Verification and Validation Report: Software Engineering

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1 Revision History

Date	Contributors	Notes
Feb 29, 2024	Cassidy	Initial Draft and Formatting
Mar 4, 2024	Stanley	Added test results for performance requirements

2 Symbols, Abbreviations and Acronyms

Table 1: Naming Conventions and Terminology

Term, Abbreviation, or Acronym	**Description**
A	Shorthand for Assumption
ASL	Shorthand for American Sign Language. It is a form of sign language primarily used in the US and in parts of Canada
ASLingo	The commercial name for the project
CV	Refers to Computer Vision, the field of technology that involves processing visual input to achieve various means.
CR	Shorthand for 'Cultural Requirements', a subsection of Non-Functional Requirements.
HSR	Shorthand for 'Health and Safety Requirements', a subsection of Non-Functional Requirements.
FR	Shorthand for Functional Requirements
LR	Shorthand for 'Legal Requirements', a subsection of Non-Functional Requirements.
LFR	Shorthand for 'Look and Feel Requirements', a subsection of Non-Functional Requirements.
MSR	Shorthand for 'Maintainability and Support Requirements', a subsection of Non-Functional Requirements.
OER	Shorthand for 'Operational and Environmental Requirements', a subsection of Non-Functional Requirements.

OpenCV	Refers to the Open Computer Vision Library library available for free to developers in order to develop Computer Vision applications.
PR	Shorthand for 'Performance Requirements', a subsection of Non-Functional Requirements.
SR	Shorthand for 'Security Requirements', a subsection of Non-Functional Requirements.
UHR	Shorthand for 'Usability and Humanity Requirements', a subsection of Non-Functional Requirements.

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3 General Information

3.1 Summary

As a maching learning-based image recognition web app, ASLingo has many areas to be tested. The overall software will be broken down into modules. There will be a front-end, a back-end, a database, and a machine learning model which all need to be separately tested, along with physical hardware and compatibility. This document serves as a report of the testing done to ensure that this system has been properly and throughly tested to meet the requirements set by the Software Requirements Specification.

3.2 Objectives

This document aims to outline the testing plan for ASLingo in order to create a functional and reliable product for users that aligns with the specified requirements. The team seeks to build confidence in stakeholders and users that the software is correct and meets or exceeds the initial intended goals, resulting in an overall satisfactory user experience.

3.3 Relevant Documentation

Below is a list of the relevant documentation referenced within the Verification and Validation Plan.

The Development Plan outlines the roles of each team member and the areas that each member will focus on. This breakdown of team responsibilities allows the team to assign testing roles accordingly. This document also contains the tools that the team plans on using for testing.

The VnV Plan outlines the testing plan for the system, as well as outlining the test cases that the team will perform to ensure the project has been properly and throughly tested. This document also contains the tools that the team plans on using for testing.

The Software Requirements Specification lists the functional and non-functional requirements which will aid in testing by formulating a testing plan to meet each requirement. Non-functional requirements should be tested such that

the fit criteria are met.

The Hazard Analysis identifies failure modes to determine the implementation strategies to mitigate them. These will be used as a part of the testing plan to ensure that the failures are covered.

The Module Guide divides the software into modules. The team will build the testing plan around the modules.

The Module Interface Specification further decomposes the software's modules into specific access routines. The team will build the testing plan such that each function and routine works as intended.

4 Functional Requirements Evaluation

4.1 System Tests for Authentication

Table 2: System Tests for Authentication

Test ID	**Description**	**Input**	**Expected Output**	**Actual Output**	**Result**	**Req ID**
FRT1-A1	User can make their account	User inputs username and password, then selects "Sign In"	User successfully makes their account		Pass	FR3
FRT1-A2						FR4
FRT1-A3						FR5
FRT1-A4						FR13

4.2 System Tests for ASL Learning Progression

Table 3: System Tests for ASL Learning Progression

Test ID	**Description**	**Input**	**Expected Output**	**Actual Output**	**Result**	**Req ID**
FRT2-LP1	User performs ASL signs	Alphabetical signs	Corresponding letter of alphabet	the letter	Pass	FR2
FRT2-LP2	Complete diagnostic quiz	User goes to home page	System starts diagnostic quiz	quiz is started	Pass	FR6
FRT2-LP3	User attempts progression based course	User completes their diagnostic quiz	system generates new quiz for user based on results	No new course is generated	Fail	FR7
FRT2-LP4	User tracks their progression	User goes to progression tab	Views their progress	None	Fail	FR7, FR12
FRT2-LP5	System Saved User Progress	User completes a quiz	result is stored and saved	Not saved	Fail	FR8
FRT2-LP6	Get live feedback from user signs	User signs	Systems outputs corresponding sign	The corresponding sign	Pass	FR10

4.3 System Tests for Web Application

Table 4: System Tests for Web Application

Test ID	**Description**	**Input**	**Expected Output**	**Actual Output**	**Result**	**Req ID**
FRT3-U1						FR9

4.4 System Tests for Hardware

Table 5: System Tests for Hardware

Test ID	Description	Input	Expected Output	Actual Output	Result	Req ID
FRT4-HW1						FR1
FRT4-HW2						FR11

5 Nonfunctional Requirements Evaluation

5.1 System Tests for Usability

We tested our usability requirements using a survey for a group of testers to fill out after using the application for 15 minutes. The group of users had an interest in learning ASL, and were willing to fill out this questionnaire to give some perspective on the usability of our application. The survey questions can be found in the Appendix 13.1.

Table 6: System Tests for Usability

Test ID	Description	Input	Expected Output	Actual Output	Result	Req ID
NFRT1-UT1						UHR1
NFRT1-UT2						UHR1
NFRT1-UT3						UHR2
NFRT1-UT4						UHR3
NFRT1-UT5						UHR4

5.2 System Tests for Performance

Table 7: System Tests for Performance

Test ID	Description	Input	Expected Output	Actual Output	Result	Req ID
NFRT2-PT1	The application should respond to user input within 1 second.	The user should respond to the application's prompt.	The system should register the user's input and respond to the user quickly.	The system responded with the detected sign almost instantly.	Pass	PR1
NFRT2-PT2	The application should be able to accurately determine if the user has signed the correct response to the prompt 95% of the time.	The user should sign in response to the application's prompt.	The application should register the user's signed input and determine if they have signed the required action correctly.	Static hand signs are recognized with a total testing accuracy of around 98%. Dynamic hand signs are inconsistent, with accuracies at around 50 - 60%.	Fail	PR2

6 Comparison to Existing Implementation

This section will not be appropriate for every project.

7 Unit Testing

8 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]

9 Automated Testing

10 Trace to Requirements

11 Trace to Modules

12 Code Coverage Metrics

13 Appendix

13.1 Usability Survey Questions

A link to the survey that participants were given can be found here. Participants were asked to rank how they felt about the following statements, with the response options being Strongly Disagree, Disagree, Neutral, Agree, and Strongly Agree.

1. It was very easy to get right into a testing session with little to no hassle.
2. The User Interface is very friendly and it is easy to identify where everything is.
3. During a Quiz, its very easy to understand what to do and how to complete it.
4. While signing, it is very easy to see what sign I am making and whether to make adjustments or not.
5. At my current level of ASL knowledge, it is easy to use the application
6. On a scale of 1 to 10, how would you rate your experience with ASLingo? [1 = terrible, 10 = fantastic]

13.2 Appendix — Reflection

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

1. 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.)