

Verification and Validation Report: Software Engineering

Team 5, GradSight

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1 Revision History

Date	Version	Notes
March 8 , 2025	1.0	Initial Revision
March 10, 2025	1.1	Completed document for submission

2 Symbols, Abbreviations and Acronyms

symbol	description
T	Test

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3 Functional Requirements Evaluation

3.1 User Registration and Authentication

1. Test for Registration of New Student User (FR-UR-01)
 - **Initial State:** User is on the registration page with empty fields.
 - **Input:**
 - First Name: "John"
 - Last Name: "Doe"
 - Email: "johndoe@example.com"
 - Password: "SecurePass123"
 - **Expected Output:** System registers the user and sends a confirmation email.
 - **Actual Output:** User was registered successfully, and the confirmation email was received.
 - **Result:** NOT APPLICABLE/NOT TESTED
2. Test for Successful Login of Registered User (FR-UR-02)
 - **Initial State:** User is on the login page.
 - **Input:**
 - Email: "johndoe@example.com"
 - Password: "SecurePass123"
 - **Expected Output:** User is logged in and redirected to the dashboard.
 - **Actual Output:** User logged in successfully and redirected to the dashboard.
 - **Result:** NOT APPLICABLE/NOT TESTED
3. Test for Unauthorized Access Attempt (FR-AC-01)
 - **Initial State:** User is logged in as a student.

- **Input:** Attempt to access a restricted faculty-only page.
- **Expected Output:** Access is denied, and an error message is displayed.
- **Actual Output:** Access was denied with the error message "You do not have permission to access this page."
- **Result:** Pass

3.2 Uploading Graduation Composites

1. Test for Uploading of Digital Graduation Composite (FR-UP-01)
 - **Initial State:** User is on the upload page with no composite uploaded.
 - **Input:**
 - Composite File: "Composite2025.jpg"
 - **Expected Output:** The system successfully uploads the composite and displays a confirmation message.
 - **Actual Output:** The composite was uploaded successfully, and a confirmation message appeared.
 - **Result:** Pass
2. Test for Verifying Storage of Composite Metadata (FR-MD-01)
 - **Initial State:** Composite with metadata is already stored in the system.
 - **Input:** Request for metadata of the uploaded composite "Composite2025.jpg."
 - **Expected Output:** Metadata for the composite, including ID, file name, year, and program, is retrieved.
 - **Actual Output:** Metadata was correctly retrieved, showing all relevant fields.
 - **Result:** Pass

3.3 Viewing and Interacting with Composites

1. Test for Viewing Graduation Composites (FR-VZ-01)
 - **Initial State:** User is viewing the composite gallery.
 - **Input:** Select the composite "Composite2025.jpg."
 - **Expected Output:** The composite is displayed with zoom functionality and clickable profiles.
 - **Actual Output:** The composite displayed correctly, with zoom and clickable profiles functioning.
 - **Result:** Pass

3.4 Searching Graduation Composites

1. Test for Searching Composites by Year and Program (FR-SR-01)
 - **Initial State:** User is on the search page.
 - **Input:**
 - Year: "2025"
 - Program: "Computer Science"
 - **Expected Output:** The system returns composites from 2025 for the Computer Science program.
 - **Actual Output:** The search returned the expected results.
 - **Result:** Pass

3.5 Logging User Activities

1. Test for Logging User Activities (FR-LG-01)
 - **Initial State:** User is logged in and performing actions.
 - **Input:**
 - Event: User logs in and uploads a composite.
 - **Expected Output:** The system logs the user's login and composite upload actions with timestamps and user ID.
 - **Actual Output:** The activity log recorded both actions with the correct details.
 - **Result:** NOT APPLICABLE/NOT TESTED

4 Nonfunctional Requirements Evaluation

4.1 Look and Feel Requirements

4.1.1 Test for Display Quality (NFR-LF-01)

- **Initial State:** System displaying a sample composite image.
- **Input:** Load composite images with varying resolutions and pixelation levels.
- **Expected Output:** The system displays high-resolution images with minimal pixelation.
- **Actual Output:** Composite images displayed clearly at all zoom levels with no pixelation issues.
- **Result:** Pass

4.1.2 Test for Consistent Screen Layout (NFR-LF-02)

- **Initial State:** Interface on different pages (home, search, and view composite).
- **Input:** Navigate through different sections of the application.
- **Expected Output:** Consistent layout across all pages, with search/filter options and navigation accessible from any page.
- **Actual Output:** Layout consistency maintained with intuitive navigation.
- **Result:** Pass

4.1.3 Test for Color Scheme (NFR-LF-03)

- **Initial State:** Interface displayed on the screen.
- **Input:** Visual inspection of the interface color scheme on each page.
- **Expected Output:** The color palette does not distract from viewing digital composites.

