Verification and Validation Report: Software Engineering

Team #22, TeleHealth Insights
Mitchell Weingust
Parisha Nizam
Promish Kandel
Jasmine Sun-Hu

March 10, 2025

1 Revision History

Table 1: Revision History

Date	Vers.	Contributors	Notes
3/09/25	1.0	Jasmine Sun-Hu	Added: • 9 Trace to Requirements • 10 Trace to Modules
3/09/25	1.1	Mitchell Weingust	Added: • 4.2 Usability and Humanity • 4.4 Operational and Environmental • 7 - Changes Due to Testing • 11 - Code Coverage Metrics
3/10/25	1.2	Jasmine Sun-Hu	Added: • 3.4 Data Processing and Display • 4.1 Look and Feel Requirements • 4.5 Maintainability and Support • 4.7 Cultural
3/10/25	1.3	Mitchell Weingust	Added: • Appendix - Relflection

2 Symbols, Abbreviations and Acronyms

symbol	description
T	Test

[symbols, abbreviations or acronyms – you can reference the SRS tables if needed —SS]

Contents

1 Revision History **i**

2 Symbols, Abbreviations and Acronyms **ii**

3 Functional Requirements Evaluation **1**
- 3.1 Authentication . . . 1
- 3.2 Data Collection and Storage . . . 4
- 3.3 Video and Audio Data Analysis . . . 5
- 3.4 Data Processing and Display . . . 6
- 3.5 System Set Up . . . 8
- 3.6 Assessment Interface . . . 10

4 Nonfunctional Requirements Evaluation **12**
- 4.1 Look and Feel Requirements . . . 12
- 4.2 Usability and Humanity . . . 13
- 4.3 Performance . . . 15
- 4.4 Operational and Environmental . . . 20
- 4.5 Maintainability and Support . . . 26
- 4.6 Cultural . . . 31
- 4.7 Security . . . 31
- 4.8 Compliance . . . 34

5 Comparison to Existing Implementation **35**

6 Unit Testing **35**

7 Changes Due to Testing **35**

8 Automated Testing **36**
- 8.1 Linters . . . 36
- 8.2 Unit Testing . . . 36
- 8.3 Continuous Integration . . . 37

9 Trace to Requirements **38**

10 Trace to Modules **41**

11 Code Coverage Metrics **42**

List of Tables

1 Revision History i
2 Traceability Table Between System Test Cases and Functional Requirements (Part 1) 38
3 Traceability Table Between System Test Cases and Functional Requirements (Part 2) 38
4 Traceability Table Between System Test Cases and Nonfunctional Requirements (Part 1) 39
5 Traceability Table Between System Test Cases and Nonfunctional Requirements (Part 2) 40
6 Traceability Table Between System Test Cases and Modules 41
7 Code Coverage Report for Each Service 42

List of Figures

1 Results of Usability Survey - 1 14
2 Results of Usability Survey - 2 15
3 Language Selection 16
4 Results of Usability Survey - Scalability 22
5 Device Setup 23
6 Results Storage - AWS Amazon Web Services (2025) 24
7 Results Storage - JSON 25
8 GitHub Issue Creation GitHub (2024) 26
9 Website on iPad Screen Size 28
10 Website on iPhone Screen Size 29
11 Website on Surface Laptop Screen Size 30

This document contains the team's verification and validation report for the TeleHealth Insights project. This document features functional requirements evaluation, nonfunctional requirements evaluation, unit testing, changes due to testing, automated testing, trace to requirements, trace to modules, and code coverage metrics.

3 Functional Requirements Evaluation

The following section covers all the functional requirements tests specified in the project's VnV Plan document. The coverage can be traced in Table X.

3.1 Authentication

The test results below focus on ensuring users can safely and securely login, create and access their accounts without worrying about others accessing their information.

Test Case Identifier: FR-ST-A1

Input: Selection of Parent account role for login

Expected Output: The expected result is the Parent account role is selected and User is brought to the Parent login screen

Actual Output: The actual result is the Parent account role is selected and User is brought to the Parent login screen

Expected and Actual Output Match: True

Relevant Functional Requirement(s): FR-A1

Test Case Identifier: FR-ST-A2

Input: Selection of Clinician account role for login

Expected Output: The expected result is the Clinician account role is selected and User is brought to the Clinician login screen

Actual Output: The actual result is the Clinician account role is selected and User is brought to the Clinician login screen

Expected and Actual Output Match: True

Relevant Functional Requirement(s): FR-A1

Test Case Identifier: FR-ST-A3

Input: Selection of 'Create Account', with a username that does not exist in the database, upon attempting to access the system

Expected Output: The expected result is a new Parent account is created

Actual Output: The actual result is a new Parent account is created

Expected and Actual Output Match: True

Relevant Functional Requirement(s): FR-A2

Test Case Identifier: FR-ST-A4

Input: Selection of 'Create Account', with a username that exists in the database, upon attempting to access the system

Expected Output: The expected result is a new Parent account fails to be created

Actual Output: The actual result is a new Parent account fails to be created

Expected and Actual Output Match: True

Relevant Functional Requirement(s): FR-A2

Test Case Identifier: FR-ST-A5

Input: Admin user selects option to 'Create Account', with a username that does not exist in the database, upon attempting to access the system

Expected Output: The expected result is a new Clinician account is created

Actual Output: The actual result is a new Clinician account is created

Expected and Actual Output Match: True

Relevant Functional Requirement(s): FR-A3

Test Case Identifier: FR-ST-A6

Input: Admin user selects option to 'Create Account', with a username that exists in the database, upon attempting to access the system

Expected Output: The expected result is a new Clinician account fails to be created

Actual Output: The actual result is a new Clinician account fails to be created

Expected and Actual Output Match: True

Relevant Functional Requirement(s): FR-A3

Test Case Identifier: FR-ST-A7

Input: Unique username and corresponding password that exists in the database

Expected Output: The expected result is a successful login to a user's account

Actual Output: The actual result is a successful login to a user's account

Expected and Actual Output Match: True

Relevant Functional Requirement(s): FR-A4

Test Case Identifier: FR-ST-A8

Input: Selection of 'logout'

Expected Output: The expected result is a successful logout from a user's account

Actual Output: The actual result is a successful logout from a user's account

Expected and Actual Output Match: True

Relevant Functional Requirement(s): FR-A5

3.2 Data Collection and Storage

The test cases below focus on ensuring data is collected and stored correctly. We test to make sure no identifiable information is stored in the database and we also check that all multimedia data is linked correctly to user assignment.

Test Case Identifier: FR-ST-DSC1

Input: Insertion of multimedia files into the database

Expected Output: A success message in the console for both storing and retrieving the data; the retrieved files are uncorrupted and match the original files

Actual Output: A success message in the console and a link to multimedia file

Expected and Actual Output Match: True

Relevant Functional Requirement(s): FR-DSC1

Test Case Identifier: FR-ST-DSC2

Input: Insertion of a test assessment session with video, audio files, flagged occurrences, and timestamps for each assessment question

Expected Output: Creation of a JSON file containing the flagged occurrences and timestamps stored alongside the session data

Actual Output: A JSON file was created in AWS with the correct expected output

Expected and Actual Output Match: True

Relevant Functional Requirement(s): FR-DSC2

Test Case Identifier: FR-ST-DSC3

Input: Attempted insertion of a record containing personally identifiable information (e.g. address)

Expected Output: The console throws an error as no such field exists for personal information

Actual Output: The database throws an invalid payload error

Expected and Actual Output Match: True

Relevant Functional Requirement(s): FR-DSC3

Test Case Identifier: FR-ST-DSC4

Input: Insertion of multiple sessions, each tagged with a unique user identifier

Expected Output: All session data is stored and correctly grouped under their respective unique user identifiers

Actual Output: The database creates folders based on the unique identifiers

Expected and Actual Output Match: True

Relevant Functional Requirement(s): FR-DSC4

Test Case Identifier: FR-ST-DSC5

Input: Insertion of an assessment report linked to a patient's unique identifier

Expected Output: The report is successfully stored, linked to the corresponding patient identifier

Actual Output: The assessment is put into the correct folder and is added to the JSON that links multimedia to assignment

Expected and Actual Output Match: True

Relevant Functional Requirement(s): FR-DSC5

3.3 Video and Audio Data Analysis

The test cases below ensure that both video and audio data is correctly accessed, processed and stored in its respective user folder with no errors.

Test Case Identifier: FR-ST-VDA1

Input: Request by the analysis model to access video and audio data from a completed session

Expected Output: All requested videos and audio files are processed success-

fully with a corresponding success message logged

Actual Output: A success message in the console after video and audio are finished processing

Expected and Actual Output Match: True

Relevant Functional Requirement(s): FR-ST-VDA1

Test Case Identifier: FR-ST-VDA2, FR-ST-VDA3

Input: Video and audio data containing speech disturbances, interruptions, and other irregularities for analysis

Expected Output: A JSON file is generated that records the number of disturbances

Actual Output: A JSON file is created in the correct user folder with a link to the video and contains bias timestamps

Expected and Actual Output Match: True

Relevant Functional Requirement(s): FR-ST-VDA2, FR-ST-VDA3

3.4 Data Processing and Display

This set of test cases will help confirm the system's data retrieval, report generation, and display functionalities to ensure the clinician experience aligns with the project's goals.

