

Lab 3 - Prototype Test Plan

Team Silver

CS 411

Professor Kennedy

22 November 2019

Version 1

1. Objectives	2
2. References	2
4. Test Procedures	3
4.1 Smartphone Test Category	4
4.1.1 Pushing Emergency contact to server	4
4.1.2 Pushing new seizures to server	5
4.1.3 Phone to Cloud Query	6
4.1.4 Seizure alert from server to the smartphone	8
4.1.5 Add new emergency contacts to app database	9
4.2 Server Test Case Category	10
4.2.1 Server Training Duration	10
4.2.2 User Modifiable Error-Sensitivity	11
4.3 Smartwatch Test Case Category	13
4.3.1 Notifying Emergency Contacts	13
5. Traceability to Requirements	15

1. Objectives

The intent of this Test Plan and Procedure is to ensure the approach to developing and testing the SeizSmart prototype can lead to a successful demonstration of the SeizSmart product's operation. SeizSmart will implement a wearable seizure detection method using off the shelf smartwatch and smartphone technology, allowing users to automatically notify emergency contacts when a seizure is in progress. The plan and procedures described in this document will be used to verify stable operation of the SeizSmart Prototype.

2. References

Team Silver. (2019, October 8). Lab 1 – SeizSmart Product Description. Retrieved November 13, 2019, from <https://www.cs.odu.edu/~411silver>

Team Silver. (2019, November 8). Lab 2 – SeizSmart Product Specification. Retrieved November 13, 2019, from <https://www.cs.odu.edu/~411silver>

[This space intentionally left blank]

4. Test Procedures

Section 4 of this document will describe the tests that will be used to verify the functionalities of the SeizSmart prototype. Each test case will include a name, a reference id, a description, the test's purpose, any conditions required to set up the test, the test's activities and their expected results.

[This space intentionally left blank]

4.1 Smartphone Test Category

Section 4.1 will include all tests on the functionality of the Android smartphone application and its components.

4.1.1 Pushing Emergency contact to server

Description: Test smartphones ability to send new emergency contacts to server

Purpose: The purpose of this is to test that the phone can successfully push emergency contacts to the server database. This is necessary because during an onset of a seizure the active emergency contact will receive this notification.

Setup Conditions:

1. Generate emergency contact test data on the smartphone
2. Check that a connection is available

Test Procedure:

Test Procedure 1: Generate emergency contact test data

Expected Result: Test data should be generated with no issues

Test Procedure 2: Phone is connected to web socket

Expected Result: Return flag should be true when connection is established

Test Procedure 3: Push emergency contact data to server

Expected Result: Upon checking the server database there should be a new entry

Test Procedure 4: Message on the smartphone that this entry has been successfully added to the database

Expected Result: Boolean flag will be responsible for sending this message

4.1.2 Pushing new seizures to server

Description: Test smartphones ability to send new seizures to server

Purpose: The purpose of this is to test that the phone can successfully push new seizures to the server database. This is necessary because the user might need to manually log seizures that were not detected by the smartphone for whatever reason

Setup Conditions:

1. Generate new seizure data on the smartphone
2. Check that a connection is available

Test Procedure 1: Generate new seizure data

Expected Result: Test data should be generated with no issues

Test Procedure 2: Phone is connected to web socket

Expected Result: Return flag should be true when connection is established

Test Procedure 3: Push seizure data to server

Expected Result: Upon checking the server database there should be a seizure tag for a specific day and time

Test Procedure 4: Message on the smartphone that this entry has been successfully added to the database

Expected Result: Boolean flag will be responsible for sending this message

[This space intentionally left blank]

4.1.3 Phone to Cloud Query

Description: The smartphone's ability to query cloud MySQL database

Purpose: The test will ensure that the smartphone is able to retrieve a specific range of data from the MySQL database that was pruned from the local SQLite database and load the data back into the SQLite database.

Setup Conditions:

1. Procedurally generate data on server
2. Generate same data on smartphone application
3. Load generated data into MySQL database with a specific timeframe and userID.

Test Procedure 1: Ping cloud server from phone application

Expected Result: Ping completes with no timeouts

Test Procedure 2: Query the MySQL database for data within a specific timeframe and authorized UserID

Expected Result: Data is retrieved from the MySQL database with no HTTP errors

Test Procedure 3: Query the MySQL database for data within a specific timeframe and unauthorized UserID

Expected Result: Unauthorized access error message

Test Procedure 4: After test procedure 2, verify data received from MySQL database matches the data generated

Expected Result: Generated data matches queried data at all points for given timeframe.

Test Procedure 5: After test procedure 4, insert data into SQLite database

Expected result: SQLite table matches queried data for given timeframe

[This space intentionally left blank]

4.1.4 Seizure alert from server to the smartphone

Description: The smartphone ability to receive seizure alert from the server

Purpose: Once a seizure a detected. The user should be able to clear the alert using the smartphone application if it is false positive.

Setup Conditions:

1. Generate false seizure on the smartwatch

Test Procedure 1: The server should send this alert to the smartphone using the websocket

Expected Result: The smartphone's activity should change to the seizure alert activity upon receiving the alert.