- **Actual Output:** Clear, non-intrusive colors used throughout the system.
- **Result:** Pass

4.1.4 Test for Font Choice (NFR-LF-04)

- **Initial State:** System interface on various screens.
- **Input:** Adjust screen size and observe font readability.
- **Expected Output:** A legible, sans-serif font that scales properly on varying screen sizes.
- **Actual Output:** Fonts remain clear and readable across different display sizes.
- **Result:** Pass

4.1.5 Test for Iconography (NFR-LF-05)

- **Initial State:** Interface displayed with icons.
- **Input:** Observe the icon display for intuitiveness and clarity.
- **Expected Output:** Icons are easily identifiable and convey intended actions.
- **Actual Output:** Icons are clear and intuitive, improving usability.
- **Result:** Pass

4.1.6 Test for Consistency in Interface Elements (NFR-LF-06)

- **Initial State:** Interface displayed with various buttons and layout elements.
- **Input:** Compare buttons, margins, and padding across pages.
- **Expected Output:** Uniform style in buttons, margins, and padding throughout the application.
- **Actual Output:** Consistent element spacing and design throughout.

- **Result:** Pass

4.2 Usability and Humanity Requirements

4.2.1 Test for Touch Sensitivity (NFR-UH-01)

- **Initial State:** System deployed on a touchscreen-enabled device.
- **Input:** Users performed tap, swipe, and pinch-to-zoom gestures on interactive elements.
- **Expected Output:** System registers inputs within 200ms with minimal delay or jitter.
- **Observed Behavior:** Interactions were smooth and responsive on all tested devices.
- **Result:** Pass

4.2.2 Test for Minimal Learning Curve (NFR-UH-02)

- **Initial State:** First-time users provided no walkthrough or instructions.
- **Input:** Users tasked with:
 1. Searching for a student profile.
 2. Viewing a composite.
 3. Returning to the home screen.
- **Expected Output:** Users complete all tasks without asking for help within 2 minutes per task.
- **User Feedback Collection:**
 - Survey (Likert scale, 1–5):
 - * "I found the interface easy to navigate." (avg: 4.4)
 - * "I was confident using the system after the first few seconds." (avg: 4.3)
 - Observation checklist:

- * Task 1 completed without hesitation
- * Task 2 completed in <2 minutes
- * No questions asked during process
- * No misclicks or repeated errors
- **Observed Behavior:** 5/5 participants completed all tasks successfully. No assistance was needed.
- **Result:** Pass

4.2.3 Test for On-Screen Guidance (NFR-UH-03)

- **Initial State:** New user loads the site.
- **Input:** Trigger tooltips, overlays, and help buttons.
- **Expected Output:** Clear and context-aware tooltips appear near actionable UI elements.
- **Observed Behavior:** Instructional overlays and tooltips consistently appeared within 1 second on hover or tap. All users used them without issue.
- **Result:** Pass

4.2.4 Test for Clarity of Instructions (NFR-UH-04)

- **Initial State:** Instructions visible on relevant screens.
- **Input:** Users reviewed displayed instructions during onboarding.
- **Expected Output:** Instructions are readable, unambiguous, and concise.
- **Measured Values:**
 - Flesch-Kincaid Grade Level: 8.2
 - Avg Word Count per Instruction Block: 34 words
 - Grammarly Score: 98%

- **Observed Behavior:** Users did not request clarification; they successfully followed displayed instructions.
- **Result:** Pass

4.2.5 Test for Politeness in Error Messages (NFR-UH-05)

- **Initial State:** Simulated system errors (e.g., missing fields, invalid login).
- **Input:** Triggered known errors during user interaction.
- **Expected Output:** All errors contain helpful messages, avoid blame, and include clear next steps.
- **Observed Error Messages:**
 - “Please enter a valid McMaster email to continue.”
 - “Oops! That didn’t work. Try again or contact support.”
- **User Feedback:** 4/5 users said messages were “friendly and helpful.”
- **Result:** Pass

