Verification and Validation Report: Software Engineering

Team #13, ARC
Avanish Ahluwalia
Russell Davidson
Rafey Malik
Abdul Zulfiqar

March 11, 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

1 Revision History i

2 Symbols, Abbreviations and Acronyms ii

3 Functional Requirements Evaluation 1
- 3.1 Profile Testing . . . 1
- 3.2 Touring . . . 1
- 3.3 Tour management . . . 2

4 Nonfunctional Requirements Evaluation 4
- 4.1 Performance Testing . . . 4
- 4.2 Reliability Testing . . . 4
- 4.3 Distribution Testing . . . 5
- 4.4 Performance . . . 5
- 4.5 etc. . . . 5

5 Comparison to Existing Implementation 5

6 Unit Testing 5

7 Changes Due to Testing 5

8 Automated Testing 6

9 Trace to Requirements 6

10 Trace to Modules 6

11 Code Coverage Metrics 6

List of Tables

1 **Functional Requirements Evaluation Results for Profile Testing** 1

2 **Functional Requirements Evaluation Results for Profile Testing** 2

3 **Functional Requirements Evaluation Results for Managing Tours** . . . 3

4 **Performance Testing Evaluation Results** . . . 4

5 **Reliability Testing Evaluation Results** . . . 4

6 **Distribution Testing Evaluation Results** 5
7 **Results of Usability Survey** 8

List of Figures

1 "Navigation between interfaces is intuitive" statement ratings 8
2 "Placing objects is easy" statement ratings 8
3 "Generating objects is easy" statement ratings 9
4 "It is easy to start a tour" statement ratings 9
5 "Changing settings is easy" statement ratings 9
6 "The app is generally satisfying to use" statement ratings 10
7 "Using the app distracts from the surroundings" statement ratings . . 10

This document ...

3 Functional Requirements Evaluation

3.1 Profile Testing

The following section presents the results of the profile testing

Table 1: **Functional Requirements Evaluation Results for Profile Testing**

Id	Type	Inputs	Expected Result	Actual Result	Result
Test-PS1	Manual	User enters valid credentials.	The user successfully logs in and is redirected to their profile page.	Same as expected	Pass
Test-PS2	Manual	User inputs new password and confirms.	System updates the password and provides a confirmation message.	Same as expected	Pass
Test-PS3	Automated	None	Profile information (username, password, status) is displayed correctly.	Same as expected	Pass
Test-PS4	Manual	User navigates to help page.	A help page with FAQs and ad- ditional help information is displayed.	Same as expected	Pass

3.2 Touring

The following section presents the results of the general users experience of using a tour.

Table 2: **Functional Requirements Evaluation Results for Profile Testing**

Id	Type	Inputs	Expected Result	Actual Result	Result
Test-TR1	Manual	General user attempts to navigate to the touring screen.	The touring screen is reachable.	Same as expected	Pass
Test-TR2	Manual	Organization user attempts to navigate to touring screen.	The touring screen is hidden from user.	Same as expected	Pass
Test-TR3	Manual	General user finds a tour and attempts to preview it	User can see the information described in TR-FR3.	Same as expected	Pass
Test-TR4	Manual	General user navigates to the tour list interface, and searches for a tour belonging to an organization.	The tour has been found.	Same as expected	Pass
Test-TR5	Manual	General user goes close to a tour area in the real-world	A push notification appears on the user's phone indicating that a tour is nearby and prompts them to preview it.	Same as expected	Pass
Test-TR6	Manual	General user scans the QR code through the camera app.	The camera app opens Realm to the preview of the corre- sponding tour.	Same as expected	Pass
Test-TR7	Manual	General user selects option to change tour view to AR view and back. The app switches the view to AR view and then back to map view.	Same as expected	Pass	
Test-TR8	Manual	General user selects map view	The user can see the map with the properties described in TR-FR4.1.	Same as expected	Pass
Test-TR9	Manual	General user selects AR view.	The user can see an AR view with the properties described in TR-FR4.2.	Same as expected	Pass

3.3 Tour management

The following section presents the results of the organizational users side of managing a tour.

Table 3: **Functional Requirements Evaluation Results for Managing Tours**

Id	Control	Inputs	Expected Result	Actual Result	Result
Test-TM1	Manual	Organization user attempts to navigate to tour management screen.	The tour management screen is reachable.	Same as expected	Pass
Test-TM2	Manual	General user attempts to navigate to tour management screen.	The tour management screen is hidden from user.	Same as expected	Pass
Test-TM3	Manual	User attempts to create a tour by inputting all the information described in TM-FR4 and placing one of each type of object in the environment.	The tour is successfully created with the correct data.	Same as expected	Pass
Test-TM4	Manual	User attempts to create a tour by inputting all the information described in TM-FR4 and selects the option to save as a draft.	The tour is successfully created as a draft.	Same as expected	Pass
Test-TM5	Manual	Organization user attempts to create a tour by inputting all the information described in TM-FR4 and selects the option to publish the tour.	The tour is successfully created and published.	Same as expected	Pass
Test-TM6	Manual	User navigates to the draft tour and selects publish option.	The tour is successfully published.	Same as expected	Pass
Test-TM7	Manual	User navigates to the tour and selects the preview option.	The tour can be previewed through the lens of what a Gen- eral User would see.	Same as expected	Pass
Test-TM8	Manual	User navigates to the tour they wish to edit, selects the edit option and changes all the inputs described in TM-FR4.	The tour is successfully edited with the correct data.	Same as expected	Pass

4 Nonfunctional Requirements Evaluation

4.1 Performance Testing

The following section presents the results of our performance testing.

