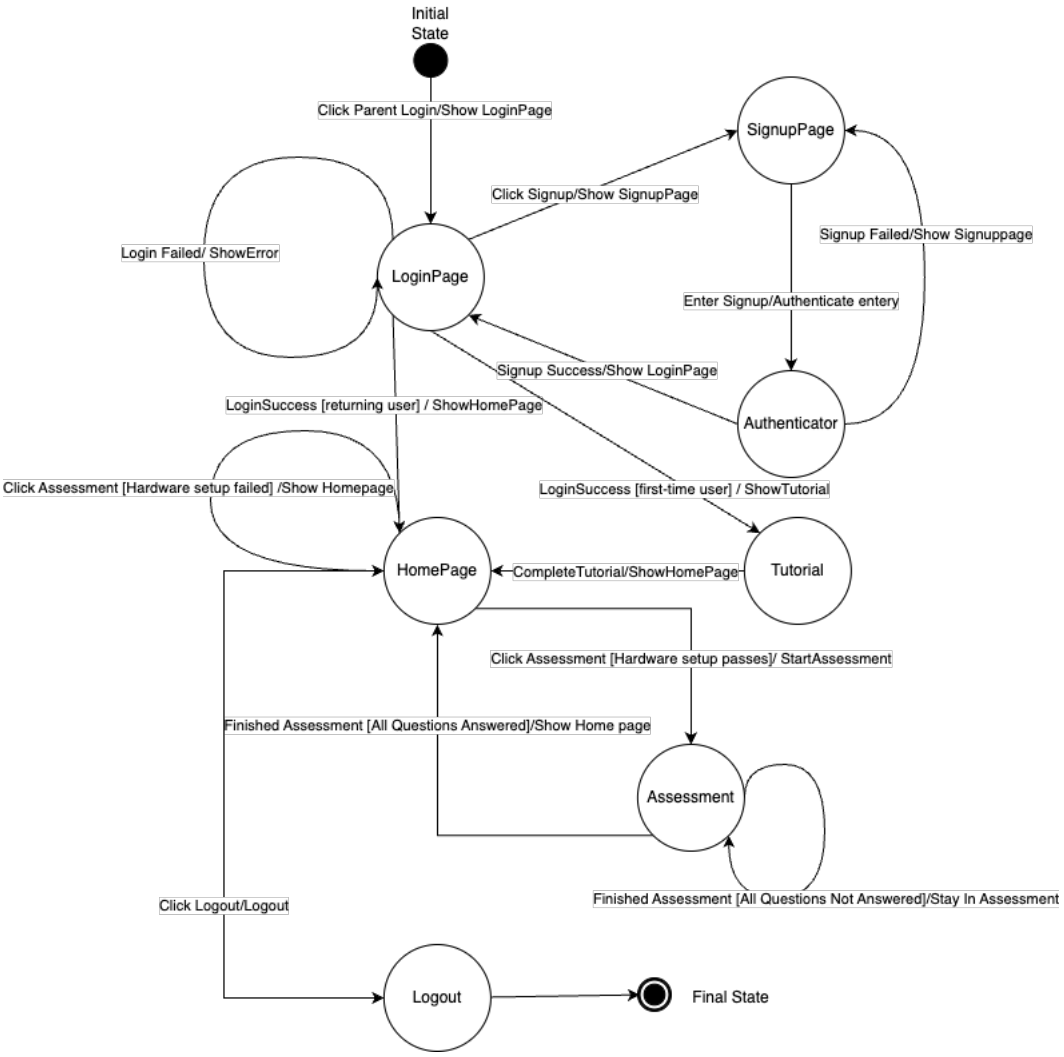

Figure 6: Finite State Machine that represents the Parent-Child interaction with the Assessment Interface

This is the project's most critical element because the system's primary objective is to support parents when conducting at home speech assessments for their child. The success of the system is dependent on the parent-child correctly using the interface.

10 Look and Feel Requirements

10.1 Appearance Requirements

LF-AR1. The platform should maintain a modern, organized, and visually appealing design that looks clean and professional, while not overwhelming users with unnecessary clutter.
Rationale: A clean layout reduces cognitive load, making it easier for users to use the platform effectively without distractions.
Fit criterion: The user interface must return minimal reports of visual confusion or overwhelming elements in usability testing.

