HIT3061 – Software Team Project - Semester 2, 2013

Tremor Detection with Leap Motion

Test Plan

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**Table 1. Document Change Control**

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| Version | Date | Author | Changes |
| 1.1 | 09/09/2013 | Daniel Corsaletti | Create Document |
| 1.2 | 27/09/2013 | Daniel Corsaletti | Updated more sections of document |
| 1.3 | 30/9/2013 | Minh Duc Nguyen | 1.3/ Measurable  4.2/ Technical Environment  5/ Function to be tested (table)  6/ Deliverables ( 6.1 – functional test result, 6.2 – Usability Questionaires |
| 1.4 | 05/10/2013 | Daniel Corsaletti | Made some changes based on feedback.  Compelted section 3 |
| 1.5 | 06/10/2013 | SHENGWEI LI | Add parts on section 3 and 4.  Add more test cases in section 5. |
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**Table 2. Document Sign Off**

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# Test Plan

## Introduction

This test plan will be used so we are able to accurately identify and detect which aspects of our application need to be tested to ensure that the data we are gathering and supplying to the client is correct and that the overall project is reliable and fulfils their requirements.

## Objectives

The main criteria to ensure that this project is a success, is to make sure that our application can accurately test a tremor in the user’s hands. In order for this goal to be achieved we must make sure that our methods of calculating a tremor are correct. Our main objectives from testing include:

* Ensure a tremor can be identified
* Ensure the tremor calculating formulas and noise reduction formulas are correct
* Ensure application can be used with 1 hand
* Ensure the identification of any situations where the Leap Motion device might struggle to capture data accurately
* Ensure ease of use of application
* Ensure the identification of as many bugs and/or issues as possible

## Measurable

The specific objectives of the test plan are to measure:

* Hand Tremor variables for each finger that include:
  + Hertz
  + Amplitude
  + Velocity
  + Acceleration
* The noise during the data capturing session, which means that the application should apply a mathematical algorithm to detect whether a movement is a hand tremor or a noise.

# Scope

Testing of this application will be used to ensure whether the project meets all of its functional requirements. By assessing the validity of its results and testing its usability, we are able to assess whether what we are handing over to the client is what they required.

The main aim of this project is to prove that by using a Leap Motion device and adding our own functionality it is possible to create an application that can correctly identify and detect a tremor, so the main focus in testing is to ensure we have calculated tremors correctly. To test the accuracy of our tremor indication, we will need to create some arrays of numbers to use as test data that we can test our tremor calculation formulas on, checking to see if it produces the expected result we would hope to achieve from that test. After checking these formulas this way we can also record vision of a test being completed and then show this footage to our client, along with the results of the test and check if these are the type of results he would expect. All these tests will be used to ensure that the tremor analysis works exactly as we had planned.

Our application will also be tested for usability, to ensure that our client will be able to use it in his own environment. To test this we will be using the client for feedback on how useable our application is. As our client is the only user of this application it is mainly his feedback we will be paying attention to. We must ensure that this application is useable by him, but we will also aim to make it easy enough to be used by anyone.

Other tests that must be completed will rely more upon the reliability of the Leap Motion device. We must ensure it is still able to function correctly under different circumstances that our client might be in. To test for this we will be using the device with different situations of the client in mind, for example, with gloves on, or with freshly cleaned hands. We do not expect there to be any issues, however testing is still necessary.

For our testing purposes file generation will be necessary, however in the final application the client has not asked for any file saving so we will not need to test the effectiveness or the ability to store these files anywhere.

# Test Strategy

## Function Testing

The main functionality of the application is the ability to correctly analyse a tremor, we need to ensure that our implemented formulas are capable of correctly calculating the frequency, amplitude, velocity and acceleration of a tremor. We will use Unit Testing to test if we are measuring each of the characteristics of a tremor correctly. This is also the same method we will be using to test the noise cancellation functionality. Testing this functionality separately allows us to ensure that all of the values are being correctly calculated.

Another testing method we will use to test our application is to record each member of our team using the application on camera. We will have each member hold their hand over the Leap Motion device and we will record footage of their hand as they conduct a tremor test. This will be stored with the results generated from a tremor test and we will pass this data onto our client. This will be used so that our client is able to study the results from a test and determine whether the program is producing results that he would expect. This is another method for determining whether the functionality of the application is working correctly.

The other functionality of the application that is being tested has been outlined below in the Functions to be tested section. Each Use Case will be analysed by team members and will be tested to ensure all functionality is complete and working correctly.

## Usability Testing

The Usability of the application will be tested by each member to ensure that we are all able to easily use and conduct a test on the application while also using a Leap Motion device; however the main tester of the applications usability will be our client. As this application is being developed specifically for him we do not have to ensure it is usable for a large audience, only to ensure it is usable for him.

Since there is not a large amount of navigation required for somebody to use this application and conduct a test, it is also not necessary for us to conduct any tests in a usability lab. Our client will be able to open this application and interact with it straight away to begin a test, there is no need to test all the aspects of this application as if it were a final product. Our aim is to make this application as usable as possible for our client, but we will try to accomplish that by asking our client for direct feedback on whether he is able to effectively use the application with ease and is satisfied with how it operates.

## Performance Testing

Throughout the testing phase of our project we will be testing for any situations in which the performance of our application may suffer. These tests will consist of intentionally trying to find faults with the application that may exist in an environment the user will be running it in. Examples of such tests could be the use of the application when the computer is not connected to a power outlet, or when the computer is not connected to the internet.