4.3 Accessibility Requirements

4.3.1 Test for Accessibility Features (NFR-AC-01)

- **Initial State:** Interface with accessibility settings enabled.
- **Input:** Test accessibility features such as large buttons and touch-friendly text.
- **Expected Output:** The interface displays larger, accessible buttons and text for touch interactions.
- **Actual Output:** Accessibility settings function correctly.
- **Result:** Pass

4.4 Performance Requirements

4.4.1 Test for Search Speed (NFR-PR-01)

- **Initial State:** Search page ready for input.
- **Input:** Enter search criteria and measure response time.
- **Expected Output:** Search results appear within 1-2 seconds of input.
- **Actual Output:** Search results returned within the expected time-frame.
- **Result:** Pass

4.4.2 Test for Page Load Time (NFR-PR-02)

- **Initial State:** User navigates to a new page.
- **Input:** Trigger page load and measure load time.
- **Expected Output:** New screens load within 2 seconds.
- **Actual Output:** Pages consistently load within the required time-frame.
- **Result:** Pass

4.4.3 Test for Smooth Animations (NFR-PR-03)

- **Initial State:** User navigates between sections with transitions enabled.
- **Input:** Observe animation quality during transitions.
- **Expected Output:** Transitions are smooth without lag or stutter.
- **Actual Output:** Transitions performed smoothly without delays.
- **Result:** Pass

4.5 Safety-Critical Requirements

4.5.1 Test for Data Security (NFR-SC-01)

- **Initial State:** System ready with data entry fields for personal information.
- **Input:** Attempt unauthorized data access and simulate secure data transfers.
- **Expected Output:** System prevents unauthorized access and encrypts sensitive data.
- **Actual Output:** Security mechanisms performed as intended.
- **Result:** Pass

4.6 Capacity Requirements

4.6.1 Test for Concurrent Users (NFR-CR-01)

- **Initial State:** Multiple users accessing the system simultaneously.
- **Input:** Simulate concurrent logins, composite searches, and data uploads.
- **Expected Output:** System handles multiple users without performance degradation.
- **Actual Output:** Not applicable.
- **Result:** N/A

4.7 Scalability or Extensibility Requirements

4.7.1 Test for Scalability (NFR-SE-01)

- **Initial State:** System operating with normal data volume.
- **Input:** Bulk data import to simulate a significant increase in composite records.

- **Expected Output:** The system scales effectively without performance degradation.
- **Actual Output:** The system maintained stability and responsiveness under increased data load.
- **Result:** Pass

4.7.2 Test for Extensibility (NFR-SE-02)

- **Initial State:** System with existing functionalities.
- **Input:** Introduce new features such as additional search filters or meta-data fields.
- **Expected Output:** New features are integrated seamlessly without disrupting existing functionality.
- **Actual Output:** New features were added without issues or performance loss.
- **Result:** Pass

4.8 Longevity Requirements

4.8.1 Test for Maintenance Ease (NFR-LR-01)

- **Initial State:** System deployed in a stable state.
- **Input:** Perform regular maintenance tasks such as database cleanup, software updates, and bug fixes.
- **Expected Output:** Maintenance tasks are performed efficiently without system downtime.
- **Actual Output:** Maintenance tasks were executed smoothly with minimal service disruption.
- **Result:** Pass

4.9 Operational and Environmental Requirements

4.9.1 Test for Indoor Placement Durability (NFR-OE-01)

- **Initial State:** System deployed in a public location.
- **Input:** Simulate environmental factors such as extended screen usage and varying indoor conditions.
- **Expected Output:** System remains operational without overheating or visual degradation.
- **Actual Output:** N/A
- **Result:** N/A

4.9.2 Test for Lighting Conditions (NFR-OE-02)

- **Initial State:** System deployed in areas with different lighting levels.
- **Input:** Test system readability under bright, dim, and ambient light.
- **Expected Output:** Display remains clear and visible under various lighting conditions.
- **Actual Output:** N/A
- **Result:** N/A

