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

Date	Version	Notes
Date 1	1.0	Notes
Date 2	1.1	Notes

2 Symbols, Abbreviations and Acronyms

symbol	description
T	Test

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

Contents

List of Tables

List of Figures

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 cases 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:

Expected and Actual Output Match: True

Relevant Functional Requirement(s): FR-A1

3.2 Data Collection and Storage

The test cases below foucs on ensuring data is collected and stored correctly. We test to make sure no identifable 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 consol throws an error as no such field exists for persoanl 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 identifers

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 assement 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 successfully with a corresponding success message logged

Actual Output: A sucess 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

The test cases below

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:

Expected and Actual Output Match: True

Relevant Functional Requirement(s): FR-A1

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

The test cases below

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:

Expected and Actual Output Match: True

Relevant Nonfunctional Requirement(s): FR-A1

4.2 Usability and Humanity

The test cases below

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:

Expected and Actual Output Match: True

Relevant Nonfunctional Requirement(s): FR-A1

4.3 Performance

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

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, PR-ST-PA3

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, PR-ST-PA3

Test Case Identifier: PR-ST-RFT1

Input/Condition: Simulate a 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_RATE

Expected and Actual Output Match: True

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

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-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 failur 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 cases below

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:

Expected and Actual Output Match: True

Relevant Nonfunctional Requirement(s): FR-A1

4.5 Maintainability and Support

The test cases below

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:

Expected and Actual Output Match: True

Relevant Nonfunctional Requirement(s): FR-A1

4.6 Cultural

The test cases below

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:

Expected and Actual Output Match: True

Relevant Nonfunctional Requirement(s): FR-A1

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

[This section should highlight how feedback from the users and from the supervisor (when one exists) shaped the final product. In particular the feedback from the Rev 0 demo to the supervisor (or to potential users) should be highlighted. —SS]

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

10 Trace to Modules

11 Code Coverage Metrics

References

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