# Environment Requirements

## Physical environment

To get an accurate assessment on how well our program correctly calculates tremors we initially planned to use software that already detects tremors and then compare the results. This meant getting the client to supply us with some test data that had been generated from the machines that he already uses and maybe add in a Leap Motion device to track the hand movements as well. We also talked about testing the application while also using high speed cameras and accelerometers; however this was beginning to complicated things further than we believed they needed to be. We deemed these methods to be unfeasible and decided against it and will instead focus on providing tests that we are able to control.

Since we are not actually trying to test the accuracy of the Leap Motion device and are instead testing the implementation of our calculations we have decided to set up a test case where a user will have their hand movements recorded on camera and then both the recording and results of the test are shown to our client to see if he believes these results look accurate. It may not be an ideal testing situation but if the client is happy with this type of testing it could be useful. For these tests we will also require a camera and have our client (or another surgeon familiar with tremors) to come in and check recorded tests.

Arrays of data that we can use as test data will also be created to run through the program. This will be used to check if the calculations we are performing on the data produce a result that is the same as what we would expect the program to output for a test with those figures.

Another aspect of the program to test will be testing the program under different circumstances that the client will be in. As a surgeon we believe it is possible he could be wearing gloves or having freshly washed hands which could raise or lower the temperature of his skin. A user may also be wearing rings or jewellery that may interfere with the Leap Motion device so it’s important we test for these factors too. As the Leap Motion devices uses light to capture movement we also decided to test the application under different lights. We aim to replicate these situations and test to make sure these do not interfere with the results.

## Technical Environment

Hardware:

* CPU: Core 2 Duo 2.0Mhz
* RAM: 2 GB
* Free space for software application requires at least 500 MB
* Monitor: 32bits or higher display adapter
* Keyboard
* Mouse
* LeapMotion device

Software:

* Internet browse.IE 8, Google Chrome,firefox.
* Windows XP, 7macOSX lion
* LeapMotion device driver

Network:

* Web application works in either online or offline network connection

Place:

* Swinburne Hawthorn Library

# Functions to be tested

The main functionality of our application will be to accurately analyse a tremor in a user’s hand. The different statistics of this tremor that we are trying to capture include the frequency, the amplitude, the acceleration and the velocity of the tremor. We will need to test that each of these is correctly being calculated. It will be difficult to confirm these calculations are correct, however using journal articles (Weichert and Bachmann et al., 2013, pp. 6380--6393), we can confirm that the Leap Motion device is accurate, so using simple calculations to gain maximum values and changes in direction is a simple task. As previously stated, a method of testing our calculations would be to show somebody who is familiar with tremors the visual recording of a test and hopefully producing what are expected results. Additional test data will be created to test if the application correctly calculates the tremors. We will generate arrays of data with an expected outcome in mind and check if the functions are able to correctly produce these results.

Another factor that is present in tremor calculations is the identification and removal of any noise in a user’s movements. Once this is calculated then we can get a proper reading of a tremor, and the application’s ability to identify and display information about the tremor can be assessed.

Some of the functionality of this test will be the ability to be guided and interact with the application without the use of a mouse. The user will be able to begin a test by holding their hand over the Leap Motion sensor and being told if they are using the application correctly or not. We need to make sure accessing a test and completing it is possible without even touching a mouse or keyboard once the test parameters have been set up.

The application will be used on only 1 hand; however ideally it will not have a specific hand that needs to be used. We must test that a user is able to use either a right or a left hand without making any changes to the test. This is mainly for the preference of the user, however if restrictions need to be made and only allow a specific hand then that is a change we will have to investigate.

As part of our testing we are creating output files of all tests, however the client didn’t want any file storage as a functional requirement. He was happy for the application to only display the results on the screen at the end of the test. This means no file storage tests will need to be conducted.

A list of functions to be tested is in the table below.

|  |  |  |
| --- | --- | --- |
|  | **Test Case Objective** | **Expected output (Pass requirements)** |
| 1 | Correctly calculate the frequency of a user’s tremor | Displays an expected result based on our created test data |
| 2 | Correctly calculate the velocity of a user’s tremor | Displays an expected result based on our created test data |
| 3 | Correctly calculate the amplitude of a user’s tremor | Displays an expected result based on our created test data |
| 4 | Correctly calculate the acceleration of a user’s tremor | Displays an expected result based on our created test data |
| 5 | Validate noise in movement | Should display appropriate message to indicate user whether current movement is a tremor or a noise during the assessment task |
| 6 | Correctly output tremor analysis values: Hertz, Amplitude, Velocity and Acceleration | A summary page for 4 output values must be displayed after finishing capturing task. |
| 7 | User instruction | A set of user interaction instructions will be shown before and after the measuring task. |
| 8 | Detecting Leap Motion device connection | Display appropriate message to indicate to the user whether the device has been connected/disconnected |

# Deliverables

A test report that includes the results of the client reviewing our footage of tests being conducted will be delivered to show the results of our testing. This will include the results of different tests that were conducted by different users and whether our client was satisfied with the results that were produced for each test. We will also include in this document the scripts and arrays that we created and ran through our functions to determine whether our tremor calculations were accurate, along with our expected results and the results produced from our program.

This document will also contain the results for the usability tests and performance tests of our application. We will identify how easy our application was to use without having to interact with a mouse or keyboard to conduct a test. Here we will also, identify if the application is useable in a variety or possible situations like while wearing gloves or jewellery. We will also discuss the results of what hands can be used while testing and what and list some situations where the performance of our application may suffer.

Any defects discovered throughout testing will also be outlined in the test report. Due to the constant changes made to the application, this will most likely consist of small bugs rather than any big issues that exist.

# Bibliography

1. Weichert, F., Bachmann, D., Rudak, B. and Fisseler, D. 2013. Analysis of the Accuracy and Robustness of the Leap Motion Controller. *Sensors*, 13 (5), pp. 6380--6393.