Test Case Identifier: FR-ST-DPD1

Input: Query request for a specific patient's processed assessment data.

Expected Output: The expected result is the successful retrieval of all relevant assessment data, displayed without errors within MAX_PROCESSING_TIME

Actual Output: The expected result is the successful retrieval of all relevant assessment data, displayed with a minor error regarding the video recording progress bar within
MAX_PROCESSING_TIME.

Expected and Actual Output Match: False

Relevant Functional Requirement(s): FR-DPD1

Test Case Identifier: FR-ST-DPD2

Input: Trigger for report generation based on a retrieved assessment dataset.

Expected Output: The expected result is a generated report containing all required data within MAX_PROCESSING_TIME.

Actual Output: The actual result is an online report dashboard containing all required data within MAX_PROCESSING_TIME.

Expected and Actual Output Match: True

Relevant Functional Requirement(s): FR-DPD2

Test Case Identifier: FR-ST-DPD3

Input: Clinician dashboard query to display the generated report.

Expected Output: The expected result is a report displayed in the clinician's dashboard with accurate formatting, charts, and tables, fully loaded within MAX_PROCESSING_TIME.

Actual Output: The actual result is a report displayed in the clinician's dashboard with accurate formatting and graphs, loaded within MAX_PROCESSING_TIME.

Expected and Actual Output Match: True

Relevant Functional Requirement(s): FR-DPD3

Test Case Identifier: FR-ST-DPD4

Input: Clinician request to access a specific previously generated report.

Expected Output: The expected result is successful retrieval and display of the requested report without errors, within MAX_PROCESSING_TIME.

Actual Output: The expected result is successful retrieval and display of the requested report displayed with a minor error regarding the video recording progress bar, within MAX_PROCESSING_TIME. **Expected and Actual Out-**

put Match: False

Relevant Functional Requirement(s): FR-DPD4

3.5 System Set Up

The test cases below conduct navigation through the system to prepare a parent user to take an assessment.

Test Case Identifier: FR-ST-SS1

Input: User navigates to the page where assessment information is displayed before starting hardware checks.

Expected Output: User is able to view relevant information about the assessment before beginning any hardware checks.

Actual Output: A parent user is able to enter the main assessment page upon entering and view relevant information including instructions and selecting assessment type. Information is accessible and readable.

Expected and Actual Output Match: T

Relevant Functional Requirement(s): FR-ST-SS1

Test Case Identifier: FR-ST-SS2

Input: User initiates the audio hardware check through the system

Expected Output: : User receives confirmation that the audio input and output devices are functioning correctly.

Actual Output: A parent user is able to test their audio output including microphone and speakers. The system automatically detects their audio inputs/outputs. User was notified if the check failed with an appropriate error. Information is accessible and readable.

Expected and Actual Output Match: True

Relevant Functional Requirement(s): FR-ST-SS2

Test Case Identifier: FR-ST-SS3

Input: User initiates the video hardware check through the system.ar **Expected Output:** : User receives confirmation that the video capturing device is functioning correctly.

Actual Output: A parent user is able to test their video input. The system automatically detects their video input. User was notified if the check failed with an appropriate error. Information is accessible and readable.

Expected and Actual Output Match: True

Relevant Functional Requirement(s): FR-ST-SS3

Test Case Identifier: FR-ST-SS4

Input: User proceeds to the tutorial section after completing hardware checks.

Expected Output: User is directed to a tutorial that explains the assessment process in a step-by-step manner.

Actual Output: Upon completing the audio and video checks, the user is navigated to instructions and practice question.

Expected and Actual Output Match: True

Relevant Functional Requirement(s): FR-ST-SS4

Test Case Identifier: FR-ST-SS5

Input: User initiates the start of the assessment through the system.

Expected Output: User is taken to the first assessment question, and the assessment begins.

Actual Output: Upon completing tutorial, the system directs the user to start assessment, and is directed to the first question.

Expected and Actual Output Match: True

Relevant Functional Requirement(s): FR-ST-SS5

3.6 Assessment Interface

The test cases below navigates through the assessment pages to ensure test is conducted and results are stored properly.

Test Case Identifier: FR-ST-AI1

Input: User initiates the assessment.

Expected Output: System begins recording both audio and video, with an indicator showing recording is active.

Actual Output: Upon starting the assessment, device light turns on as a visible indictor that recording is ongoing.

Expected and Actual Output Match: True

Relevant Functional Requirement(s): FR-ST-AI1

Test Case Identifier: FR-ST-AI2

Input: System progresses to a new question in the assessment.

Expected Output: The system plays the corresponding audio prompt for the new question.

Actual Output: The system successfully progresses to a new question in the system upon completing a previous one. The system plays the correct audio.

Expected and Actual Output Match: True

Relevant Functional Requirement(s): FR-ST-AI2

Test Case Identifier: FR-ST-AI3

Input: System loads a new question.

Expected Output: System displays all possible answer options for the user to select from.

Actual Output: The system successful displays the image answer options that correspond with the appropriate audio.

Expected and Actual Output Match: True

Relevant Functional Requirement(s): FR-ST-AI3

Test Case Identifier: FR-ST-AI4

Input: User selects one of the displayed answer options.

Expected Output: System highlights or otherwise indicates the user's selected option

Actual Output: Once an answer option is selected, the system highlights this image.

Expected and Actual Output Match: True

Relevant Functional Requirement(s): FR-ST-AI4

Test Case Identifier: FR-ST-AI5

Input: User confirms their selection

Expected Output: System moves the user to the next question or stage.

Actual Output: Once User has selected an answer and hits submit to confirm their answer, the system progresses to the next question or stage.

Expected and Actual Output Match: True

Relevant Functional Requirement(s): FR-ST-AI5

Test Case Identifier: FR-ST-AI6

Input: User enters and exits each question.

Expected Output: System records timestamps for entry and exit for each question.

Actual Output: Timestamps of each question are not properly logged.

Expected and Actual Output Match: Fail

Relevant Functional Requirement(s): FR-ST-AI6

Test Case Identifier: FR-ST-AI7

Input: User completes the final question and confirms the selection.

Expected Output: System displays a message informing the user that the assessment is complete.

Actual Output: Once assessment is complete, the system displays a completion message.

Expected and Actual Output Match: True

Relevant Functional Requirement(s): FR-ST-AI7

4 Nonfunctional Requirements Evaluation

The following section covers all the nonfunctional requirements specified in the project's VnV Plan document. The coverage can be traced in Table X.

4.1 Look and Feel Requirements

These test cases ensure that all appearance and style requirements are addressed effectively, covering navigation, user-friendliness, brand consistency, visual appeal, and responsiveness.

Test Case Identifier: LF-ST-LFR1

Input: Conduct user tests with participants performing core tasks like starting an assessment, navigating menus, and viewing results.

Expected Output: The expected result is that at least VERY_HIGH_SUCCESS_RATE of users can complete all core tasks independently

Actual Output: The actual result is that at least VERY_HIGH_SUCCESS_RATE of users can complete all core tasks independently

Expected and Actual Output Match: True

Relevant Nonfunctional Requirement(s): LF-AR1, LF-AR2, LF-AR4

Test Case Identifier: LF-ST-LFR2

Input: Perform visual inspection and feedback collection, along with response-time measurements for interactive elements.

Expected Output: The expected result is that there is VERY_HIGH_SUCCESS_RATE consistency in design across all pages, HIGH_SUCCESS_RATE of user interactions provide immediate feedback within SHORT_PROCESSING_TIME, and positive feedback from usability testing participants is received regarding appearance.

Actual Output: The actual result is that there is VERY_HIGH_SUCCESS_RATE consistency in design across all pages, HIGH_SUCCESS_RATE of user interactions provide immediate feedback within SHORT_PROCESSING_TIME, and positive feedback from usability testing participants is received regarding appearance.

Expected and Actual Output Match: True

Relevant Nonfunctional Requirement(s): LF-AR3, LF-AR5, LF-SR1, LF-SR2

4.2 Usability and Humanity

The test results below ensures that the system meets usability and humanity requirements for users to have an enjoyable and accessible experience.

Test Case Identifier: UH-ST-EOU1

Input: Users complete one full assessment using the system

Expected Output: User answers questions in the Usability Survey, and results are culminated and averaged.
Averages should be at least 'Agree' on the answer scale

Actual Output: User answers were on average at least 'Agree' on the answer scale across all rating questions in the usability survey (Figure 1, Figure 2).