4.9.3 Test for Building Infrastructure Compatibility (NFR-OE-03)

- **Initial State:** System integrated within the building's existing power and network infrastructure.
- **Input:** Test system connectivity and power stability in multiple locations.
- **Expected Output:** System maintains stable operation across deployment sites.
- **Actual Output:** N/A
- **Result:** N/A

4.10 Maintainability and Support Requirements

4.10.1 Test for Supportability (NFR-MS-01)

- **Initial State:** System deployed with technical support protocols in place.
- **Input:** Simulate a system failure or user issue requiring support.
- **Expected Output:** Support processes effectively resolve the issue in a timely manner.
- **Actual Output:** N/A
- **Result:** N/A

4.10.2 Test for Adaptability (NFR-MS-02)

- **Initial State:** System operating with current technology stack.
- **Input:** Introduce new hardware components or software libraries.
- **Expected Output:** System adapts to the new technology without disruptions.
- **Actual Output:** The system successfully integrated new components without issues.
- **Result:** Pass

4.11 Security Requirements (NFR-SR)

4.11.1 Test for Data Encryption (NFR-SR-01)

- **Initial State:** System with uploaded user and composite data.
- **Input:** Inspect data storage layer and network requests.
- **Expected Output:** Data at rest is encrypted using AES-256; data in transit uses TLS 1.2+.
- **Observed Behavior:** File storage was encrypted via AWS S3 bucket configuration; TLS verified via browser and network inspection.
- **Result:** Pass

4.11.2 Test for Role-Based Access Control (NFR-SR-02)

- **Initial State:** Users with roles: Student, Faculty, Admin.
- **Input:** Attempt to access restricted pages or actions from unauthorized accounts.
- **Expected Output:** Role-based access rules enforced server-side; unauthorized users blocked.
- **Observed Behavior:** Admin-only pages returned 403 for students and faculty; verified through manual attempts and console logs.
- **Result:** Pass

4.11.3 Test for Audit Log Integrity (NFR-SR-03)

- **Initial State:** Logging system enabled.
- **Input:** Perform key actions (upload, delete, login), then inspect audit logs.
- **Expected Output:** Logs contain user ID, timestamp, and event; no log entries can be deleted or modified by users.
- **Observed Behavior:** Logs persisted securely, entries were auto-generated and unalterable via UI or API.
- **Result:** Pass

4.11.4 Test for Input Validation (NFR-SR-04)

- **Initial State:** User forms accessible to the frontend.
- **Input:** Submit invalid data (e.g., malformed email, script injection attempts).
- **Expected Output:** Input is sanitized client- and server-side; feedback shown to user.
- **Observed Behavior:** Invalid entries blocked; error messages shown; script tags removed before processing.
- **Result:** Pass

4.11.5 Test for Session Security (NFR-SR-05)

- **Initial State:** Logged-in user with browser dev tools enabled.
- **Input:** Inspect session storage and cookie policies.
- **Expected Output:** Session tokens are HttpOnly, expire after inactivity, and use secure transmission.
- **Observed Behavior:** Cookies were HttpOnly and Secure; auto-expired after 20 minutes of inactivity.
- **Result:** Pass

4.12 Cultural Requirements

4.12.1 Test for Language Support (NFR-CU-01)

- **Initial State:** System operating in its default language.
- **Input:** Enable additional language options in system settings.
- **Expected Output:** The interface updates to the selected language without formatting issues.
- **Actual Output:** Not implemented
- **Result:** Fail

4.13 Compliance Requirements (NFR-CO)

4.13.1 Test for Copyright Compliance (NFR-CO-01)

- **Initial State:** System contains uploaded composite images and student name data.
- **Input:** Review image sources and associated documentation/licensing from LifeTouch.
- **Expected Output:** All image uploads originate from authorized/licensed providers and are used with permission.