Table 4: **Performance Testing Evaluation Results**

Id	Type	Inputs	Expected Result	Actual Result	Result
Test-QS-PE1	Automatic	User performs actions to navigate to the Map interface.	The map and its overlays are completely visible and can be interacted with.	Same as expected	Pass
Test-QS-PE2	Automatic	User selects the option to view their entire Inventory.	The Inventory loads completely and can be interacted with within 1-10 seconds depending on the number of objects present in the Inventory.	Same as expected	Pass
Test-QS-PE3	Manual	Device settings and sensors are functioning properly. User initiates a scan of the environment.	Rendered results appear within 1 second of the initial scan data.	Same as expected	Pass
Test-QS-PE4	Manual	Tester initiates the generation of an AR object.	The AR object is fully generated and visible.	Same as expected	Pass
Test-QS-PE5	Manual	Tester attempts to view AR objects within the app.	The app renders AR objects with minimal lag or provides a fallback mode (low-resolution objects) for accessibility.	Same as expected	Pass

4.2 Reliability Testing

The following section presents the results of our reliability testing.

Table 5: **Reliability Testing Evaluation Results**

Id	Type	Inputs	Expected Result	Actual Result	Result
Test-QS-RE1	Automatic	Inject random data or errors into the test database to trigger failure.	(a) Database recovers automatically or through a set of recovery steps. (b) If there is user data loss, only 2% of user data will be lost after the recovery. (c) System returns to normal operation, allowing all users to access their data without issues.	Same as expected	Pass

4.3 Distribution Testing

The following section presents the results of our distribution testing.

Table 6: **Distribution Testing Evaluation Results**

Id	Type	Inputs	Expected Result	Actual Result	Result
Test-DI-D1	Automated	Attempt to download and install the app on the user device.	(a) The app installs successfully on devices running iOS 16.0+ and Android 12+. (b) The app functions as expected post-installation on the device.	Same as expected	Pass
Test-DI-D2	Manual	Review server locations where user data is stored.	All user data is stored within North America.	Same as expected	Pass

4.4 Performance

4.5 etc.

5 Comparison to Existing Implementation

This section will not be appropriate for every 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

9 Trace to Requirements

10 Trace to Modules

11 Code Coverage Metrics

References

Appendix — Usability Survey Results

Link to view survey: here

Table 7 below showing the results of the Usability survey

Table 7: **Results of Usability Survey**

Statement	**Average Rating of Statement Accuracy / 5**	**Analysis**
Navigation between interfaces is intuitive	3.833	Most users found the navigation to be intuitive, although navigation seems to be the lowest rated aspect of the functional user experience
Placing objects is easy	3.917	No ratings below a three and an average rating of "Agree" says that this was well recieved
Generating objects is easy	3.917	Again, no ratings below a three and an average rating of "Agree" indicates that the design works for most users
It is easy to start a tour	4.167	A good indication that the touring experience was designed well
Changing settings is easy	4.417	Somewhat expected, users generally did not have issues finding and changing settings as it was a straightforward feature
The app is generally satisfying to use	3.667	This was the lowest rating of all our positive statements. We recieved relevant feedback on the non-uniform look and feel of the app making the app feel like a rushed development
Using the app distracts from the surroundings	3.167	More found the app distracting than not, but the results are somewhat inconclusive given the variance

Figure 1: "Navigation between interfaces is intuitive" statement ratings

Figure 2: "Placing objects is easy" statement ratings

Figure 3: "Generating objects is easy" statement ratings

./Images/Q3.png

Figure 4: "It is easy to start a tour" statement ratings

./Images/Q4.png

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?

   The unit tests seemed fairly simple and intuitive to do and the work was split up well between the group.

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

   Executing some of the test cases smoothly was a pain point, as well as getting them to pass, but sticking with it and sitting through them after some time, we were able to do our tests and pass 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?

   Usability survey and feedback on the app was given from peers. Since we don't have a client, a lot of our feedback was from the Professor and TA during Rev0.

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

Figure 5: "Changing settings is easy" statement ratings

./Images/Q5.png

Figure 6: "The app is generally satisfying to use" statement ratings

./Images/Q6.png

Figure 7: "Using the app distracts from the surroundings" statement ratings

./Images/Q7.png

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.)

We had initially expected many of our tests to be automated, but after actually going through them, a lot of them seemed to be more manual work, such as logging in ourselves, testing out the tours, etc. We learned that many of the manual tests are moreso for the code correctness and such, and, at least for our project, the functionality had to be tested through doing.