Expected and Actual Output Match: True

Relevant Nonfunctional Requirement(s): UH-EOU1, UH-EOU2, UH-LI1, UH-UP1, UH-AR

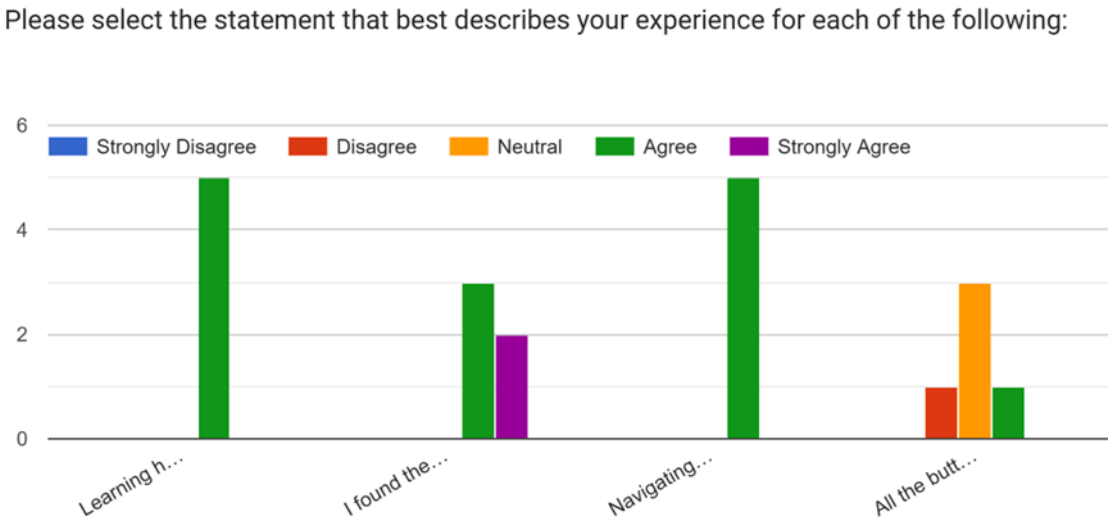

Figure 1: Results of Usability Survey - 1

Test Case Identifier: UH-ST-PI1

Input: List of available languages to perform assessments in is available to be selected and listed

Expected Output: The expected result is the available languages for the assessment are English and Mandarin

Actual Output: The assessment can be completed in either English and Mandarin (Figure 3)

Expected and Actual Output Match: True

Relevant Nonfunctional Requirement(s): UH-PI1

Test Case Identifier: UH-ST-LI1

Input: Link to documentation is available on the system's frontend interface, and can be accessed

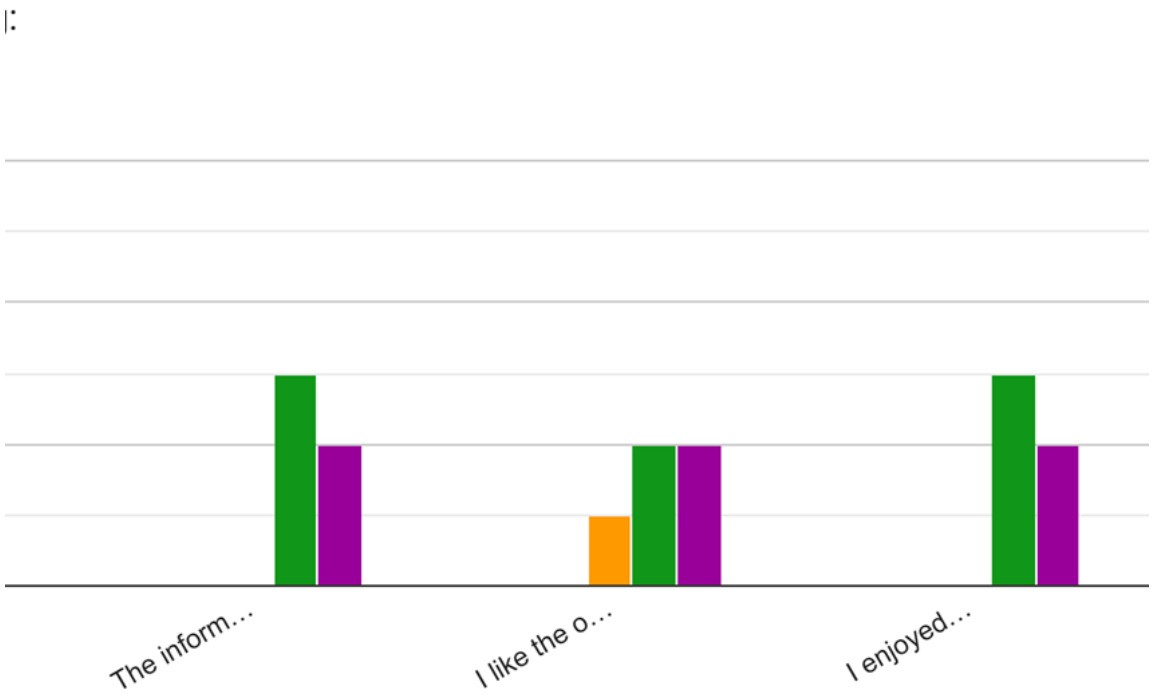

Figure 2: Results of Usability Survey - 2

Expected Output: The expected result is a user can verify the link takes them to access documentation

Actual Output: No user documentation is linked to the current version of the system

Expected and Actual Output Match: False

Relevant Nonfunctional Requirement(s): UH-LI2

4.3 Performance

The test cases outlined below ensure proper performance and stability of our system and database.

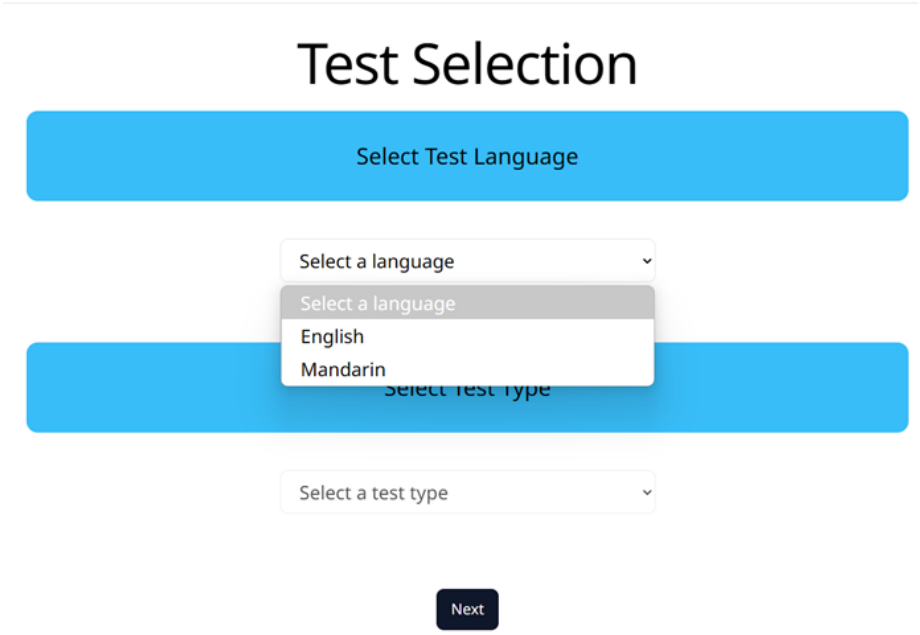

Figure 3: Language Selection

Test Case Identifier: PR-ST-SL1

Input/Condition: User navigates through various web pages.

Expected Output/Results: All web pages load completely with all functionalities within MAX_LOAD_TIME.

Actual Output/Results: All web pages load with correct data within MAX_LOAD_TIME.

Expected and Actual Output Match: True

Relevant Functional Requirement(s): PR-ST-SL1

Test Case Identifier: PR-ST-SL2

Input/Condition: A session is recorded during which two faces appear and a keyword is said.

Expected Output/Results: The latency between video and recorded playback remains below SHORT_PROCESSING_TIME.

Actual Output/Results: The latency is within the SHORT_PROCESSING_TIME when reviewing on clinician side

Expected and Actual Output Match: True

Relevant Functional Requirement(s): PR-ST-SL2

Test Case Identifier: PR-ST-SL3

Input/Condition: A video recorded during an assessment session is stored and later retrieved.

Expected Output/Results: The retrieved video meets or exceeds AVERAGE_RESOLUTION.

Actual Output/Results: Video is AVERAGE_RESOLUTION

Expected and Actual Output Match: True

Relevant Functional Requirement(s): PR-ST-SL3

Test Case Identifier: PR-ST-PA1

Input/Condition: Analysis model loaded with sample audio and video data containing known speech disturbances and multiple faces.

Expected Output/Results: The model detects speech and multiple faces with an accuracy of VERY_HIGH_SUCCESS_RATE.

Actual Output/Results: The model detects multiple faces with VERY_HIGH_SUCCESS_RATE but not speeches

Expected and Actual Output Match: False

Relevant Functional Requirement(s): PR-ST-PA1

Test Case Identifier: PR-ST-PA3

Input/Condition: User performs actions in the recorded session

Expected Output/Results: The timestamps delay within SHORT_PROCESSING_TIME of the real-time action.