LF-AR2. The platform's navigation should be intuitive and allow users to quickly understand how to move between different sections.
Rationale: Simple, user-friendly navigation ensures that users can move through the system without confusion, especially since the platform will be used by both children and adults.
Fit criterion: During user testing, at least 95% of participants must successfully complete navigation-related tasks without external guidance.

LF-AR3. The design should promote a calm and reassuring environment that is visually appealing but not overstimulating.
Rationale: Children undergoing assessments may feel anxious; a calming design helps create a more comfortable and welcoming environment.
Fit criterion: Feedback from child users and caregivers during usability testing must indicate that the design fosters a calm and positive experience.

LF-AR4. The assessment interface should be designed to be easily understood by children, with accessible and age-appropriate elements.
Rationale: A simple design tailored to children's comprehension levels ensures they can participate in the assessment without confusion or frustration.
Fit criterion: In user testing, 95% of children aged 6-12 must be able to complete a sample assessment without adult assistance.

LF-AR5. The platform should provide immediate feedback for user interactions, confirming that inputs have been registered.

Rationale: Feedback is important to confirm that the system is responding to user inputs, which is especially critical for children who may be unsure if their actions have been registered.
Fit criterion: 100% of user interactions must trigger an appropriate feedback response within 0.5 seconds.

10.2 Style Requirements

LF-SR1. The design should maintain consistency across all pages to create a cohesive user experience.
Rationale: Consistency in design elements helps reduce user confusion, making the platform easier to navigate and more aesthetically pleasing.
Fit criterion: All visual elements must adhere to a style guide, ensuring a consistent look across 100% of the platform's pages.

LF-SR2. The design should align with the client's established company brand guidelines, including the use of specific colors, logos, or fonts.
Rationale: Aligning with brand guidelines ensures that the platform reflects the client's professional image and maintains brand integrity.
Fit criterion: 100% of the platform's design elements must comply with the client's branding guidelines.

11 Usability and Humanity Requirements

11.1 Ease of Use Requirements

UH-EOU1. The system shall be intuitive for new users to understand.
Rationale: New users should not be overwhelmed with the system. New users must be able to understand the system to effectively perform the assessment (parents and children), or view the results (clinicians).
Fit criterion: The duration between starting the assessment to finishing the first question is less than 2 minutes.

UH-EOU1. The system shall provide detailed instructions on how to use key features of the application, along with its purpose.
Rationale: The system will provide relevant important information about the assessment so the user is informed about the system's usage.
Fit criterion: The system will direct the user to additional information prior to starting the setup process, and upon completion of the assessment.

11.2 Personalization and Internationalization Requirements

UH-PI1. The system shall support multiple languages.
Rationale: The assessment must be conducted in two languages for the purpose of the research study. As well, it would be beneficial for parents and children to navigate the system in their preferred language.
Fit criterion: The assessment will always be available to be conducted in two different languages (within a single assessment).

11.3 Learning Requirements

UH-LI1. The system shall not require additional resources to be navigated.
Rationale: The system should be intuitive to navigate without additional information to simplify the assessment process.
Fit criterion: All information required for the assessment will be directly displayed by the system.

UH-LI1. The system shall include a user-guide for additional usage information.
Rationale: User documentation can be helpful for troubleshooting

and maintenance should problems arise. This document is optional and not required reading for the user's interactions with the system.
Fit criterion: User documentation will be provided on the team's GitHub upon project completion.

11.4 Understandability and Politeness Requirements

UH-UP1. The system will not use technical language when displaying information to the user.
Rationale: The system will be designed for parents and children to participate in assessments, thus the system should make information easily understandable.
As well, clinicians may not have a technological background, so any technical aspects should be communicated in easy to understand terms.
Fit criterion: The system will be reviewed by the team's supervisor and their collaborator to verify all language used is appropriate for users.

11.5 Accessibility Requirements

UH-AR1. The system shall be simple and intuitive for assessment interactions with children.
Rationale: Children interacting with the assessment can vary in age and cognitive abilities. To get reliable assessment results, the children participating must understand the system they interact with.
Fit criterion: The assessment will feature minimal display elements, with clear indication of interactions.

