Verification and Validation Plan for Solar Water Heating Systems Incorporating Phase Change Material

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Contents

1 General Information

The following section provides an overview of the Test Plan for Smart Waiter Solutions. This section explains the purpose of this document, the scope of the system, and an overview of the following sections

1.1 Purpose

The main purpose of this document is to describe the verification and validation process that will be used to test a simulation for solar water heating systems incorporating PCM. This document is indented to be used as a reference for all future testing and will be used to increase confidence in the software implementation.

    This document will be used as a starting point for the verification and validation report. The test cases presented within this document will be executed and the output will be analyzed to determine if the software is implemented correctly.

1.2 Scope

1.3 Overview of Document

The following sections provide more detail about the V&V of a solar water heating simulator. Information about the testing process is provided, and the software specifications that were discussed in the SRS document are stated. The evaluation process that will be followed during testing is outlined, and test cases for both the system testing and unit testing are provided

2 Plan

This section provides a description of the software that is being tested, the team that will perform the testing, the milestones for the testing phase, and the budget allocated to the testing.

2.1 Software Description

The software being tested is a simulator for a SWHS incorporating PCM. Given the physical parameters of the system, including dimensions, properties of the water and PCM,and relevant physical constants, the simulator calculates the changes in temperature and energy of the water and PCM over time.

2.2 Test Team

The team that will execute the test cases, write and review the V&VR consists of:

- Maya Grab

- Dr. Spencer Smith

- Thulasi Jegatheesan

2.3 Milestones

2.3.1 Location

The location where the testing will be performed is Hamilton Ontario. The institution that will be performing the testing is McMaster University.

2.3.2 Dates and Deadlines

2.4 Budget

The budget for the testing of this system is being funded by McMaster University and NSERC.

3 Software Specification

This section provides the functional requirements, the business tasks that the software is expected to complete, and the nonfunctional requirements, the qualities that the software is expected to exhibit.

3.1 Functional Requirements

- Input the physical constants, properties and initial temperatures of water and PCM, and dimensions of the tank

- Verify that the inputs satisfy the required physical constraints

- Compute the calculated values required to solve the governing differential equations

- Calculate the temperatures and energy of water and PCM over time.

3.2 Nonfunctional Requirements

Priority nonfunctional requirements are correctness, understandability, reliability, and maintainability.

4 Evaluation

This section first presents the methods and constraints that are to be used during the evaluation process. This is followed by how the data obtained by the testing will be evaluated, which includes: how the data will be recorded, how to move from one test to the next, and how to determine if the test was successful.

4.1 Methods and Constraints

4.1.1 Methodology

4.1.2 Extent of Testing

4.1.3 Test Tools

4.1.4 Testing Constraints

4.2 Types of Tests

4.2.1 Functional Testing

4.2.2 Structural Testing

4.2.3 Unit Testing

4.2.4 Manual and Automatic Testing

4.2.5 Static and Dynamic Testing

Static testing refers to testing techniques that simulate a dynamic environment. This does not involve program execution. Instead, a walk-though through will be performed checking pre and post conditions evaluate to requirements specified. As well to make sure proper syntax is used thoroughly.This type of testing is crucial in design stage. On the contrary, dynamic testing refers to executing the program while running test cases to view expected behaviour. This is done to find and fix defects in the program. This will be performed after implementation phase.

5 POC System Test Description

5.1 Barcode Scanning

Smart-Waiter needs to ensure users are able to scan a barcode with minimal attempts. The number of expected attempts will be presented in the final SRS document. Various forms of testing will be performed to evaluate this criteria.

5.1.1 Test Factors

5.1.2 Methods of testing

- Static testing is used to ensure pre and post conditions are met syntactically. That is, implementing the ability to scan a barcode and use it to query a menu from the database.

- Dynamic testing is used to guarantee validity, and record number of successful attempts given a sample size of attempts performed.

5.1.3 Test Cases

Test Case	Initial State	Input	Output
5.1.1	Barcode Scanning Page – Empty	Eligible Barcode	Restaurant Menu
5.1.2	Barcode Scanning Page – Empty	Corrupted Barcode	Message prompt reading, "Please try again". After third attempt, prompt will read, "Please contact waiter" and will indicate an option to report bug
5.1.3	Barcode Scanning Page – Empty	Picture without barcode	Message prompt reading, "Please try again". After third attempt, prompt will read, "Please contact waiter" and will indicate an option to report bug

5.2 Database Querying

5.2.1 Test Factors

5.2.2 Inputs

5.2.3 Outputs

5.2.4 Initial State

5.2.5 Methods of Testing

5.2.6 Test Cases

6 Final Demonstration System Test Description

6.1 Account Login

6.1.1 Test Factors

6.1.2 Inputs

6.1.3 Outputs

6.1.4 Initial State

6.1.5 Methods of testing

6.1.6 Test Cases

6.2 Order Transaction

6.2.1 Test Factors

6.2.2 Inputs

6.2.3 Outputs

6.2.4 Initial State

6.2.5 Methods of testing

6.2.6 Test Cases

6.3 Usability Testing

6.3.1 Test Factors

6.3.2 Inputs

6.3.3 Outputs

6.3.4 Initial State

6.3.5 Methods of testing