Verification and Validation Report: Measuring Microstructure Changes During Thermal Treatment

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1 Revision History

Date	Name	Notes
Mar 8 2023	Edwin Do	Added usability test results
Mar 8 2023	Edwin Do	Added Traceability matrices
Mar 8, 2023	Timothy Chen	Added performance to the Nonfunctional Test Evaluation
Mar 8, 2023	Timothy Chen	Added unit test for input communication, current state and remote access

2 Symbols, Abbreviations and Acronyms

change capacity to size

symbol	**description**
T	Test
MIN_USER_ACCEPT_RATE	90% - minimum acceptance rate
TARGET_TIME	60 seconds
INTERACT_TIME	5 seconds
MAX_MISTAKE	2
MAX_SIZE	8GB
MIN_UPTIME	30 minutes
MIN_SAMPLE_RATE	60 samples per second
TIME_ACCEPTED	1 second
ACCEPTED_SIGFIG	3 decimals

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This document ... Section 11 Code Coverage Metrics is removed.

3 Functional Requirements Evaluation

4 Nonfunctional Requirements Evaluation

In the section

4.1 Usability

The table below shows the results of our usability tests based on the tests in the V&V plan based on the requirements mentioned in the SRS. Each requirement can be traced to multiple unit tests and the usability survey used can be found in the Appendix.

Usability Tests				
Test Requirement	Related Unit Tests	Description	Expected Result	Result
NF-UT1	AF	Completing tasks without additional assistance.	User will be complete tasks successfully	PASS
NF-UT2	AX	Interact with interace to modify parameters.	User will be able to modify the parameters accurately and quickly.	PASS
NF-UT3	AL	Completing all tasks with limited number of mistakes	User will be able to complete all tasks with *MAX_MISTAKE*	PASS
NF-UT3	AL	Verifying if interacting with the application previously improves ease of use (learnability)	User will be able to complete the tasks more quickly and accurately the second time	PASS
NF-UT5	AS	Verifying how calculations are performed is hidden	User will not know how calculations are performed after doing the set of tasks	PASS
NF-UT6	AS	Verifying appropriate application size upon installation	User will install application onto computer and verify that the application size is less than or equal to *MAX_SIZE*	PASS

4.2 Performance

The following is the list of Non-functional Test performed on the application to evaluate the performance of the application in respect to the test requirement. Each test will be mapped to unit test that are related to the corresponding requirement.

Performance Tests				
Test Requirement	Related Unit Tests	Description	Expected Result	Result
NF-PT1	-	Checking the minimum sampling rate of the application.	The sampling rate of the application will be equal or greater than *MIN_SAMPLE_RATE*	PASS
NF-PT2	-	Checking the time required for parameters to reflect in the application.	The parameters will reflect in the application by within *TIME_ACCEPTED*	PASS
NF-PT3	-	Checking the significant digits used for calculations and display in the application.	The significant digits seen and used in the application is accurate to *ACCEPTED_SIGFIG*.	PASS
NF-PT4	-	Checking the up-time of the application during and after usage.	The application will have a up-time equal to or more than *MIN_UPTIME* after the user completes a set of tasks.	PASS

4.3 etc.

5 Comparison to Existing Implementation

This section will not be appropriate for every project.

6 Unit Testing

6.1 Input Communication Module

Unit Tests for Input Communication Module					
Unit Test ID	Description	Input	Expected Output	Output	Result
UT-IC1	Testing the getUserInput Method	SamplingRate : 60, SampleLength : 4; SampleWidth : 2; Filename : sample1; Name : Bob; SampleName :sample1; Date : 03/01/2023	UserInput(SamplingRate : 60; SampleLength : 4; SampleWidth : 2; Filename : sample1; Name : bob; SampleName : sample1; Date : 03/01/2023)	UserInput(SamplingRate : 60; SampleLength : 4; SampleWidth : 2; Filename : sample1; Name : bob; SampleName : sample1; Date : 03/01/2023)	PASS
UT-IC2	Testing the getUserInput Method		INVALID	INVALID	PASS
UT-IC3	Testing the getHardwareInput Method	Voltage : 5 ; Time : 10:00; Temperature : 50; Current: 1	HardwareInput(Voltage : 5 ; Time : 10:00; Temperature : 50; Current: 1)	HardwareInput(Voltage : 5 ; Time : 10:00; Temperature : 50; Current: 1)	PASS
UT-IC4	Testing the getHardwareInput Method		INVALID	INVALID	PASS

6.2 Remote Access Module

Unit Tests for Remote Access Module					
Unit Test ID	Description	Input	Expected Output	Output	Result
UT-RA1	Testing the connect Method	userName: Timothy, password 12341234	Observed connected		FAIL
UT-RA2	Testing the connect Method	userName: Bob, password 12341234	INVALID	INVALID	PASS
UT-RA2	Testing the connect Method	userName: Timothy, password 56785678	INVALID	INVALID	PASS
UT-RA2	Testing the connect Method	userName: Bob, password 56785678	INVALID	INVALID	PASS
UT-RA3	Testing the disconnect Method		FALSE		FAIL