12 Performance Requirements

12.1 Speed and Latency Requirements

PR-SL1. 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.

PR-SL2. 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.

PR-SL3. The system must ensure that all video recordings are capture and stored 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.

PR-SL4. 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

PR-SCL1. There are no safety-critical requirements

12.3 Precision or Accuracy Requirements

PR-PA1. 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%.

PR-PA2. 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%.

PR-PA3. 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.

PR-PA4. 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.

PR-PA5. 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

PR-RFT1. The system must manage any technical 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 if something is wrong or why the system is not working as they expect, leading to frustration.
Fit criterion: The system must display error messages for at least 95% of common user errors.

PR-RFT2. 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.

PR-RFT3. 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

PR-CR1. 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.

PR-CR2. 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.

PR-CR3. The system must support a minimum of 200 concurrent users simultaneously upon initial release, and have the capability to scale to accommodate more users as demand increases.
Rationale: Supporting 200 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 200 concurrent users.

PR-CR4. The system must support a minimum of 100 concurrent video and audio recording uploads simultaneously and have the capability to scale to accommodate more users as demand increases.
Rationale: Supporting 100 concurrent user uploads 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 100 concurrent uploads.

12.6 Scalability or Extensibility Requirements

PR-SE1. 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.

PR-SE2. 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.

PR-SE3. 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

PR-LR1. 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.

PR-LR2. The system must be compatible with major operating systems, including Windows, macOS, 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

OE-EPE1. The system can be run on all browser-supported devices regardless of screen sizes.
Rationale: The system will be run on a variety of devices through web browsers, and should adapt the different screen sizes so users get full functionality.
Fit criterion: The system's displayed elements will scale appropriately to different screen sizes.

13.2 Wider Environment Requirements

OE-WE1. The system shall be used in a quiet environment.
Rationale: The system will be performing audio and video analysis, and conducting the assessment in a loud or busy environment could lead to unexpected results due to noise.
Fit criterion: The system will inform the user, prior to setup, that the optimal experience for the assessment is in a quiet environment.

OE-WE1. The system shall be used with an internet connection.
Rationale: The assessment will be conducted online, and not saved locally on the user's device. Therefore, an internet connection is required.
Fit criterion: The system will be accessed online. The system will inform the user, prior to setup, that the assessment will be conducted online, and no files will be downloaded to their device for the assessment.

13.3 Requirements for Interfacing with Adjacent Systems

OE-IA1. The system shall be hosted on an external server for retrieving and storing data.
Rationale: The supervisor's collaborator is running the current system on an external server, which the new system will utilize.

Fit criterion: The system (including the assessment) will be published and accessed through the external server.

13.4 Productization Requirements

OE-PR1. N/A

13.5 Release Requirements

OE-RR1. N/A

14 Maintainability and Support Requirements

14.1 Maintenance Requirements

MS-MR1. The platform should be built using a modular architecture so that individual components may be updated or replaced independently without disrupting the entire system.
Rationale: Modular systems improve maintainbility by isolating changes to specific components, reducing downtime, and ensuring new features or bug fixes can be implemented seamlessly, without affecting the core functionality of the system.
Fit criterion: Any update, modification, or replacement of an individual component shall not require any changes to unrelated modules/components; no more than 1 configuration update to dependent components within a module; and have no downtime exceeding 5 minutes during initial deployment.

14.2 Supportability Requirements

MS-SR1. Users should be able to submit feature requests or report issues directly to the platform's GitHub repository, ensuring that the development team can track and prioritize improvements or bug fixes.
Rationale: Centralizing feature requests and issue tracking in GitHub makes it easier for the development team to manage feedback and streamline future updates.
Fit criterion: The platform must include a direct link to the GitHub repository, with a clear option for users to submit requests or report issues, and GitHub should have dedicated categories for issues, feature requests, and feedback.

MS-SR2. The platform should provide a comprehensive, easy-to-follow tutorial that guides users through the website and the assessment process.
Rationale: Tutorials help users understand the functionality of the platform, reducing the need for external support and improving user experience, particularly for new users or children.
Fit criterion: The tutorial must be accessible from the homepage and should cover all core functionalities. In usability testing, 90% of users should be able to complete tasks correctly after following the tutorial.

