Maseeh College of Engineering and Computer Science

PORTLAND STATE UNIVERSITY

Test Plan

SeLo Security Locker

Homework 7

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I. Introduction

1. Product Overview

The SeLo Security Lockbox is an affordable, wall mounted alternative to secure documents and valuables that comes loaded with features that make it standout as a product. It is capable of being powered by a portable 5V source, has electronic keypad and a theft deterrent mechanism. It occupies a small footprint for compact locations.

This document contains a brief summary of the SeLo Security Lockbox that is being tested and covers the tests that will be performed to assess functionality vs. requirement.

The paper follows with reference documents in section II. In section III, the paper continues with the plan to identify the items and the features to be tested, the types of testing to be performed. The schedule of all testing activities, resources, and the risks associated with the plan are described in section IV.

2. Out of Scopes

- Box's dimensions and capacity testing
- Box's weight and load ratings
- Box's structural integrity testing
- Box's mechanical operations and aesthetics assessment

II. Reference Documents

1. Industry Standards

- ANSI/BHMA A156.13-2017: Mortise Locks and Latches
- ANSI/BHMA A156.12-2018: Interconnected Locks

2. Design Document

- SeLo Security Locker - Product Design Specification (PDS) version #1
- SeLo Security Locker - PDS with additional requirement version #3
- SeLo Security Locker - Detailed Designs version #1
- Other design reference: Intelligent Security Lock: V., Pandit, et al. *2017 International Conference on Trends in Electronics and Informatics (ICEI 2017): Tirunelveli, India, 11-12 May 2017*. IEEE, 2017.

3. Test Plan Documents

- "How Can a Test Plan Software Help in IEEE 829 Standard Compliance?" *ReQtest*, 25 Nov. 2019, reqtest.com/testing-blog/how-to-write-a-test-plan-2/
- Sonali, et al. "Tips to Write Simple & Effective Test/QA Plan - [Sample Test Plan Report to Download]." *Opencodez*, 17 June 2019, www.opencodez.com/software-testing/test-planning.htm.

III. Objective Statements:

The objectives of this test plan is to layout and describe the individual modules of the SeLo Security Locker product (**(1) Unit Test**), test the functionality as described in the Product Design Specification and the Detailed Design documents (**(2) Functional Test**), and test the ease of use with users who are from another group in ECE411 (**(3) Alpha Test**). Developers and testers of SeLo Security Locker put the product through those tests (unit, functional, and alpha testing), to ensure proper operation according to the design documentation.

In the next sections, we have the test cases with their unique test identifiers grouped by three objectives:

1. Unit Testing

2. Functional Testing

3. Alpha Testing

IV. List of Test Cases Grouped by Objectives:

1. Objective 1- Unit testing:

a. **Test case A - Numpad Test #1 (Test ID: NP-UT-01):** This test is to check if the user entered their PIN correctly and as intended. Testers press 4 keys on the numpad a couple of times and observe the inputs through a computer's serial monitor feature.
b. **Test case B - Servo Motor Test #1 (Test ID: SM-UT-01):** This test is to check if the motor rotates the specified direction to lock and unlock the box's door. Run a short script in Arduino IDE, load it onto the microcontroller and verify the motor rotates the correct direction/angle as designed.
c. **Test case C - Buzzer Test #1 (Test ID: BZ-UT-01):** This test is to check if the buzzer activates when it is supposed for key presses and status updates. Run a short script in Arduino IDE to see if the buzzer makes noise under the design circumstances.
d. **Test case D - LED Test #1 (Test ID: LE-UT-01):** This test is to check if the LED lights up when it is supposed to. Run a short script in Arduino IDE to see if the LED turns on/off or blinks for a key press and for visual cues.

e. **Test case E - PCB Power Test #1 (Test ID: PC-UT-01):** This test is to check if the PCB is being supplied with 5V through the micro USB port. Plug the PCB into a battery pack and use a multimeter to measure from the 5V input to ground.
f. **Test case F - PCB Built-in LED Test #1 (Test ID: BL-UT-01):** This test is to check if the TX LED turns on when it is supposed to. Transmit something to the microcontroller and see if the TX LED turns on.
g. **Test case G - PCB Built-in LED Test #2 (Test ID: BL-UT-02):** This test is to check if the RX LED turns on when it is supposed to. Output something from the microcontroller and see if the RX LED turns on.
h. **Test case H - PCB Built-in LED Test #3 (Test ID: BL-UT-03):** This test is to check if the USER LED (PIN 13 LED) turns on when it is supposed to. Send a HIGH signal to this LED, then a LOW signal.