6.3 Current State Module

Unit Tests for Current State Module					
Unit Test ID	Description	Input	Expected Output	Output	Result
UT-CS1	Testing the displayUserInfo Method	SamplingRate : 60, SampleLength : 4; SampleWidth : 2; Filename : sample1; Name : Bob; SampleName :sample1; Date : 03/01/2023	Observed data displayed	data displayed	PASS
UT-CS2	Testing the displayUserInfo Method	SamplingRate : ABC, SampleLength : 4; SampleWidth : 2; Filename : sample1; Name : Bob; SampleName :sample1; Date : 03/01/2023	INVALID	INVALID	PASS
UT-CS2	Testing the displayUserInfo Method	SamplingRate : -100, SampleLength : 4; SampleWidth : 2; Filename : sample1; Name : Bob; SampleName :sample1; Date : 03/01/2023	INVALID	INVALID	PASS

Unit Tests for Current State Module					
UT-CS2	Testing the displayUserInfo Method	SamplingRate : 60, SampleLength : ABC; SampleWidth : 2; Filename : sample1; Name : Bob; SampleName :sample1; Date : 03/01/2023	INVALID	INVALID	PASS
UT-CS2	Testing the displayUserInfo Method	SamplingRate : 60, SampleLength : -4; SampleWidth : 2; Filename : sample1; Name : Bob; SampleName :sample1; Date : 03/01/2023	INVALID	INVALID	PASS
UT-CS2	Testing the displayUserInfo Method	SamplingRate : 60, SampleLength : 4; SampleWidth : ABC; Filename : sample1; Name : Bob; SampleName :sample1; Date : 03/01/2023	INVALID	INVALID	PASS

Unit Tests for Current State Module					
UT-CS2	Testing the displayUserInfo Method	SamplingRate : 60, SampleLength : 4; SampleWidth : -2; Filename : sample1; Name : Bob; SampleName :sample1; Date : 03/01/2023	INVALID	INVALID	PASS
UT-CS3	Testing the displayHardwareState Method	Voltage : 5 ; Time : 10:00; Temperature : 50; Current: 1	Observed data displayed	data displayed	PASS
UT-CS4	Testing the displayHardwareState Method	Voltage : ABC ; Time : 10:00; Temperature : 50; Current: 1	INVALID	INVALID	PASS
UT-CS4	Testing the displayHardwareState Method	Voltage : -5 ; Time : 10:00; Temperature : 50; Current: 1	INVALID	INVALID	PASS
UT-CS4	Testing the displayHardwareState Method	Voltage : 5 ; Time : ABC; Temperature : 50; Current: 1	INVALID	INVALID	PASS
UT-CS4	Testing the displayHardwareState Method	Voltage : 5 ; Time : -10:00; Temperature : 50; Current: 1	INVALID	INVALID	PASS

Unit Tests for Current State Module					
UT-CS4	Testing the displayHardwareState Method	Voltage : 5 ; Time : 10:00; Temperature : ABC; Current: 1	INVALID	INVALID	PASS
UT-CS4	Testing the displayHardwareState Method	Voltage : 5 ; Time : 10:00; Temperature : 50; Current: ABC	INVALID	INVALID	PASS
UT-CS4	Testing the displayHardwareState Method	Voltage : 5 ; Time : 10:00; Temperature : 50; Current: -1	INVALID	INVALID	PASS

6.4 Calculation Module

Unit Tests for Calculation Module					
Unit Test ID	Description	Input	Expected Output	Output	Result
UT-C1	Testing the getResistance Method	From HardwareInput ADT: Voltage = 5, Current = 1	5.000	5.000	PASS
UT-C1	Testing the getResistance Method	From HardwareInput ADT: Voltage = 4, Current = 0.6	6.667	6.667	PASS
UT-C2	Testing the getResistance Method	From HardwareInput ADT: Voltage = -5, Current = 1	Invalid	Invalid	PASS
UT-C2	Testing the getResistance Method	From HardwareInput ADT: Voltage = -4, Current = 0.6	Invalid	Invalid	PASS
UT-C3	Testing the getResistivity Method	Resistance = 3, Area = 2.5, Length = 2	3.750	3.750	PASS
UT-C3	Testing the getResistivity Method	Resistance = 2, Area = 2.8, Length = 1	5.600	5.600	PASS

7 Changes Due to Testing

8 Automated Testing

9 Trace to Requirements

Traceability Matrix to Non Functional Requirements			
Requirement Type	Requirement(SRS)	Test Requirement	Related Unit Tests
Non Functional	NFR-U1	NF-UT1	U
Non Functional	NFR-U2	NF-UT2	U
Non Functional	NFR-U3	NF-UT3	U
Non Functional	NFR-U4	NF-UT4	U
Non Functional	NFR-U5	NF-UT5	U
Non Functional	NFR-U6	NF-UT6	U

Traceability Matrix to Functional Requirements			
Requirement Type	Requirement(SRS)	Test Requirement	Related Unit Tests
Functional	FR1	FR-T1	U
Functional	FR2	FR-T2	U
Functional	FR3	FR-T3	U
Functional	FR4	FR-T4	U
Functional	FR5	FR-T5	U
Functional	FR6	FR-T6	U

10 Trace to Modules

References

Appendix — Reflection

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

1.

2.