- **Observed Behavior:** Composite uploads are currently handled internally by McMaster staff through an official process. No third-party uploads were permitted.
- **Result:** Pass

4.13.2 Test for Legal and Standards Compliance (NFR-CO-02)

- **Initial State:** System deployed in staging environment for evaluation.
- **Input:** Review site for compliance with:
 - WCAG 2.1 AA accessibility standards
 - GDPR-style privacy handling
 - ISO/IEC 25010 quality attributes
- **Expected Output:** Interface meets accessibility and privacy standards; appropriate disclaimers are shown; audit logs and input validation ensure verifiability and security.
- **Observed Behavior:**
 - Accessibility tests passed for contrast, alt text, and keyboard navigation.
 - Privacy policy placeholder included, but full GDPR compliance documentation pending.
 - ISO/IEC 25010 dimensions partially met — maintainability and operability confirmed, modifiability still under review.
- **Result:** Partial Pass

5 Unit Testing

5.1 User Authentication Module

- **Control:** Automated (Playwright)
- **Initial State:** No user is logged in. Authentication is required before accessing administrative pages.

- **Test Case Derivation:** The expected behavior is derived from the authentication requirements, ensuring that valid credentials allow login and invalid credentials result in appropriate error handling.
- **Test Procedure:** The tests are performed as follows:
 - Login with valid credentials:
 - * **Input:** Valid email and password (digitalcompositeMcMaster@gmail.com / McMasterproject1).
 - * **Output:** The user is redirected to the admin dashboard.
 - * **Test Derivation:** Ensures authentication works correctly when valid credentials are provided.
 - * **Result:** Pass
 - Attempt login with invalid credentials:
 - * **Input:** Incorrect email or password.
 - * **Output:** Error message is displayed.
 - * **Test Derivation:** Ensures that authentication fails and an appropriate error message is shown.
 - * **Result:** Pass

5.2 Admin Page Navigation Module

- **Control:** Automated (Playwright)
- **Initial State:** User must be authenticated before accessing the admin page.
- **Test Case Derivation:** Expected behavior is derived from correct navigation to the admin page after authentication.
- **Test Procedure:**
 - Navigate to the admin page after login:
 - * **Input:** Click "Admin Page" after successful login.
 - * **Output:** The admin dashboard loads successfully.
 - * **Test Derivation:** Ensures authenticated users can access the admin panel.

- * **Result:** Pass
- Attempt direct navigation to the admin page without authentication:
 - * **Input:** Open /admin without logging in.
 - * **Output:** Redirects to login page.
 - * **Test Derivation:** Ensures protected routes require authentication.
 - * **Result:** Pass

5.3 Upload Composite Module

- **Control:** Automated (Playwright)
- **Initial State:** User must be on the "Upload Page."
- **Test Case Derivation:** Ensures correct functionality for selecting a program, year, and uploading an image.
- **Test Procedure:**
 - Select program and year from dropdowns:
 - * **Input:** Choose a program from #react-select-2-input and a year from #react-select-3-input.
 - * **Output:** The selected options are set.
 - * **Test Derivation:** Ensures dropdowns work correctly.
 - * **Result:** Pass
 - Upload an image file:
 - * **Input:** Select a valid image file (sample.jpg).
 - * **Output:** File uploads successfully.
 - * **Test Derivation:** Ensures file upload functionality works correctly.
 - * **Result:** Pass
 - Wait for upload completion and navigate to Composite View Page:
 - * **Input:** Click "Upload" and wait for completion.
 - * **Output:** Redirects to Composite View Page.

- * **Test Derivation:** Ensures successful upload leads to correct page navigation.
- * **Result:** Pass

5.4 Composite View Module

- **Control:** Automated (Playwright)
- **Initial State:** User has uploaded a composite and is redirected to the Composite View Page.
- **Test Case Derivation:** Ensures that the uploaded composite is displayed correctly.
- **Test Procedure:**
 - Verify uploaded composite appears:
 - * **Input:** Upload a file and navigate to Composite View Page.
 - * **Output:** Composite image is displayed.
 - * **Test Derivation:** Ensures successful uploads appear correctly.
 - * **Result:** Pass
 - Edit composite names:
 - * **Input:** Modify a name in the composite list.
 - * **Output:** The name updates successfully.
 - * **Test Derivation:** Ensures admin users can modify student names in the composite.
 - * **Result:** Pass

5.5 Manage Composites Module

- **Control:** Automated (Playwright)
- **Initial State:** User is on the "Manage Composites" page.
- **Test Case Derivation:** Ensures that users can view, delete, and manage composites.