14.3 Adaptability Requirements

MS-AR1. The platform should be responsive, automatically adjusting its layout and design to suit different screen sizes, including desktops, tablets, and mobile devices.

Rationale: A responsive design ensures the platform is accessible on any device, providing a seamless user experience regardless of screen size or resolution.

Fit criterion: The platform's interface should render correctly on screens ranging from 4" (mobile) to 27" (desktop) with no loss of functionality or readability. Testing must show that 100% of essential features are usable on all screen sizes.

15 Security Requirements

15.1 Access Requirements

SR-AC1. Only users with an Admin role can create and assign accounts to clinicians.
Rationale: Full access of the system and permissions including creating clinician accounts should only be available to admin roles by the system.
Fit criterion: Admin users will have full access to the system including create clinician accounts, viewing data records, and starting assessments.

SR-AC1. Users with parent roles can complete assessments.
Rationale: Users with a parent role should have the ability to create accounts and complete assessments with their children on the system.
Fit criterion: Users with parent roles will only be able to create a parent account, login to the system, have access to completing the assessments, and logging off the system

SR-AC1. Users with clinician roles can view assessment results.
Rationale: Clinicians must be able to see all video and audio recordings of completed assessments, as well as the analyzed results from the system to aid in their research.
Fit criterion: User with a clinician role will not be able to log in to a parent account and start/complete assessments.

SR-AC1. Users shall input their username and password to securely login.
Rationale: Users should be able to securely login by inputting their login credentials to ensure to prevent unauthorized access.
Fit criterion: A user should not be able to login to an account they do not have the required credentials for.

15.2 Integrity Requirements

SR-INT1. N/A

15.3 Privacy Requirements

SR-P1. The system shall adhere to all data protection and privacy laws in the region its used.
Rationale: The system will respect the privacy and confidentiality of all users to adhere to all applicable protection laws.
Fit criterion: The system will be reviewed prior to public release to ensure it follows all applicable protection laws

SR-P1. The system shall encrypt all sensitive data in transit and at rest to keep data confidential.
Rationale: The system should encrypt sensitive data at all times to ensure high level of security to protect user information from potential data footage leaks, and unauthorized access
Fit criterion: Data follows the standard encryption protocol at all times; data is encrypted when in transit and only decrypted when viewed by clinician user for analysis purposes.

SR-P1. The system shall not collect any personal identifiable information from the user.
Rationale: The system should not collect any personal identifiable information to ensure confidentially of all video and audio recordings associated with the user.
Fit criterion: The system does not store any personal identifiable information. All data stored includes, username, and data/audio recordings only.

15.4 Audit Requirements

SR-AU1. N/A

15.5 Immunity Requirements

SR-IM1. The system must mandate strong passwords.
Rationale: The system must require a strong password mandate to secure user accounts from unauthorized access.
Fit criterion: The system will complete account creation upon entering a valid password that follows the specified mandate.

16 Cultural Requirements

16.1 Cultural Requirements

CU-CR1. The platform must not contain any language or imagery that could be considered culturally insensitive or offensive to any users, particularly the primary user groups.

Rationale: Ensuring cultural sensitivity is critical in a healthcare setting, especially when working with diverse populations. Avoiding insensitive content fosters a respectful and inclusive environment for users.

Fit criterion: During user acceptance testing and content review, 100% of language and imagery used on the platform must be validated by at least 5 representatives of the primary user groups to ensure no instances of insensitivity.

CU-CR2. The platform should be bilingual, supporting both English and Mandarin for all user interfaces and assessments to accommodate the language preferences of users.

Rationale: Given that the target user base includes bilingual children, providing language options ensures accessibility and inclusivity, allowing users to complete assessments in their choice of language.

Fit criterion: 100% of text, instructions, and assessments must be fully translated and accessible in both English and Mandarin, with no language discrepancies or untranslated segments.

17 Compliance Requirements

17.1 Legal Requirements

CR-LR1. N/A

17.2 Standards Compliance Requirements

CR-STD1. The system shall use security measures to protect all stored user assessment data.

Rationale: The system must use strong security measures to protect sensitive and confidential user information including collected video and audio recordings from assessment results to ensure privacy and integrity.