Test Procedure 2: The smartphone should clear this alert

Expected Result: No emergency contacts should be notified

[This space intentionally left blank]

4.1.5 Add new emergency contacts to app database

Description: The smartphone ability to add new emergency contacts to app database

Purpose: The user should be able to add a new emergency contact into the app database. After this emergency contact can be notified or not when a seizure is detected

Setup Conditions:

1. Generate new emergency contact on the smartphone

Test Procedure 1: This new emergency contact should be added to the app database

Expected Result: Message should be displayed if emergency contacts has been successfully added to the database

[This space intentionally left blank]

4.2 Server Test Case Category

Section 4.2 will include all tests on the functionality of the SeizSmart server and training of the neural network.

4.2.1 Server Training Duration

Description: This test tests that the server's ability to train a neural network to learn a trend does not exceed an expected time limit.

Purpose: This test will use a predefined dataset to train a neural network and ensure the time required to achieve $<1\%$ error is acceptable.

Setup Conditions:

1. Read in dataset of known seizure biometric data.
2. Train neural network.
3. Evaluate how likely biometrics correspond to a seizure. Test fails if the likelihood does not follow known trend data.

Test Procedure:

1. Read in training data
2. Create untrained NN with Architecture matching one used on watch
3. Record training begin time
4. Perform training until error $<1\%$
5. Record training end time

Expected Result:

1. End time - Begin time < 60 seconds

4.2.2 User Modifiable Error-Sensitivity

Description: A neural network calculates a seizure probability between 0.0 and 1.0 for a time frame. Another variable ranging from 0.0 to 1.0 may be defined by the user to represent the error-sensitivity of the final action taken by the detection algorithm. This test validates that this value has the expected impact on the result.

Purpose: Demonstrating that the value of the sensitivity variable has the intended effect on the outcome of the detection algorithm is critical for edge case biometrics that could qualify as either seizure or non-seizure related data depending on the value of this variable.

Setup Conditions:

1. Construct a neural network trained on a small set of sample data.
2. Depending on the value of the user set sensitivity, the sample test data prepared for accelerometer, gyroscope, and heart rate could be labeled as either seizure related data OR non-seizure related.

Test Procedure 1: Run detection algorithm multiple times; once per piece of prepared test data, with a sensitivity set to 0.0.

Expected Result: Majority of results should be positive.

Test Procedure 2: Run detection algorithm multiple times; once per piece of prepared test data, with a sensitivity set to 0.25.

Expected Result: A smaller majority of results should be positive.

Test Procedure 3: Run detection algorithm multiple times; once per piece of prepared test data, with a sensitivity set to 0.5.

Expected Result: About 50% of results should be negative and 50% should be positive.

Test Procedure 4: Run detection algorithm multiple times; once per piece of prepared test data, with a sensitivity set to 0.75.

Expected Result: A smaller majority of results should be negative.

Test Procedure 5: Run detection algorithm multiple times; once per piece of prepared test data, with a sensitivity set to 1.0.

Expected Result: Majority of results should be negative.

[This space intentionally left blank]

4.3 Smartwatch Test Case Category

Section 4.3 will include all tests on the functionality of the Android smartwatch application and its components.

4.3.1 Notifying Emergency Contacts

Description: Once a seizure has been detected and the patient does not respond in the given time, emergency contacts must receive a text message indicating a seizure has occurred.

Purpose: This will ensure that emergency contacts receive a text message every time the patient has a seizure

Setup Conditions:

1. Simulate a seizure event
2. Let the countdown timer runout
3. Once the countdown timer runs out, the patient's emergency contact should receive a text message indicating the patient is having a seizure

Test Procedure:

Test Procedure 1: Verify that network access is granted and that the wear device can send a text message.

Expected Result: Permission is verified.

Test Procedure 2: Send test text message.

Expected Result: The default emergency contact receives a text message.

Test Procedure 3: Send text message after countdown completes.

Expected Result: The emergency contact(s) receive a text message after the countdown is over.

Test Procedure 4: Text message content

Expected Result: The text message is sent with the patient's name, location, accelerometer and gyroscope averages at the onset.

Test Procedure 5: Enabled/Disabled emergency contact(s)

Expected Result: All of the enabled emergency contact(s) will receive a text message and the disabled emergency contacts will not receive a text message.

Test Procedure 6: Time taken to send text message

Expected Result: The time taken to send a text message to an emergency contact(s) will be ≤ 15 seconds.

[This space intentionally left blank]

Requirement ID	Test Case ID								
	4.1.1	4.1.2	4.1.3	4.1.4	4.1.5	4.2.1	4.2.2	4.3.1	
3.1.8.3.2									
3.1.8.3.3									
3.1.8.3.4									
3.1.9.3.1							X		
3.1.9.3.2							X		
3.1.9.3.3							X		
3.1.9.3.4							X		
3.1.9.3.5							X		
3.1.10.3.1						X			
3.1.10.3.2						X			
3.1.10.3.3						X			