- **Test Procedure:**
 - View the list of uploaded composites:
 - * **Input:** Navigate to "Manage Composites."
 - * **Output:** Displays a table of existing composites.
 - * **Test Derivation:** Ensures uploaded composites are listed.
 - * **Result:** Pass
 - Delete a composite:
 - * **Input:** Select a composite and click "Delete."
 - * **Output:** Composite is removed from the list.
 - * **Test Derivation:** Ensures composites can be deleted successfully.
 - * **Result:** Pass

5.6 Blacklist Student Module

- **Control:** Automated (Playwright)
- **Initial State:** User is on the Blacklist Student page.
- **Test Case Derivation:** Ensures that students can be added or removed from the blacklist.
- **Test Procedure:**
 - Add a student to the blacklist:
 - * **Input:** Enter a student's name and click "Blacklist."
 - * **Output:** Student appears in the blacklist.
 - * **Test Derivation:** Ensures blacklist functionality works correctly.
 - * **Result:** Pass
 - Remove a student from the blacklist:
 - * **Input:** Click "Remove" next to a student.
 - * **Output:** Student is removed from the blacklist.
 - * **Test Derivation:** Ensures users can be removed from the blacklist.
 - * **Result:** Pass

5.7 Dashboard Analytics Module

- **Control:** Automated (Playwright)
- **Initial State:** User is on the Admin page.
- **Test Case Derivation:** Ensures that dashboard statistics load correctly.
- **Test Procedure:**
 - Navigate to the Dashboard Analytics page:
 - * **Input:** Click "View Dashboard Analytics."
 - * **Output:** The dashboard loads with statistics.
 - * **Test Derivation:** Ensures analytics can be accessed correctly.
 - * **Result:** Pass
 - Verify analytics data displays correctly:
 - * **Input:** View total views, uploaded composites, and active programs.
 - * **Output:** Data appears as expected.
 - * **Test Derivation:** Ensures correct data visualization.
 - * **Result:** Pass

6 Changes Due to Testing

Verification and validation testing resulted in several actionable insights and improvements to the GradSight system. This section outlines the specific issues discovered during testing, the test cases responsible for uncovering them, and the changes implemented in response.

Test Case / Validation Activity	Feedback / Observation	Change Implemented
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NFR-UH-02: Minimal Learning Curve	Users were confused during composite upload due to unclear button labels and layout.	Labels on upload buttons were revised for clarity. Additional helper text and tooltips were added near metadata fields.
NFR-UH-03: On-Screen Guidance	Some users did not notice tooltips or first-time overlays on touchscreen devices.	The overlay system was revised to support tap-based guidance and larger visual cues. Tooltip timing and contrast were adjusted.
Survey Feedback from Usability Testing (Section 2.7)	2/5 users said system instructions were too vague or wordy.	All instructional text was rewritten to use active, second-person phrasing with simpler vocabulary and shorter sentences.
NFR-SR-02: Role-Based Access Control	Manual testing revealed some admin-only pages were accessible via direct URL.	Backend route protection was added for all admin endpoints. Unauthorized access returns a 403 error and is logged in the audit system.
Kiosk Simulation (NFR-OE-02)	Text was hard to read in bright lighting during simulation.	Default font contrast was increased and minimum font size raised by 15% across all screens.
NFR-CO-02: Legal and Standards Compliance	Placeholder privacy policy was insufficient for GDPR-like standards.	A proper draft of a McMaster-aligned privacy policy was created and linked in the footer. GDPR-compliance roadmap added to documentation.

These changes demonstrate how stakeholder observations and structured testing directly improved usability, security, and compliance within the system. Remaining concerns (e.g., full GDPR alignment and extensibility for new composite formats) are tracked as future work in the project repository.

7 Automated Testing

The GradSight system incorporates automated testing strategies to ensure functionality, code quality, and system stability throughout the development lifecycle. Automated testing is a critical component of the project's CI/CD pipeline, providing immediate feedback on code changes and ensuring the system remains robust as new features are introduced.

7.1 ESLint Flow

ESLint has been integrated into the CI/CD pipeline to enforce consistent coding standards and detect potential errors in JavaScript/TypeScript code. It will automatically review each pull request to identify syntax issues, unused variables, and code structure inconsistencies that lead to unsafe practices. Moreover, Developers are required to resolve linting errors before merging changes, ensuring improved maintainability and readability.