Fit criterion: All stored user assessment data is only associated with a username.

Traceability Matrix

The tracability matrix between the project's product use cases and functional requirements are depicted in Table 12. The tracability matrix between the project's product use cases and non-functional requirements are depicted in Table 13.

Table 12: Traceability Matrix for PUCs and FRs

PUC no	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
FR-A1				X	X																										
FR-A2	X	X																													
FR-A3		X	X																												
FR-A4				X		X	X	X																							
FR-A5				X																											
FR-SS1									X					X																	
FR-SS2											X																				
FR-SS3											X																				
FR-SS4														X																	
FR-SS5															X																
FR-AI1													X		X																
FR-AI2																		X													
FR-AI3																	X														
FR-AI4																	X		X												
FR-AI5																				X											
FR-AI6																X															
FR-AI7																					X										
FR-DSC1												X																			
FR-DSC2												X															X	X	X		
FR-DSC3												X																			
FR-DSC4												X										X									
FR-DSC5																															X
FR-VADA1												X																			
FR-VADA2																							X	X	X	X					
FR-VADA3																											X	X	X		
FR-DPD1																											X	X			
FR-DPD2																														X	
FR-DPD3																														X	
FR-DPD4										X																					

Table 13: Traceability Matrix for PUCs and NFRs

PUC no	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
LF-AR1	X		X	X	X	X	X	X	X	X	X			X	X		X	X	X	X	X									X	
LF-AR2	X		X	X	X				X	X	X			X	X						X									X	
LF-AR3									X		X			X	X		X	X	X	X	X										
LF-AR4									X		X			X	X		X	X	X	X	X										
LF-AR5	X	X	X	X	X	X	X	X			X		X		X	X		X	X	X	X									X	
LF-SR1									X	X					X		X		X		X									X	
LF-SR2									X					X			X				X									X	
UH-EOU1	X		X	X	X				X	X	X		X	X	X		X	X	X	X	X									X	
UH-EOU2	X	X	X		X				X	X	X			X																	
UH-PI1									X		X			X	X		X	X			X									X	
UH-LI1									X	X	X		X	X																X	
UH-LI2									X					X																	
UH-UP1	X	X		X	X				X		X			X	X		X	X	X	X	X										
UH-AR1									X		X			X	X		X	X	X	X	X										
PR-SL1	X		X	X			X		X	X	X			X	X		X				X									X	
PR-SL2													X										X	X	X	X					
PR-SL3												X													X	X					
PR-SL4																							X	X	X	X	X	X	X	X	
PR-PA1																							X	X			X				
PR-PA2																									X	X	X				
PR-PA3																												X			
PR-PA4																						X								X	
PR-PA5																	X														
PR-RFT1	X	X	X	X	X	X	X		X	X	X		X	X	X	X	X	X		X	X									X	
PR-RFT2	X		X									X				X						X							X		X
PR-RFT3	X	X	X	X	X						X								X	X											
PR-CR1	X		X																												
PR-CR2	X		X									X										X							X		X
PR-CR3				X											X							X									
PR-CR4													X									X									
PR-SE1	X	X	X																												
PR-SE2												X										X							X		X
PR-SE3																							X	X	X	X	X	X			
PR-LR1	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
PR-LR2	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
OE-EPE1				X					X	X	X		X	X	X		X	X	X	X	X									X	
OE-WE1													X																		
OE-WE2				X					X	X		X					X			X		X							X	X	X
OE-IA1												X										X							X		X
MS-MR1	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
MS-SR1									X	X			X	X	X		X	X												X	
MS-SR2									X					X																	
MS-AR1	X		X	X	X				X	X	X			X	X		X		X	X	X									X	
SR-AC1			X	X	X	X	X	X																							
SR-AC2	X			X	X	X	X	X	X		X		X	X	X		X	X	X	X											
SR-AC3																														X	
SR-AC4		X		X		X	X	X																							
SR-P1												X										X							X		X
SR-P2	X	X	X	X								X										X	X	X	X	X	X	X	X	X	X
SR-P3	X											X										X							X		X
SR-IM1	X		X																												
CU-CR1				X	X				X	X	X						X	X			X									X	
CU-CR2	X		X	X					X					X			X	X	X	X	X										
CR-STD1												X										X							X		X

18 Open Issues

1. Live video recording in clincian-led sessions, and future analysis of those recordings.

2. Using an external microphone and video capturing setup, utilizing other portable electronic devices, such as phones and tablets.