Actual Output/Results: The timestamps delay SHORT_PROCESSING_TIME

Expected and Actual Output Match: True

Relevant Functional Requirement(s): PR-ST-PA3

Test Case Identifier: PR-ST-PA4

Input/Condition: Manual verification of the answer key's accuracy.

Expected Output/Results: The expected output is that the answer key is MAX_SUCCESS_RATE.

Actual Output/Results: The answer key is MAX_SUCCESS_RATE.

Expected and Actual Output Match: True

Relevant Functional Requirement(s): PR-ST-PA4

Test Case Identifier: PR-ST-RFT1

Input/Condition: Simulate common user errors (e.g., invalid inputs).

Expected Output/Results: The system displays clear error messages for at least VERY_HIGH_SUCCESS_RATE of the errors encountered.

Actual Output/Results: System gives correct feedback to user with a VERY_HIGH_SUCCESS_RA

Expected and Actual Output Match: True

Relevant Functional Requirement(s): PR-ST-RFT1

Test Case Identifier: PR-ST-RFT2

Input/Condition: Monthly data backup event.

Expected Output/Results: The expected output is that the system performs a data backup within a MONTHLY_BACKUP timeframe on the first of each month.

Actual Output/Results: This test case is currently out of scope as we don't have enough data to verify it.

Expected and Actual Output Match: N/A

Relevant Functional Requirement(s): PR-ST-RFT2

Test Case Identifier: PR-ST-CR1

Input/Condition: System loaded with MIN_USERS accounts.

Expected Output/Results: The expected result is that the system operates stably and manages all accounts without issues.

Actual Output/Results: System runs smoothly with MIN_USERS accounts

Expected and Actual Output Match: True

Relevant Functional Requirement(s): PR-ST-CR1

Test Case Identifier: PR-ST-CR2

Input/Condition: Data stored in the database approaches the annual MIN_STORAGE threshold.

Expected Output/Results: The system accommodates the data volume without performance degradation.

Actual Output/Results: The system accommodates the MIN_STORAGE threshold with room to increase data storage

Expected and Actual Output Match: True

Relevant Functional Requirement(s): PR-ST-CR2

Test Case Identifier: PR-ST-SE1

Input/Condition: Increase user base by YEARLY_INCREASE_PERCENTAGE.

Expected Output/Results: The expected result is that the system maintains performance while handling user growth.

Actual Output/Results: This test case is currently out of scope due to time constraints

Expected and Actual Output Match: N/A

Relevant Functional Requirement(s): PR-ST-SE1

Test Case Identifier: PR-ST-LR1

Input/Condition: Monitor system stability over successive updates on the release build.

Expected Output/Results: The system's failure rate remains below LOW_FAILURE_RATE during updates.

Actual Output/Results: system failure rate remains below LOW_FAILURE_RATE during deployment of versions

Expected and Actual Output Match: True

Relevant Functional Requirement(s): PR-ST-LR1

Test Case Identifier: PR-ST-LR2

Input/Condition: The system is run on multiple operating systems (Windows, macOS).

Expected Output/Results: The system functions correctly on all tested platforms without issues.

Actual Output/Results: The system functions correctly on multiple operating systems

Expected and Actual Output Match: True

Relevant Functional Requirement(s): PR-ST-LR2

4.4 Operational and Environmental

The test results below ensures that the system can be used in a variety of environments, along with the requirements for which users are expected to use the system within, and the capabilities and qualities the system has to interact with adjacent systems in the environment.

Test Case Identifier: OE-ST-EPE1

Input: Testing the system, including the assessment, on a variety of screen sizes

Expected Output: The expected result is the system's displayed elements will scale appropriately to different screen sizes

Actual Output: The actual result is the system's displayed elements scaled, to the satisfaction of 60% of users (Figure 4)

Expected and Actual Output Match: True

Relevant Nonfunctional Requirement(s): OE-EPE1

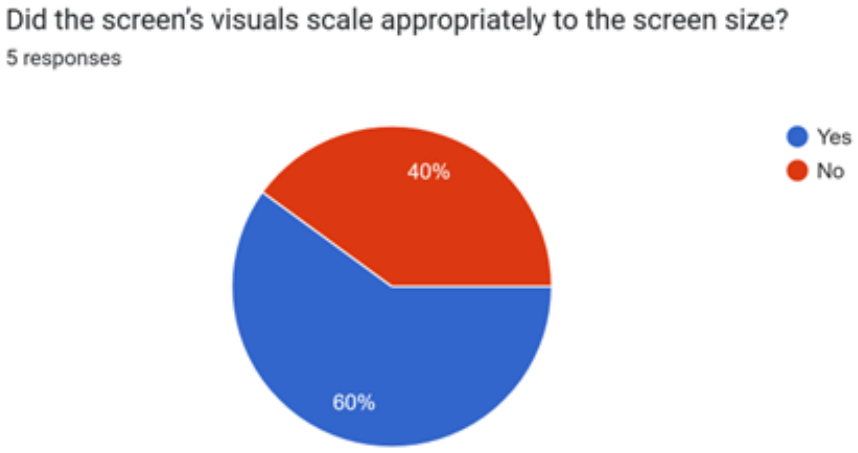

Figure 4: Results of Usability Survey - Scalability

Test Case Identifier: OE-ST-WE1

Input: User attempts to start system setup

Expected Output: The expected result is device verification displayed on-screen, informing the user that the environment they're in is suitable for the assessment

Actual Output: The actual result is the system verifies the user can proceed to the assessment following system setup, and allowing the user to test out their peripherals prior to starting the assessment (Figure 5)

Expected and Actual Output Match: True

Relevant Nonfunctional Requirement(s): OE-WE1, OE-WE2

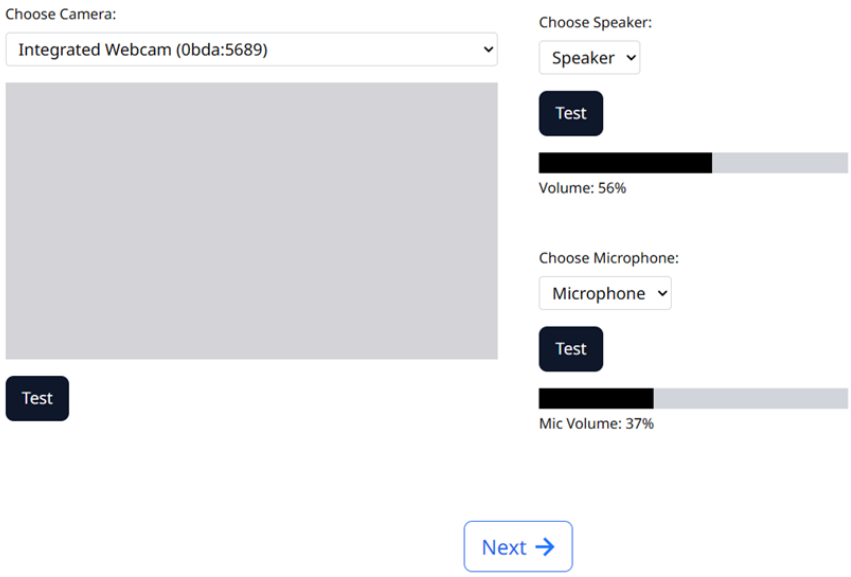

Figure 5: Device Setup

Test Case Identifier: OE-ST-IA1

Input: Assessment is complete, and results need to be stored

Expected Output: Verify results are stored in the external server

Actual Output: Results can be accessed through the server to ensure data has been uploaded and stored successful (Figure 6 and Figure 7)

Expected and Actual Output Match: True

Relevant Nonfunctional Requirement(s): OE-IA1

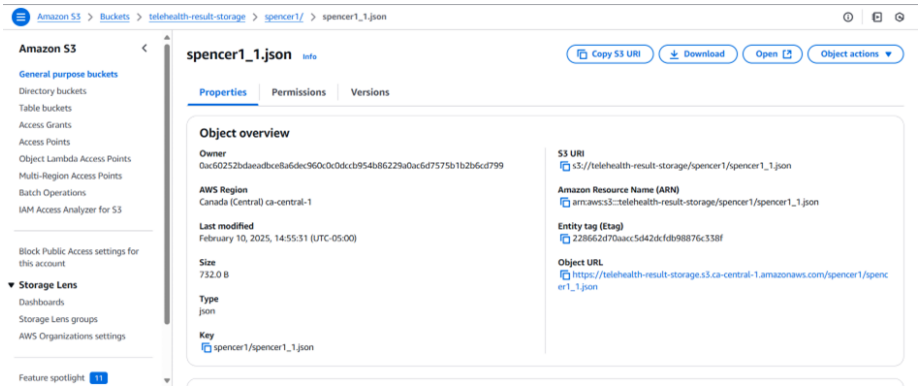

Figure 6: Results Storage - AWS Amazon Web Services (2025)

```
{
  "assessment_id": 1,
  "date": "2025-02-10",
  "questionBankId": "english-matching",
  "results": [
    {
      "question_id": 5,
      "user_answer": "a",
      "bias_state": false,
      "mark_state": "Undetermined"
    },
    {
      "question_id": 1,
      "user_answer": "a",
      "bias_state": false,
      "mark_state": "Undetermined"
    },
    {
      "question_id": 4,
      "user_answer": "c",
      "bias_state": false,
      "mark_state": "Undetermined"
    },
    {
      "question_id": 2,
      "user_answer": "a",
      "bias_state": false,
      "mark_state": "Undetermined"
    },
    {
      "question_id": 3,
      "user_answer": "b",
      "bias_state": false,
      "mark_state": "Undetermined"
    }
  ]
}
```


Figure 7: Results Storage - JSON

4.5 Maintainability and Support

These test cases ensure the platform meets its maintenance, support, and adaptability requirements effectively.