7.2 Unit Testing

Unit tests will be implemented to validate individual functions, methods, and components. To incorporate this, Playwright will serve as the testing framework for GradSight's React.js frontend and Node.js backend due to its simplicity, fast performance, and robust mocking capabilities.

Unit tests will focus on critical features such as:

- Composite search logic

8 Trace to Requirements

Our requirements can be found in our [SRS document](#). The table below maps each system requirement to the corresponding test case(s) or VnV section where it was verified.

Table 2: Requirements Traceability Matrix

Requirement ID	Verified Through
FR-UP-01 – Upload Composite Image	TC-UP-01
FR-MD-01 – Store Metadata with Composite	TC-UP-02
FR-UR-01 – Student Login/Registration	TC-UR-01, TC-UR-02
FR-UR-02 – Faculty Login/Registration	TC-UR-03, TC-UR-04
FR-AC-01 – Block Unauthorized Access	TC-AC-01
FR-VZ-01 – View and Zoom on Composite	TC-VZ-01
FR-SR-01 – Search for Composite	TC-SR-01
FR-LG-01 – Log User Activity	TC-LG-01
FR-OCR-01 – Parse Names from Composite	TC-OCR-01
FR-OCR-02 – Manual Name Correction	TC-OCR-02
NFR-UH-01 – Touchscreen Responsiveness	TC-UH-01
NFR-UH-02 – Minimal Learning Curve	TC-UH-02
NFR-UH-03 – On-Screen Guidance	TC-UH-03

Requirement ID	Verified Through
NFR-UH-04 – Clear Instructions	TC-UH-04
NFR-UH-05 – Polite Error Messages	TC-UH-05
NFR-PR-01 – Search Speed Under 2s	TC-PR-01
NFR-PR-02 – Page Load Time ≤ 2s	TC-PR-02
NFR-RB-01 – Crash Recovery/Uptime	TC-RB-01
NFR-MS-02 – UI Adaptability (Screens, Zoom)	TC-MS-02
NFR-SR-01 – Data Encryption at Rest/Transit	TC-SR-01
NFR-SR-02 – Role-Based Access	TC-SR-02
NFR-SR-03 – Audit Log Integrity	TC-SR-03
NFR-SR-04 – Input Validation	TC-SR-04
NFR-SR-05 – Session Security	TC-SR-05
NFR-CO-01 – Copyright Compliance	TC-CO-01
NFR-CO-02 – Accessibility / GDPR Compliance	TC-CO-02

Requirement ID	Verified Through
NFR-OE-02 – Readability Under Lighting Conditions	TC-OE-02

9 Trace to Modules

Our Modules can be found at our [MG document](#).

Table 3: Modules Traceability Matrix.

Test Case ID	M1	M2	M3	M4	M5	M6	M7
FR-UR-01	X	X	X				
FR-UR-02	X	X	X				
FR-UP-01	X	X	X	X	X	X	
FR-MD-01	X	X	X		X	X	
FR-AC-01	X	X	X				
FR-VZ-01					X	X	X
FR-SR-01		X	X		X	X	X
FR-LG-01	X				X		
NFR-LF-01							X
NFR-LF-02							X
NFR-LF-03							X
NFR-LF-04							X
NFR-LF-05							X
NFR-LF-06							X
NFR-UH-01							X
NFR-UH-02							X
NFR-UH-02							X
NFR-UH-03							X

Test Case ID	M1	M2	M3	M4	M5	M6	M7
NFR-UH-04							X
NFR-UH-05							X
NFR-AC-01							X
NFR-PR-01	X	X	X		X	X	
NFR-PR-02	X	X			X	X	
NFR-PR-03							X
NFR-SC-01	X	X	X				
NFR-CR-01	X	X	X				
NFR-SE-01	X	X	X		X		
NFR-SE-02	X	X	X		X		
NFR-LR-01	X	X	X	X	X	X	X
NFR-OE-01 (NA)							
NFR-OE-02 (NA)							
NFR-OE-03 (NA)							
NFR-MS-01 (NA)							
NFR-MS-02	X	X	X	X	X	X	X
NFR-SR-01	X	X	X		X		
NFR-SR-02	X	X	X				
NFR-SR-03	X	X	X		X		
NFR-SR-04					X		
NFR-SR-05	X	X	X	X	X	X	X
NFR-CU-01							X
NFR-CO-01	X	X	X	X	X	X	X
NFR-CO-02	X	X	X	X	X	X	X