19 Off-the-Shelf Solutions

19.1 Ready-Made Products

- VSee: A telehealth platform for virtual visits and remote exams [5].

19.2 Reusable Components

- Amazon Web Services: Cloud storage solution for securely storing video and audio recordings [6].
- TensorFlow: Machine Learning library for building and deploying audio and video models [7].
- PyTorch: Machine Learning library for building and deploying audio and video models [8].
- WebRTC (Real-Time Communication): APIs for secure video and audio communication [9].

19.3 Products That Can Be Copied

- Kahoot: Similar question interface with 4 options displayed [10]
- Zoom: Recording audio, video, screen-sharing capabilities [11]

20 New Problems

20.1 Effects on the Current Environment

This application is not intended to replace any existing tools but rather to complement them as a newly developed solution. Its primary purpose is to enable parents and clinicians to conduct at-home speech assessments with ease. By integrating a machine learning model, the system enhances the efficiency of clinicians when reviewing children's assessment reports. Additionally, it increases accessibility for parents, especially those who may not live near a speech clinician's office.

20.2 Effects on the Installed Systems

This application will not interfere with the existing system. It simply requires the system to have functional video and audio interfaces, along with a stable Wi-Fi connection.

20.3 Potential User Problems

- The user will not be able to enter other video or audio calls within the system while doing the assessment
- The user is limited to the quality of the speakers for the audio assessment

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

There are no liminations in the Anticipated implement environment

20.5 Follow-Up Problems

The system has no follow up problem

21 Tasks

21.1 Project Planning

Table 14: Project Task Deadlines

Phase	Task	Deadline
Revision 0	Requirements Document	Oct 11, 2024
	Hazard Analysis	Oct 23, 2024
	Verification and Validation Plan	Nov 1, 2024
	Proof of Concept Demo	Nov 11, 2024
	Design Document	Jan 15, 2025
	Demonstration	Feb 10, 2025
Revision 1	Final Demonstration	Mar 30, 2025
	EXPO Demonstration	Apr 8, 2025
	Final Documentation (Problem Statement, POC plan, Development Plan, Requirements Doc, Hazard Analysis, Design Document, V&V Plan, V&V Report, User Guide, Source Code)	Apr 2, 2024

21.2 Planning of the Development Phases

The development of the TeleHealth System will be divided into two phases including:

- Revision 0: Intitial Development of Application and Reports
- Revision 1: Refinement/Revision of Project and Deliverables

Prior to Revision 0, Team 22 has defined the team members of the project, Problem Statement of the project, POC plan, and Development Plan. Revision 0 work encompasses all the work completed starting October 11 to February 14th.In the Revision 0 Phase, the team will work on design related deliverables for the project to define the scope, the requirements, stakeholders, use cases, risks, and define the plan for implementing

the project. Using this information, the team will work towards creating a POC. A V&V report will be made based on feedback and iterations will be made accordingly. Revision 1 will focus on implementing refinements to Revision 0 documentation and adding extras to both application and deliverables. Feedback will be incorporated into any refinements from stakeholders and professor.

Table 15: Development Revision 0 Deadlines

Application Development Revision 0 Tasks	**Priority**	**Deadline**
Frontend App Setup for Video/Audio Integration	Medium	Oct 15, 2024
Video Capture & Storage Module Development (Database & Server Set Up)	High	Oct 25, 2024
Data Security and Encryption Integration	High	Oct 28, 2024
Basic Machine Learning Integration	High	Nov 5, 2024
Video Testing in Controlled Setting for POC	High	Nov 5, 2024
Proof of Concept Demo	High	Nov 11-22, 2024
Application Frontend Design	Low	Nov 10, 2024
Audio Capture & Storage Module Development	Medium	Nov 20, 2024
Application Frontend Development First Iteration Complete (Application Integration, Login & Authentication System)	Medium	Nov 25, 2024
Deep Training of Machine Learning Model	High	Dec 16, 2024