Test Case Identifier: MS-ST-MSA1

Input: Perform updates to individual components and simulate user feedback submissions via the GitHub repository.

Expected Output: The expected result is that each component update does not exceed
NUM_CODE_LINES lines of code edited outside the updated module, and users can submit issues and feature requests directly to GitHub, categorized as issues, feature requests, or feedback.

Actual Output: The actual result is that each component update does not exceed
NUM_CODE_LINES lines of code edited outside the updated module, and users can submit issues and feature requests directly to GitHub, categorized as issues, feature requests, or feedback.

Expected and Actual Output Match: True

Relevant Nonfunctional Requirement(s): MS-MR1, MS-SR1

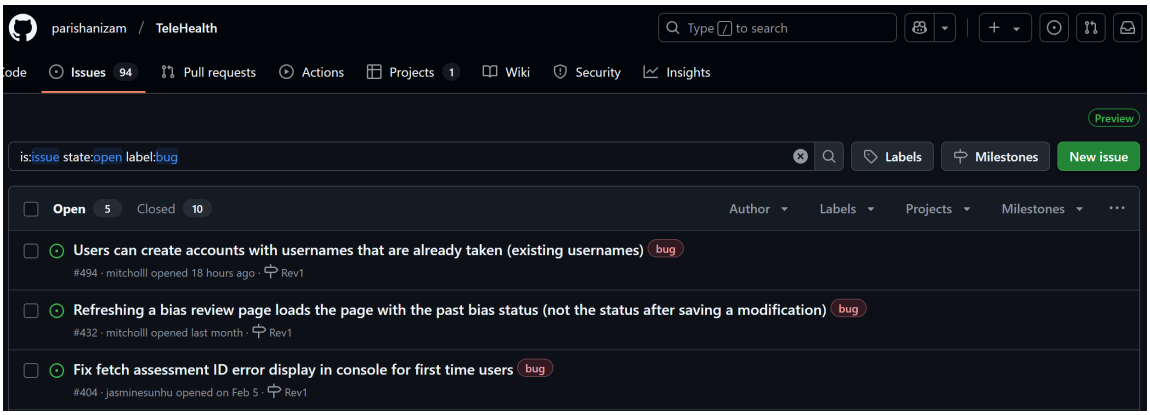

Figure 8: GitHub Issue Creation GitHub (2024)

Test Case Identifier: MS-ST-MSA2

Input: New user group follows the tutorial to complete primary tasks (e.g., starting an assessment).

Expected Output: The expected result is HIGH_SUCCESS_RATE of users can complete core tasks
correctly after following the tutorial.

Actual Output: The actual result is HIGH_SUCCESS_RATE of users can complete core tasks
correctly after following the tutorial.

Expected and Actual Output Match: True

Relevant Nonfunctional Requirement(s): MS-SR2

Test Case Identifier: MS-ST-MSA3

Input: Load and navigate the platform across multiple devices to evaluate responsive design and functionality.

Expected Output: The expected result is MAX_SUCCESS_RATE of essential features are fully functional and readable across all screen sizes tested.

Actual Output: The actual result is MAX_SUCCESS_RATE of essential features are fully
functional and readable across all screen sizes tested.