2. Objective 2 - Functional testing:

a. **Test case A - Full Sequence Test #1 (Test ID: FS-FT-01):** Tester enters a random 4-digit PIN sequence and checks if they hear an audible and visual indication at the end of the PIN sequence.
b. **Test case B - Correct PIN Test #1 (Test ID: CP-FT-01):** Tester has the SeLo security locker in the locked state. Tester enters the correct PIN and checks if the servo motor turns to release the lock, freeing the door and opening the locker.
c. **Test case C - Correct PIN Test #2 (Test ID: CP-FT-02):** Tester has the SeLo security locker in the unlocked state. Tester enters the correct PIN and checks if the servo motor turns to activate the lock, securing the door.
d. **Test case D - Password Reset Test #1 (Test ID: PR-FT-01):** Tester has the locker in the unlocked state so password reset may occur. Tester enters the sequence '****' and see if they hear the audible indicator sound to indicate to the tester to enter a new password.
e. **Test case E - Password Reset Test #2 (Test ID: PR-FT-02):** After hearing the indicator sound, the tester enters the new password and sees if the indicator is heard alerting them that the new password is set.
f. **Test case F - Password Reset Test #3 (Test ID: PR-FT-03):** After changing the PIN, the tester enters the new PIN and checks if the motor turns to activate the lock.
g. **Test case G - Password Reset Test #4 (Test ID: PR-FT-04):** Tester enters the new PIN and checks if the motor turns to unlock the locker.
h. **Test case H - Incorrect PIN Test #1 (Test ID: IP-FT-01):** Tester has SeLo in the locked state, then enters an incorrect PIN sequence, confirming that the locker remains locked (the motor does activate).
i. **Test case I - Incorrect PIN Test #2 (Test ID: IP-FT-02):** Tester has SeLo in the unlocked state, then enters an incorrect PIN sequence and confirms if the locker still remains unlocked (the motor does not activate).
j. **Test J - Incorrect PIN Test #3 (Test ID: IP-FT-03):** Tester has SeLo in the locked state, then enters an incorrect PIN sequence up to 2 times and confirms the locker still remains locked (the motor does not activate).

k. **Test K - Incorrect PIN Test #4 (Test ID: IP-FT-04):** Tester has SeLo in the unlocked state, then enters an incorrect PIN sequence up to 2 times and confirms if the locker still remains unlocked (the motor does not activate).
l. **Test case L - Theft Detection Test #1 (Test ID: TD-FT-01):** Tester has SeLo in the locked state, then enters incorrect PINs 3 times to confirm that the alarm goes off.
m. **Test case M - Theft Detection Test #2 (Test ID: TD-FT-02):** Tester has SeLo in the unlocked state, then enters an incorrect PIN 3 times to confirm that the alarm goes off.

3. Objective 3 - Alpha testing:

a. **Test case A - ECE411 Student Group Test (Test ID: SG-AT-01):** Ask a group in ECE411 to test basic functionality of the locker (enter PINs to lock and unlock) and gather feedback to address ease of use.
b. **Test case B - ECE411 Student Group Test (Test ID: SG-AT-02):** Ask a group in ECE411 to test advanced functionality of the locker (reset password) and gather feedback to address ease of use.

V. Selective Test Cases in Details (Matrix):

1. **Theft Detection Test #1 (Test ID: TD-FT-01)**

Test Writer: Hoang N., EE					
Test case name:		Theft Detection Test #1	**Test ID#**		Test ID: TD-FT-01
Description:		Tester has SeLo in the locked state, then enters incorrect PINs 3 times to confirm that the alarm goes off.	**Type:**		☑Black Box ☐White Box
Testers information					
Name of tester		Ngan H., CE	**Date**		12/6/2019
Hardware Ver:		2.0	**Time**		10:39 AM
Setup		Have fully assembled SeLo Security Locker. Have SeLo in locked state.			
Step	**Action**	**Expect results**	**Pass**	**Fail**	**Comment**

1	Plug the power cable into the portable power source (power bank)	TX and RX LEDs turn on			
2	Pull the door knob gently to ensure the door is locked	Motor does not activate. Door is locked.			
3	(1st trial) Enter any 4-digit PIN except for ‘1234’ (the default correct PIN) e.g. Enter ‘0000’	Motor does not activate. Door remains locked. Hear a ‘beep beep beep’ immediately after entering the 4th digit			
4.	(2nd trial) Enter any 4-digit PIN except for ‘1234’ (the default correct PIN) e.g. Enter ‘9999’	Motor does not move. Door remains locked. Hear a ‘beep beep beep’ immediately after entering the 4th digit			
5.	(3rd trial) Enter any 4-digit PIN except for ‘1234’ (the default correct PIN) e.g. Enter ‘ABCD’	Motor does not move. Door remains locked. Alarm goes off right after entering the 4th digit (buzzer sounds and LED blinks)			
Over result					