Table 16: Development Revision 1 Deadlines

Application Development Revision 1 Tasks	**Priority**	**Deadline**
Authentication and Access Check	High	Jan 15,2025
Usability Survey	Medium	Feb 20, 2025
User Interface Completion/Iteration	Medium	Feb 30, 2025
Unit Testing	High	March, 4, 2025
Code Refinement	Medium	April 1, 2025

22 Migration to the New Product

22.1 Requirements for Migration to the New Product

N/A

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

N/A

23 Costs

The initial release of the web application will have no costs that will be covered by the development team. This will be achieved by utilizing free services such as Figma for prototype design, GitHub Actions for automating CI pipeline, and ESLint, Jest and Pytest for testing. Power BI's free version will be used for data analytics and assisting report generation. The client already has an AWS server available to use for web hosting and data storage for this project, so the development team will not have to cover those costs.

There may be need for adding or increasing a budget in future releases as the project expands, or if the intended technology solutions need to change as the project progresses; however, there are no planned costs for the initial release.

24 User Documentation and Training

24.1 User Documentation Requirements

The system will include four forms of user documentation.

- Video tutorial and digital manual
  - The video tutorial and digital manual will guide parents through system navigation, usage guidelines, and rules. They will also address common technical issues that may arise during assessments or while using the system. Additionally, parents will be clearly informed about the extent to which they can assist their child during assessments and the types of questions that will appear.
- Privacy Policy
  - This document will clearly explain data handling practices and user privacy rights.
- Terms of Service
  - This document will outline the terms of service and detail all user responsibilities.

Motivation: Providing comprehensive user documentation will enhance the user experience when using the system.

24.2 Training Requirements

- Admin training
  - How to create clinician accounts
  - How to troubleshoot basic audio and video errors

25 Waiting Room

- Ability to upload video recording from another device for ML analysis for any given assesment
- Integrating live video and audio analysis for clinicians during an assesment

26 Ideas for Solution

Implementation for components of Telehealth System

- Video and Audio Integration

  getUserMedia API: Enables capturing video and audio directly from user's device (camera & microphone) and can be used on a React application

  MediaRecorder API: Works with getUserMedia to record the video and audio streams while the user completes the assessment, and it saves the media as files

  React Media Recorder: A React hook-based solution for integrating getUserMedia and MediaRecorder easily in React applications.

- Server

  AWS to securely store recorded video and audio files

- User Interface

  Figma: Use to design User Interface

  Expo: Javascript/React Integration to allow for web-based and mobile-based support over cross-platforms

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.

   Interface Knowledge

   - Frontend - Javascript
   - Backend - Javascript, API's , Expo Framework
   - Knowledge of Component Management - React

   Machine Learning

   - Video Integration Skills & Video Processing
   - Audio Integration Skills & Audio Processing
   - Python Data Analysis Processing

   Database Knowledge

   - Database Integration - AWS
   - Knowledge of Data Security & Encryption

   Architecture and Design Knowledge

   - Deepen knowledge on system architecture and design principles
   - Interface Design - Figma
   - Knowledge on how to use Continuous Integration

   Softskill Learning

   - Presentation Skills

- Organization & Communication Skills
- Knowledge of Agile Team Development
- Domain Knowledge on Main User Group
- Knowledge on Application of Regulatory Standards

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?

   Interface Knowledge

   - Parisha

     Approach: Approach will include using online platforms such as Udemy that cover the basics of frontend and backend development in React, as well as using API integration, and Expo Framework.

     Why: I chose this approach as I have learnt many skills, specifically React from Udemy before and it is a very detailed way to learn skills. Udemy courses include step by step tutorials as well as quizzes to learn and apply the learnt knowledge.

   - Promish

     Approach: Following a React project-based guide on YouTube.

     Why: This approach will help me understand how the language is integrated while learning about the various features React has to offer. I chose this method to solidify my knowledge of React and to better grasp how to code component-based designs. As a visual learner, YouTube is where I acquire most of my knowledge, and it is my preferred way of learning.

   Machine Learning

   - Promish

     Approach: Reading a variety of machine learning documentation to stay updated on new research.