Expected and Actual Output Match: True

Relevant Nonfunctional Requirement(s): MS-AR1

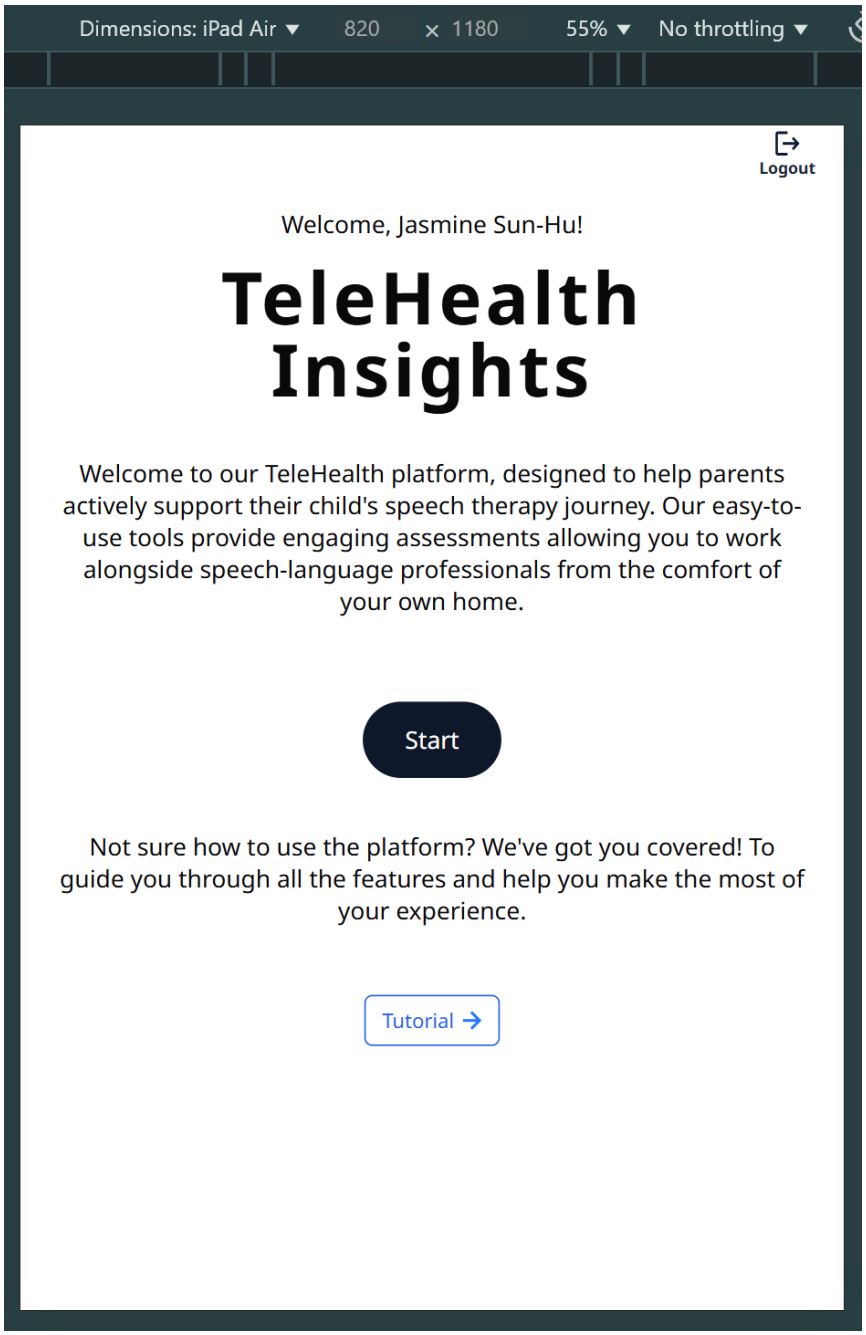

Figure 9: Website on iPad Screen Size

Figure 10: Website on iPhone Screen Size

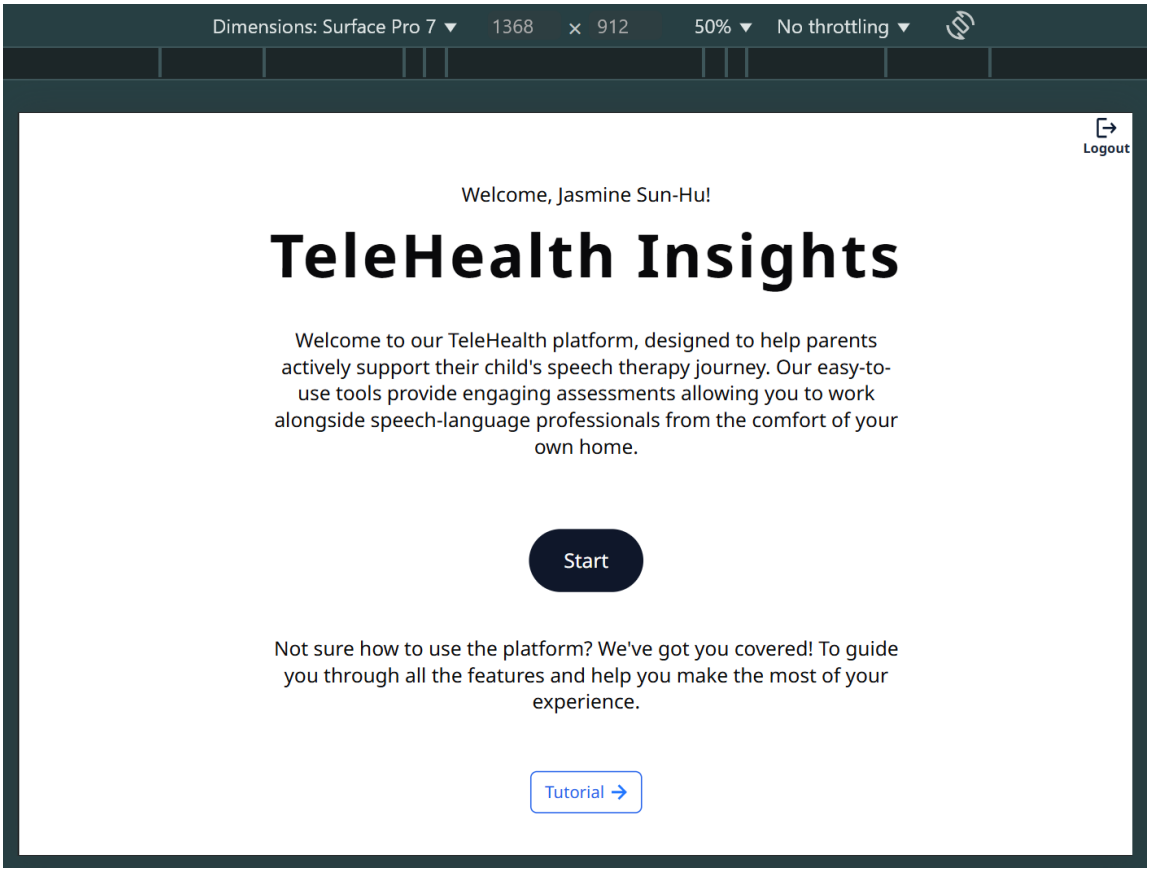

Figure 11: Website on Surface Laptop Screen Size

4.6 Cultural

These tests ensure that the platform respects cultural sensitivities and provides full bilingual support, enhancing inclusiveness and accessibility for diverse user groups.

Test Case Identifier: CU-ST-CUR1

Input: User acceptance testing gathers feedback from a diverse set of users.

Expected Output: The expected result is MAX_SUCESS_RATE of reviewed content is confirmed as culturally sensitive with no instances of offensive language or imagery.

Actual Output: The actual result is MAX_SUCESS_RATE of reviewed content is confirmed as culturally sensitive with no instances of offensive language or imagery.

Expected and Actual Output Match: True

Relevant Nonfunctional Requirement(s): CU-CR1

Test Case Identifier: CU-ST-CUR2

Input: Platform is available in both English and Mandarin, with all interface elements and assessments translated.

Expected Output: The expected result is MAX_SUCCESS_RATE of assessment content is fully
translated and functional in both English and Mandarin with no
untranslated elements.

Actual Output: The actual result is MAX_SUCCESS_RATE of assessment content is fully
translated and functional in English, but only the assessment itself is also available in Mandarin.

Expected and Actual Output Match: False

Relevant Nonfunctional Requirement(s): CU-CR2

4.7 Security

The test cases below cover security requirements associated to the system.

Test Case Identifier: SR-ST-AC1

Input: User with Admin role attempts to create and assign accounts to clinicians **Expected Output:** Only Admin users can access and execute functions related to clinician account creation.

Actual Output: Only admin can access the ability to create clincian accounts. Non-admin's do not have access to these functions and are denied

Expected and Actual Output Match: True

Relevant Nonfunctional Requirement(s): SR-ST-AC1

Test Case Identifier: SR-ST-AC2

Input: User with Parent role logs in and attempts to complete assessments. **Expected Output:** Parent users can create their account, complete assessments, and log out successfully.

Actual Output: Parent can start and complete an assessment, as well as successfully logout upon completion. They do not have access to any administrative functions.

Expected and Actual Output Match: True

Relevant Nonfunctional Requirement(s): SR-ST-AC2

Test Case Identifier: SR-ST-AC3

Input: User with Parent role logs in and attempts to complete assessments. **Expected Output:** Parent users can create their account, complete assessments, and log out successfully.

Actual Output: Parent can start and complete an assessment, as well as successfully logout upon completion. They do not have access to any administrative functions.

Expected and Actual Output Match: True

Relevant Nonfunctional Requirement(s): SR-ST-AC3

Test Case Identifier: SR-ST-AC4

Input: : Users attempt to log in with correct and incorrect credentials.

Expected Output: Users can only log in with correct credentials; unauthorized access attempts are denied.

Actual Output: Confirmed successful login for admin, parent and clinician accounts with appropriate logins. Login is denied with incorrect credentials and shown an error message.

Expected and Actual Output Match: True

Relevant Nonfunctional Requirement(s): SR-ST-AC4

Test Case Identifier: SR-ST-P1

Input: Review documentation to ensure adherence to data protection and privacy laws in the region.

Expected Output: Confirm all applicable data protection requirements are met.

Actual Output: Data is stored appropriately and reviewed.

Expected and Actual Output Match: True

Relevant Nonfunctional Requirement(s): SR-ST-P1

Test Case Identifier: SR-ST-P2

Input: Examine data in transit and at rest.

Expected Output: Data remains encrypted according to standard encryption protocols during transit and at rest. **Actual Output:** Data is not encypted

Expected and Actual Output Match: False

Relevant Nonfunctional Requirement(s): SR-ST-P2

Test Case Identifier: SR-ST-P3

Input: Examine data storage for PII.

Expected Output: System does not store any personal identifiable information: (e.g., address, date of birth, names) beyond username and assessment recordings.

Actual Output: Data stored does not contain PII. It does include names

Expected and Actual Output Match: False: We have changed requirements to include names as part of the information stored to ensure proper account creation, Authentication, and result connection.

Relevant Nonfunctional Requirement(s): SR-ST-P3

Test Case Identifier: SR-ST-IM1

Input: User attempts to create an account with both weak and strong passwords.

Expected Output: Account creation is completed only when a strong password, meeting specified security criteria, is entered. Weak passwords are rejected with an error message detailing the password requirements.

Actual Output: The system allows any password.

Expected and Actual Output Match: False: Strong passwords need to be enforced.

Relevant Nonfunctional Requirement(s): SR-ST-IM1

4.8 Compliance

The test cases below cover compliance requirements related to data storage within the system.

Test Case Identifier: FR-ST-STD1

Input: User assessment data, including video and audio recordings, is stored in the system.

Expected Output: Examine the storage configuration and security measures

applied to user assessment data.

Actual Output: Database schema checked, data is linked to username and does not contain PII information. Unauthorized access is denied.

Expected and Actual Output Match: True

Relevant Nonfunctional Requirement(s): FR-ST-STD1

5 Comparison to Existing Implementation

As this project does not have existing implementations, this section is not appropriate for the TeleHealth Insights project.

6 Unit Testing

7 Changes Due to Testing

Throughout testing, important changes to the system were identified that will be implemented into Revision 1. Feedback is based on pilot usability testing with fellow software engineering students, graduates from McMaster, and the team's supervisor, following the Revision 0 demo. The changes identiifed are aimed at enhancing the functionality and usability of the system.

- **Parent Results Accessibility** Inititally, the system was not capable of displaying the results to the parents. Upon conversations with the team's supervisor, it became clear that a missing feature that would benefit users of the system is for parents to have access to their own past assessment information. Clarity in communication surrounding their child's results is integral for conversation amongst parents and clinicians to see how the child's progress overtime.
- **Uploading Results Require Clearer Communication** Initially, to upload results, the user would press a 'submit' button on the last question of their assessment. Upon clicking this button, text would appear to inform the user that their results were being uploaded. However, feedback from the team's usability testing revealed that users would appreciate a loading screen, or a loading indicator on the screen, rather than static text to effectively communicate that results are still being uploaded. Users were previously confused on

whether or not the system was operating properly, or if it froze, due to the lack of a loading indicator.