2. **Numpad Test #1 (Test ID: NP-UT-01)**

Test Writer: Jonathan C., EE					
Test case name:		Numpad Test #1	**Test ID#**		Test ID: NP-UT-01
Description:		This test is to check if the user entered their PIN correctly and as intended. Testers press 4 keys on the numpad a couple of times and observes the inputs through a computer's serial monitor feature.	**Type:**		☐Black box ☑White Box
Testers information					
Name of tester		Karla B., CE	**Date**		12/6/2019
Hardware Ver:		2.0	**Time**		10:39 AM
Setup		Have a boot-loaded ATmega32U4 soldered on to PCB. Have a 4x4 numpad connected to the designated pin headers on the PCB. Have a computer with Arduino IDE installed.			
Step	**Action**	**Expect results**	**Pass**	**Fail**	**Comment**
1	Plug the micro USB end of a micro USB to USB - type A cable into the micro USB connector on the PCB	Nothing			

2	Turn on a computer with Arduino IDE (version 1.8.10) installed by pushing the power button	The computer boots up and arrives at the default lock screen			
3	Log in if necessary and open Arduino IDE (version 1.8.10)	Arduino IDE window shows up on the monitor			
4	Plug the USB - type A side of the microUSB-to-USB cable into the computer	The TX and RX LEDs mounted on the PCB turn on			
5	On the Arduino IDE, under **Tools**, and **Board**, select **Arduino/Genuino Micro**	**Arduino/Genuino Micro** gets selected			
6	On the Arduino IDE, under **Tools**, and **Port**, select the communication port (should be COM** Arduino/Genuino Micro)	The communication port gets selected and recognizes the connected board			
7	Upload the provided code to operate the numpad	The code gets verified and uploaded to microcontroller on board			
8	Open the Serial Monitor and select baud rate of 9600	The Arduino IDE serial monitor window shows up			
9	Enter the first digit in a random	The entered value matches with the displayed digits			

	4-digit PIN and verify if the digit corresponding with the button pressed is the same as the digit shown on the serial monitor				
10	Enter the second digit in a random 4-digit PIN and verify if the digit corresponding with the button pressed is the same as the digit shown on the serial monitor	The entered value matches with the displayed digits			
11	Enter the third digit in a random 4-digit PIN and verify if the digit corresponding with the button pressed is the same as the digit shown on the serial monitor	The entered value matches with the displayed digits			
12	Enter the final digit in a random 4-digit PIN and verify if the digit corresponding with the button pressed is the same as the digit shown on the serial monitor	The entered value matches with the displayed digits			
Over result					

IV. Test Scheduling, Resources, and Associated Risks

1. Test Scheduling

Test User Input	12/5/2019
Test Correct/Incorrect password verification	12/5/2019
Test Incorrect Password Input Followed by Correct Password Input	12/6/2019
Test Incorrect Password Input 3 Times	12/6/2019
Test Changing the Password	12/7/2019

2. Resources

The resources required for testing are:

- Multi-meter (EXTECH instrument)
- Windows 10 Computer with Atmel Studio 7 and Arduino IDE (version 1.8.10) installed
- Oscilloscope (Tektronix MSO 4054 Mixed Signal Oscilloscope)
- Power Supply (Tektronix DMM 4020 5-1/2 digital multimeter)
- Assorted clips and probes (alligator clips, banana clips, test leads)
- .ino Arduino file that compiles successfully into a .cpp file format
- AVR Dragon ISP Board with ISP connection (found in PSU Capstone Lab)
- Prototype used for development (ex. Atmega328P DIP package in breadboard) with ISP compatible connections
- PCB manufactured by OSHPark for SeLo control circuitry and component mounting surface
- Documentation and datasheets for all components (ATmega32u4) for pinout diagrams
- Extra surface mount and through-hole components (refer to BOM for specific values and component types)
- Two Team Members focused primarily on Software Development (Ngan & Karla)
    - Education level: Undergraduate
    - Requires skills and knowledge related to:
        - Arduino or embedded systems programming
        - Atmel Studio 7 or other embedded device programming environment
        - Debugging with an IDE
- Two Team Members focused primarily on Hardware Development (Jonathan & Hoang)
    - Education level: Undergraduate
    - Requires skills and knowledge related to:
        - EagleCAD or other modeling/circuit layout software
        - Soldering
        - Oscilloscope and multimeter debugging experience
- Soldering equipment and accompanying materials

- Sources of Funding

3. Associated Risks

The possible risks for the testing phase include:

- Damaging one of our PCB boards or critical components
- Not having enough replacement parts
- Bugs and glitches that are difficult to resolve, slowing down progress
- Not completing tests on time
- Inclement weather or unforeseen campus closures interfering with testing
- Difficulty integrating the software and hardware components of SeLo
- Required parts not arriving in time
- Lack of available stations in Capstone lab (for AVR Dragon)
- Team members are unable to be present for testing due to external factors