     Why: I chose to read a variety of documentation because I'm always curious about the advancements in machine learning. Exploring new research will help me understand what's available that

could be integrated into our capstone project, with the goal of making it more efficient and optimized.

- Mitchell

  Approach: Watch and follow along with online tutorials

  Why: For machine learning knowledge, I will watch a variety of online tutorials and follow along to make small examples. This will help me understand the functionality of the different machine learning models and libraries available, along with how to use them. I decided to pursue this approach because this learning model worked for me in my past research position, where I watched numerous tutorials on a variety of topics, culminating in more informed decision making.

Database Knowledge

- Parisha

  One Approach includes using video playlists available online to learn the fundamentals of Database and Security.

  Why: This is an area I have had previous experience in, being on coop as a Database Engineer for 8 months, I learnt a lot of content by visually learning and will continue to for this project.

- Jasmine

  Approach: Reviewing course notes and expanding on them

  Why: I chose this approach because I have notes from a databases course I took and am currently enrolled in an information security course. By revisiting my databases course materials from SFWRENG 3DB3, I can reinforce foundational knowledge and build upon it for deeper research specific to the project. For data security and encryption, I plan to apply what I've learned from my current information security course, making sure that data is encrypted properly and that our project meets the necessary data security standards.

Architecture amd Design Knowledge

- Jasmine

  Approach: Self-learning through online platforms and studying existing designs

Why: I chose self-learning for interface design because I have a passion for art and design. I've already begun learning Figma on my own, and this project provides extra motivation to continue doing so. By studying existing examples of good interface designs and practicing Figma in my free time, I can ensure our interface is well designed practically and aesthetically.

- Mitchell

  Approach: Explore past course notes

  Why: For architecture and design knowledge, I will explore my past course notes to familiarize myself with important past topics. The courses I plan on reviewing are SFWRENG 3A04 - Large System Design, and SFWRENG 2AA4 - Introduction to Software Development. These courses cover important topics for building software systems at different scales. This will allow me to make informed decisions on choosing the best tool for the job. In this case, I will explore the uses of different software architectures and design patterns so that the team can implement the most beneficial solution.

Soft skill Learning Everyone on the team is responsible to develop their soft skills in these areas to ensure consistency, professionalism and success for the team.

- Presentation Skills

  The team will improve our presentation skills by performing mock presentations in front of the team's supervisor for initial feedback and constructive criticism. This will result in the overall improvement of the team's comfort when presenting in front of an audience. As well, the team will master presentations by scheduling presentation rehearsals to practice and improve our confidence.

- Organization & Communication Skills

  The team will improve our organization skills by reformatting the team's main communication platform, Discord, to have improved text channel naming conventions. Currently the team's Discord server is difficult to navigate with irrelevant information spread throughout. The team wants to improve this by utilizing

new text channels for recurring meetings, reminders, and notes. As well, the team will improve our communication skills by informing each other at least 12 hours in advance of any team meetings. If a team meeting is urgent, the team member is required to state its importance. This will improve the team's organization and communication.

- Knowledge of Agile Team Development

  The team will improve on knowledge of agile team development by reading about the specifics of agile team development and reviewing our course notes on agile team development from SFWRENG 2AA4. This will help the team be more efficient when it comes to developing our capstone as everyone will be on the same page about the development process. Agile team development also allows for continuous integration in a seamless way as it its based around it.

- Domain Knowledge on Main User Group

  The team will enhance their domain knowledge of the primary user groups by reviewing research papers written by the speech-language pathology (SLP) client, and other studies on bilingual children with speech difficulties available online. Additionally, we will facilitate discussions with our capstone supervisor and the speech-language pathologist client to ensure that the interface design of the project is tailored appropriately to meet the needs of the parents and children who will be using the assessment.

- Knowledge on Application of Regulatory Standards

  The team will improve our knowledge on applying regulatory standards by tracking the relevant requirements that healthcare applications need for international standards. As we are dealing with health related data, the team wants to ensure that regulatory standards are being met. The team wants to plan in advance how we want to ensure these requirements are being met and applied. Another method the team will use is communicating with the project's supervisor about their knowledge on relevant requirements, as they are more experienced with healthcare research, and the necessary regulatory standards required.

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