- **Simplify Tutorials** The tutorial screens consisted of a variety of screenshots and descriptions, informing users of what they could expect to see from the system upon completion of the tutorial. However, upon conducting usability testing, numerous users were confused by the tutorial, and thought that the screenshots themselves were interactable buttons, as they were screenshots of the system. Tutorials will be modified to convey integral information to the user about the assessment itself, and minimize repetition of information by reducing screenshots of the system. The section of the tutorial users appreciated was the step-by-step walkthrough of a sample question. The tutorial will be reformulated to put a larger emphasis on walking users through the system, instead of displaying static information.
- **Uploading Assessment Videos** The team's supervisor expressed through feedback that the system was not effective at uploading assessment videos. Upon inspection, the team updated the deployed system to allow for faster upload speeds, resulting in a better user experience when completing assessments. This is of particular importance to the team, as the full assessment will be 30 questions, while the usability test featured only 5 questions. In addition, the system will be used by children, which may lengthen the assessment duration as well.

8 Automated Testing

8.1 Linters

To maintain a good coding standard, we integrated linters into our development workflow. For JavaScript files, we rely on Prettier to automatically format code, ensuring consistent indentation and spacing. By running Prettier as part of our pre-commit checks, any formatting concerns are addressed before merging into our main repository, which helps minimize merge conflicts and maintain a clean codebase.

8.2 Unit Testing

We use Jest as our primary JavaScript testing framework to automatically verify critical parts of our code before changes are merged into the main branch. This

approach helps us catch issues early, maintain code quality, and keep the overall system stable.

8.3 Continuous Integration

We used continuous integration (CI) pipeline to automate test execution and provide immediate feedback whenever new code is committed. We configure GitHub Actions trigger to run our Jest unit tests, linters and document tests on each pull request or direct push to main, ensuring that only code meeting quality standards is always met.

9 Trace to Requirements

Table 2: Traceability Table Between System Test Cases and Functional Requirements (Part 1)

	FR-ST-A1	FR-ST-A2	FR-ST-A3	FR-ST-A4	FR-ST-A5	FR-ST-A6	FR-ST-A7	FR-ST-A8	FR-ST-DSC1	FR-ST-DSC2	FR-ST-DSC3	FR-ST-DSC4	FR-ST-DSC5	FR-ST-VDA1	FR-ST-VDA2
FR-A1	X	X													
FR-A2			X	X											
FR-A3					X	X									
FR-A4							X								
FR-A5								X							
FR-SS1															
FR-SS2															
FR-SS3															
FR-SS4															
FR-SS5															
FR-AI1															
FR-AI2															
FR-AI3															
FR-AI4															
FR-AI5															
FR-AI6															
FR-AI7															
FR-DSC1									X						
FR-DSC2										X					
FR-DSC3											X				
FR-DSC4												X			
FR-DSC5													X		
FR-VADA1														X	
FR-VADA2															X
FR-VADA3															
FR-DPD1															
FR-DPD2															
FR-DPD3															
FR-DPD4															

Table 3: Traceability Table Between System Test Cases and Functional Requirements (Part 2)

	FR-ST-VDA3	FR-ST-DPD1	FR-ST-DPD2	FR-ST-DPD3	FR-ST-DPD4	FR-ST-SS1	FR-ST-SS2	FR-ST-SS3	FR-ST-SS4	FR-ST-SS5	FR-ST-AI1	FR-ST-AI2	FR-ST-AI3	FR-ST-AI4	FR-ST-AI5	FR-ST-AI6	FR-ST-AI7
FR-A1																	
FR-A2																	
FR-A3																	
FR-A4																	
FR-A5																	
FR-SS1						X											
FR-SS2							X										
FR-SS3								X									
FR-SS4									X								
FR-SS5										X							
FR-AI1											X						
FR-AI2												X					
FR-AI3													X				
FR-AI4														X			
FR-AI5															X		
FR-AI6																X	
FR-AI7																	X
FR-DSC1																	
FR-DSC2																	
FR-DSC3																	
FR-DSC4																	
FR-DSC5																	
FR-VADA1																	
FR-VADA2																	
FR-VADA3	X																
FR-DPD1		X															
FR-DPD2			X														
FR-DPD3				X													
FR-DPD4					X												

Table 4: Traceability Table Between System Test Cases and Nonfunctional Requirements (Part 1)

	LF-ST-LFR1	LF-ST-LFR2	UH-ST-EOU1	UH-ST-PI1	UH-ST-LI2	PR-ST-SL1	PR-ST-SL2	PR-ST-SL3	PR-ST-PA1	PR-ST-PA3	PR-ST-PA4	PR-ST-RFT1	PR-ST-RFT2	PR-ST-CR1	PR-ST-CR2	PR-ST-SE1	PR-ST-LR1
LF-AR1	X																
LF-AR2	X																
LF-AR3		X															
LF-AR4	X																
LF-AR5		X															
LF-SR1		X															
LF-SR2		X															
UH-EOU1			X														
UH-EOU2			X														
UH-PI1				X													
UH-LI1			X														
UH-LI2					X												
UH-UP1			X														
UH-AR1			X														
PR-SL1						X											
PR-SL2							X										
PR-SL3								X									
PR-SL4																	
PR-SCL1																	
PR-PA1									X								
PR-PA2									X								
PR-PA3										X							
PR-PA4											X						
PR-PA5											X						
PR-RFT1												X					
PR-RFT2													X				
PR-RFT3												X					
PR-CR1														X			
PR-CR2															X		
PR-CR3														X			
PR-CR4														X			
PR-SE1																X	
PR-SE2															X		
PR-SE3															X		
PR-LR1																	X
PR-LR2																	
OE-EPE1																	
OE-WE1																	
OE-WE2																	
OE-IA1																	
MS-MR1																	
MS-SR1																	
MS-SR2																	
MS-AR1																	
SR-AC1																	
SR-AC2																	
SR-AC3																	
SR-AC4																	
SR-P1																	
SR-P2																	
SR-P3																	
SR-IM1																	
CU-CR1																	
CU-CR2																	
CR-STD1																	

Table 5: Traceability Table Between System Test Cases and Nonfunctional Requirements (Part 2)

	PR-ST-LR2	OE-ST-EPE1	EO-ST-WE1	OE-ST-IA1	MS-ST-MSA1	MS-ST-MSA2	MS-ST-MSA3	CU-ST-CUR1	CU-ST-CUR1	SR-ST-AC1	SR-ST-AC2	SR-ST-AC3	SR-ST-AC4	SR-ST-IM1	CR-ST-D1	SR-ST-P1	SR-ST-P2	SR-ST-P3
LF-AR1																		
LF-AR2																		
LF-AR3																		
LF-AR4																		
LF-AR5																		
LF-SR1																		
LF-SR2																		
UH-EOU1																		
UH-EOU2																		
UH-PI1																		
UH-LI1																		
UH-LI2																		
UH-UP1																		
UH-AR1																		
PR-SL1																		
PR-SL2																		
PR-SL3																		
PR-SL4																		
PR-SCL1																		
PR-PA1																		
PR-PA2																		
PR-PA3																		
PR-PA4																		
PR-PA5																		
PR-RFT1																		
PR-RFT2																		
PR-RFT3																		
PR-CR1																		
PR-CR2																		
PR-CR3																		
PR-CR4																		
PR-SE1																		
PR-SE2																		
PR-SE3																		
PR-LR1																		
PR-LR2	X																	
OE-EPE1		X																
OE-WE1			X															
OE-WE2			X															
OE-IA1				X														
MS-MR1					X													
MS-SR1					X													
MS-SR2						X												
MS-AR1							X											
SR-AC1										X								
SR-AC2											X							
SR-AC3												X						
SR-AC4													X					
SR-P1																X		
SR-P2																	X	
SR-P3																		X
SR-IM1														X				
CU-CR1								X										
CU-CR2									X									
CR-STD1															X			

10 Trace to Modules

Table 6: Traceability Table Between System Test Cases and Modules

	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12	M13	M14	M15	M16	M17
FR-ST-A1	X	X	X		X			X									
FR-ST-A2	X	X	X		X			X									
FR-ST-A3		X	X		X			X									
FR-ST-A4		X	X		X			X									
FR-ST-A5	X		X		X			X									
FR-ST-A6	X		X		X			X									
FR-ST-A7					X			X									
FR-ST-A8					X			X									
FR-ST-DSC1				X		X		X									
FR-ST-DSC2				X		X	X			X		X	X				
FR-ST-DSC3				X	X												
FR-ST-DSC4				X	X												
FR-ST-DSC5				X				X		X	X						
FR-ST-VDA1				X			X					X	X				
FR-ST-VDA2				X			X	X				X	X				
FR-ST-VDA3				X			X	X				X	X				
FR-ST-DPD1				X		X		X		X	X						
FR-ST-DPD2				X		X		X		X	X						
FR-ST-DPD3	X			X		X		X		X	X						
FR-ST-DPD4	X			X		X		X		X	X						
FR-ST-SS1		X	X														
FR-ST-SS2		X	X														
FR-ST-SS3		X	X														
FR-ST-SS4		X	X														
FR-ST-SS5		X	X						X								
FR-ST-AI1		X	X	X			X		X			X	X	X	X	X	
FR-ST-AI2		X	X	X			X		X			X	X	X	X	X	
FR-ST-AI3		X	X	X			X		X			X	X	X	X	X	
FR-ST-AI4		X	X	X			X		X			X	X	X	X	X	
FR-ST-AI5		X	X	X		X	X		X			X	X	X	X	X	
FR-ST-AI6		X	X	X			X		X			X	X	X	X	X	
FR-ST-AI7		X	X	X			X		X			X	X	X	X	X	X

11 Code Coverage Metrics

This section covers the code coverage metrics summary for all files in our backend. The code coverage values are given as percentages of code covered utilizing Jest. Services such as authenticaition-service and media-processing-service have greater code coverage as they were a bigger part of our system thus we wrote more unit tests for them.