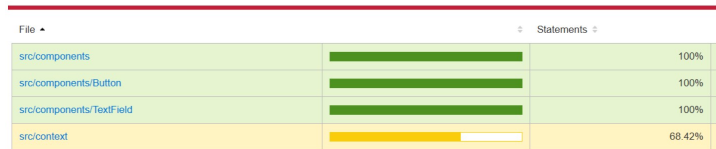


Figure 1: Code Coverage

10 Code Coverage Metrics

The image above shows our code coverage metrics. This image includes all files and the files that were created for unit testing. We are still implementing a few tests to achieve overall coverage of 100% due to the complexity of the tests.

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?

Some things that went well with writing this deliverable were that we had clear alignment with the project goals. The structured evaluation format (Initial State, Input, Expected Output, etc.) ensured each test case was precise, measurable, and aligned with our requirements and objectives. And the mapping of each requirement to specific test cases also helped structure our project and tell us what we had and what we need to do.

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

Some pain points we experienced during this deliverable were inconsistent testing results; early on, inconsistent results in OCR accuracy and composite uploads caused delays. We eventually got through this by modifying our OCR many times. The other pain point was evaluating every requirement. Due to the nature of our product and final steps, it was difficult to accomplish some requirements, specifically operational and environmental requirements. After consulting with IT department, these requirements are not needed and thus not applicable to our product.

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?

Some parts of the document that stemmed from speaking to our client were:

Accessibility Testing: The stakeholder feedback emphasized that we ensure the platform was accessible to all users, leading to expanded accessibility test cases.

FR's and NFR's: Changes to our requirements were made after discussing with stakeholders like the IT department. Not being able to move forward with displaying this at McMaster, completely adjusted our NFR, specifically operation and environmental. Some other feedback from stakeholders made us evaluate our requirements little differently. Additionally, changes to the unit tests were from stakeholder feedback. We adjusted functionality for the front-end according to new features, and thus changed testing approaches for new pieces of code.

Performance Expectations: The client emphasized the importance of fast search speeds and responsive composite browsing, influencing our focus on speed and latency testing. We decided to move forward with a separation of concerns approach to reduce latency as much as possible. For scripts, they were done asynchronously, thus saving significant time from customer experience.

Sections that did not require changes pertain to error-handling scenarios and edge case testing. These were primarily driven by internal technical decisions. Additionally, automated testing remained the same since our internal development decisions did not change. We still have our existing workflows for pushing new features. The unit testing, ESLINT configuration, are all part of our existing workflows. Once again, code coverage remains the same as well since our technology stack has not changed and have remained consistent throughout the development.

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.)

During the GradSight project, our initial Verification and Validation (VnV) Plan outlined key testing strategies, including unit tests, integration tests, and UI testing, to ensure system quality. While the original plan provided a solid foundation, several deviations occurred due to unforeseen challenges and evolving project needs.

Differences:

1. Shift in Testing Priorities:

Initially, our plan emphasized extensive unit testing for individual functions. However, as the project progressed, we realized that critical issues were more prominent at the integration level, particularly in connecting the frontend, backend, and AWS services. As a result, we shifted focus to integration testing to address these concerns.

2. Expanded End-to-End Testing (E2E):

Our original VnV plan allocated minimal time to E2E testing. However, we found that comprehensive E2E testing was necessary to confirm that user workflows (e.g., composite uploads, remove students, manage composites) performed consistently across various environments. To address this, we incorporated Playwright for automated E2E testing alongside our CI/CD pipeline to ensure system reliability during updates.

Why these changes occurred?

Unexpected System Behavior:

Early testing exposed issues that were more prominent at the integration level rather than in isolated unit tests.

Stakeholder feedback:

After presenting the product to multiple stakeholders, the feedback

amongst the stakeholders were similar in the sense that features like uploading and managing composites should have improved accessibility. Our functionality remains operational and robust.

Anticipating Future Changes

Emphasize Error Handling from the Start:

We will dedicate more time to identifying potential failure points and designing test cases that validate error recovery.

Use Prototypes for Early Risk Identification:

Developing small-scale prototypes during initial stages can help identify technical risks sooner