File	Stmts (%)	Stmts (cov/total)	Branches (%)	Branches (cov/total)	Funcs (%)	Funcs (cov/total)	Lines (%)	Lines (cov/total)
backend	78.57	11/14	25	1/4	0	0/1	78.57	11/14
backend/routes	92.3	12/13	100	0/0	0	0/1	92.3	12/13
backend/services/authentication-service	100	9/9	100	0/0	100	0/0	100	9/9
backend/services/authentication-service/config	27.77	5/18	100	0/0	0	0/6	29.41	5/17
backend/services/authentication-service/controllers	22.97	34/148	6.25	4/64	18.18	2/11	23.28	34/146
backend/services/authentication-service/models	12.19	5/41	0	0/3	0	0/8	12.5	5/40
backend/services/authentication-service/routes	100	21/21	100	0/0	100	0/0	100	21/21
backend/services/media-processing-service	100	5/5	100	0/0	100	0/0	100	5/5
backend/services/media-processing-service/config	31.57	6/19	0	0/4	0	0/4	31.57	6/19
backend/services/media-processing-service/controllers	7.35	10/136	1.78	1/56	0	0/12	7.51	10/133
backend/services/media-processing-service/helpers	19.51	8/41	0	0/10	0	0/8	20	8/40
backend/services/media-processing-service/routes	83.33	10/12	100	0/0	0	0/2	83.33	10/12
backend/services/question-bank-service	100	5/5	100	0/0	100	0/0	100	5/5
backend/services/question-bank-service/config	84	21/25	100	1/1	100	6/6	83.33	20/24
backend/services/question-bank-service/controllers	50	22/44	31.25	5/16	80	4/5	48.83	21/43
backend/services/question-bank-service/routes	100	6/6	100	0/0	100	0/0	100	6/6
backend/services/result-storage-service	100	5/5	100	0/0	100	0/0	100	5/5
backend/services/result-storage-service/config	18.18	4/22	100	0/0	0	0/7	19.04	4/21
backend/services/result-storage-service/controllers	2.08	2/96	0	0/46	0	0/9	2.15	2/93
backend/services/result-storage-service/routes	100	10/10	100	0/0	100	0/0	100	10/10

Table 7: Code Coverage Report for Each Service

References

Amazon Web Services. Telehealth result storage bucket. https://ca-central-1.console.aws.amazon.com/s3/buckets/telehealth-result-storage?region=ca-central-1&bucketType=general&tab=objects, 2025. Accessed: March 09, 2025.

GitHub. Open issues labeled "bug" in the telehealth repository. https://github.com/parishanizam/TeleHealth/issues?q=is%3Aissue%20state%3Aopen%20label%3Abug, 2024. Accessed: March 10, 2025.

Appendix — Reflection

The information in this section will be used to evaluate the team members on the graduate attribute of Reflection.

The purpose of reflection questions is to give you a chance to assess your own learning and that of your group as a whole, and to find ways to improve in the future. Reflection is an important part of the learning process. Reflection is also an essential component of a successful software development process.

Reflections are most interesting and useful when they're honest, even if the stories they tell are imperfect. You will be marked based on your depth of thought and analysis, and not based on the content of the reflections themselves. Thus, for full marks we encourage you to answer openly and honestly and to avoid simply writing "what you think the evaluator wants to hear."

Please answer the following questions. Some questions can be answered on the team level, but where appropriate, each team member should write their own response:

1. What went well while writing this deliverable?

   Jasmine: I think the team's ability to efficiently split up tasks and communicate and collaborate with each other when uncertainties arise is very high from working together over several months of documentation. Our workflow has become more optimized and smooth over time.
   Mitchell: One of the things that went well while writing this deliverable was how prepared we were to evaluate our tests. Since we created the VnV plan prior to implementing the system, the design of the software was made with the tests in mind. This made it so that we had less obstacles and design decisions to make later, and prevented many issues and bugs from arising.
   Promish: I think everyone was very organized during this deliverable. Writing unit tests wasn't too bad, and using Jest to get a coverage report was fairly easy too—it didn't throw any errors, which was always good. Lastly, merging our work together this time was easy since we figured out that writing sections into main for each of the parts and then making branches off the main with sections led to having zero merge conflicts.

2. What pain points did you experience during this deliverable, and how did you resolve them?

   Jasmine: There were points where the wording of written test cases were

ambiguous or unclear, which made it difficult to determine whether the test case could be considered a pass or not. The resolution was to discuss with the team to define any unclear terms with each other for consistency, such as visual consistency meaning using the same set of fonts, colours, button styles, image styles, etc.

Mitchell:— One of the pain points I experienced during this deliverable was figuring out priorities for next steps to improve the system. Although there were many areas that could benefit from modifications, figuring out what to prioritize first to greatly improve user satisfaction was difficult. To resolve this, I looked at the usability results and looked at what difficulties users had in common. This brought my attention to the tutorial screens, and how they need to be made to convey information to the user without simply posting screenshots of the system. Many users found the screenshots unhelpful, and conveyed that was a main point of confusion, which led to the prioritization of improving the tutorial screens.

Promish: This document was due during a very busy time when each of us had midterms, so writing and coding the unit tests was stressful. We resolved this issue by figuring out when everyone was free and dividing the work evenly based on what we did in previous documents so that everyone could work on their own time.

3. Which parts of this document stemmed from speaking to your client(s) or a proxy (e.g. your peers)? Which ones were not, and why?

   Jasmine: Changes from the VnV plan expected output for a few tests to the VnV report were made after going over peer reviews, such as for test case CU-ST-CUR1 one of the expected outputs was for an individual with credibility on the relevant cultures to approve of the site and assessment content. The practicality of this was questioned during peer review, and it was later decided that the participants in usability testing would be used to confirm no content was culturally insensitive alone would be sufficient instead. The expected output of a few test cases were adjusted for this reason.

   Mitchell: The 'Usability and Humanity' nonfunctional requirements evaluation section and 'Changes Due to Testing' section stemmed from speaking with a proxy, which was the peers we conducted the pilot usability tests with. This was especially helpful as it led to the validation of our system's use and provided us with helpful feedback that we can use to further improve the system.

   Promish: The usability testing was a result of speaking to our peers. We did

a pilot to gain insights into which parts of our frontend and user flow needed to be changed. Talking to our supervisor Irene, we talked about potential additions to our system which parents would want to see like their history. Other than that, the tests for our functional and nonfunctional requirements were taken from the ones we wrote in the VnV plan.

4. In what ways was the Verification and Validation (VnV) Plan different from the activities that were actually conducted for VnV? If there were differences, what changes required the modification in the plan? Why did these changes occur? Would you be able to anticipate these changes in future projects? If there weren't any differences, how was your team able to clearly predict a feasible amount of effort and the right tasks needed to build the evidence that demonstrates the required quality? (It is expected that most teams will have had to deviate from their original VnV Plan.)

   Jasmine: For the most part the testing was the same, there were very few activities from the VnV plan were not executed or substituted during the actual VnV, due to feasibility or limitations out of the group's control. If a test case had multiple methods to verify it, the other one was chosen. If there was no alternative verification methods from the plan, the test was modified to accommodate our circumstances and available resources, such as using peers as users for an initial pilot test when the real user groups were unavailable for the testing session times. With experience, I think I could better predict and anticipate the amount of effort, time and resources a group is able to put into testing.
   Mitchell: One of the ways the VnV Plan was different from the activities that were conducted for VnV is how we planned on fully implementing the ability to report bugs and access user documentation from inside the system. This required a modification to the plan was we were not able to assess the ability to report bugs or access user documentation. These changes occurred because the team was focused on prioritizing the system's main functionality, and both of these planned features were less impactful on the system's success. We would be able to anticipate these changes in future projects by prioritizing the testing of core essential features.
   Promish: The main change I found was in the extent to which our test cases could be written. When we were making the VnV plan, we didn't have a clear picture of how we were going to deploy our system, so certain tests—such as testing yearly server increase or max users—were very out of scope for where

we were in our project. After doing the deployment, we realized that most of these tests are solved by upgrading the external server, which I find to be out of the scope of our project. For example, if there are stability concerns, we can pay for a faster backend server since the way we deployed it allows for that. This was a good experience since, for next time, I can anticipate this change and get a better understanding of what needs to be tested in scope and what is out of scope. After our deployment, we also got access to graphs for performance, and we made graphs for usability, which is how we got our evidence for our non-functional unit tests.