

# COMP 3004 Final Project – Team 18: Design Documentation

## Use Cases

### UC1: Basic Use Case

Primary Actor: User

Preconditions:

Device has power

User attaches ear clips to earlobes

Postcondition: Device is powered off

Main Success Scenario:

1. User turns on device (**UC2: Power On**)
2. Device monitors battery continuously
3. User selects a session (**UC4: Select a Session**)
4. Device performs connection test (**UC5: Connection Test**)
5. Device displays intensity
6. Device starts session
7. User adjusts intensity (**UC6: Adjust Intensity**)
8. User undergoes therapy
9. Session ends (**UC7: End Session**)

Extensions

- 2a. Device has low battery (**UC8: Low Battery**)
- 3a. User replays a recorded Therapy from treatment history (**UC9: Replay Therapy**)
  - 3a1. Continue to step 6
- 5a. If the user is replaying a recorded therapy
  - 5a1. Device displays saved intensity
- 5b. If the user is **not** replaying a recorded therapy
  - 5b1. Device clears graph to show default intensity of 0
- 6a. If the user presses the power button during session
  - 6a1. Skip to Step 9
- 6b. If the connection is lost during session (**UC11: No Connection**)
- 8a. User records Therapy to treatment history (**UC10: Record Therapy**)

Related Information:

- Use case can be ended at any time if the user holds the Power button for 1 second (**UC3: Manual Power Off**) or if the battery runs out

### UC2: Power On

Primary Actor: User

Precondition: Device is turned off

Postcondition: Device is turned on

Main Success Scenario:

1. User presses and holds the power button until LED turns on
2. Device turns on
3. Device shows battery levels

### **UC3: Manual Power Off**

Primary Actor: User

Precondition: Device is turned on

Postcondition: Device is turned off

Main Success Scenario:

1. User presses and holds the power button
2. Device powers off

### **UC4: Select a Session**

Primary Actor: User

Precondition: Device is powered on

Postcondition: User has selected a session

Main Success Scenario:

1. User uses power button to cycle through session groups (Times)
2. Device highlights corresponding session group icon
3. User uses arrow buttons to cycle through session type (Frequencies)
4. Device highlights corresponding type icon
5. Device highlights corresponding CES mode icon (Waves)
6. User presses Start Session (check mark) button

Extensions:

- 1a) User selects user designed session group
  - 1a1. By default there are no user designed sessions
  - 1a2. If there are user designed sessions, User uses arrow buttons to cycle through custom sessions
  - 1a3. Device graph highlights corresponding user designed session
  - 1a4. Continue on step 4

Related Information:

- User designed sessions are made with the David Session Editor which is a separate device from the Oasis Pro.

### **UC5: Connection Test**

Primary Actor: Device

Precondition: There is an ongoing session

Postcondition: Connection is confirmed

Main Success Scenario:

1. Device enters connection test mode
2. The device's CES mode lights blinks
3. Device graph highlights the connection status (No [7,8] , Okay [4,5,6], Excellent [1,2,3])
4. Device confirms the connection

Extensions:

- 3a) Connection status shows No Connection
  - 3a1. Highlighted section of graph blinks
  - 3a2. Proceed to next step (4) once connection established

### **UC6: Adjust Intensity**

Primary Actor: User

Precondition: There is an ongoing session

Postcondition: The session intensity has been adjusted

Main Success Scenario:

1. User presses the INT UP/DOWN button on the device
2. Device graph lights 1 to 8 for the approximate adjusted intensity level
3. User sets the intensity so that it can just barely be felt

### **UC7: End Session**

Primary Actor: Device, User

Precondition: There is an ongoing session

Postcondition: The device is powered off

Main Success Scenario:

1. The device gradually reduces the CES stimulus
2. The device graph scrolls to 1
3. The device powers off

### **UC8: Low Battery**

Primary Actor: Device

Precondition: Battery is low

Postcondition: Device indicates condition of battery level

Main Success Scenario:

1. Device lights up graph to display battery level

Extensions:

- 1a. Battery is low
  - 1a1. First two bars light up and blink
- 1b. Battery is critically low
  - 1b1. First bar lights up and blinks
  - 1b2. Device ends any running session
  - 1b3. Device can not be used until battery is replaced

### **UC9: Record Therapy**

Primary Actor: User

Precondition: There is an ongoing session

Postcondition: Session data is recorded to saved to treatment history

Main Success Scenario:

1. Device prompts user to type in a username
2. User enters a username
3. User presses "Record Therapy" button
4. Device records session type, duration, intensity, and user's name and saves therapy to treatment history

### **UC10: Replay Therapy**

Primary Actor: User

Preconditions:

Device is powered on

Device is not currently administering therapy

Postcondition: A saved therapy is selected

Main Success Scenario:

1. User selects the Replay Therapy Button
2. Device displays saved treatment history table
3. User uses intensity buttons to cycle through saved sessions
4. Device highlights corresponding session as user cycles
5. User presses Start Session (check mark) button

### **UC11: Connection Lost**

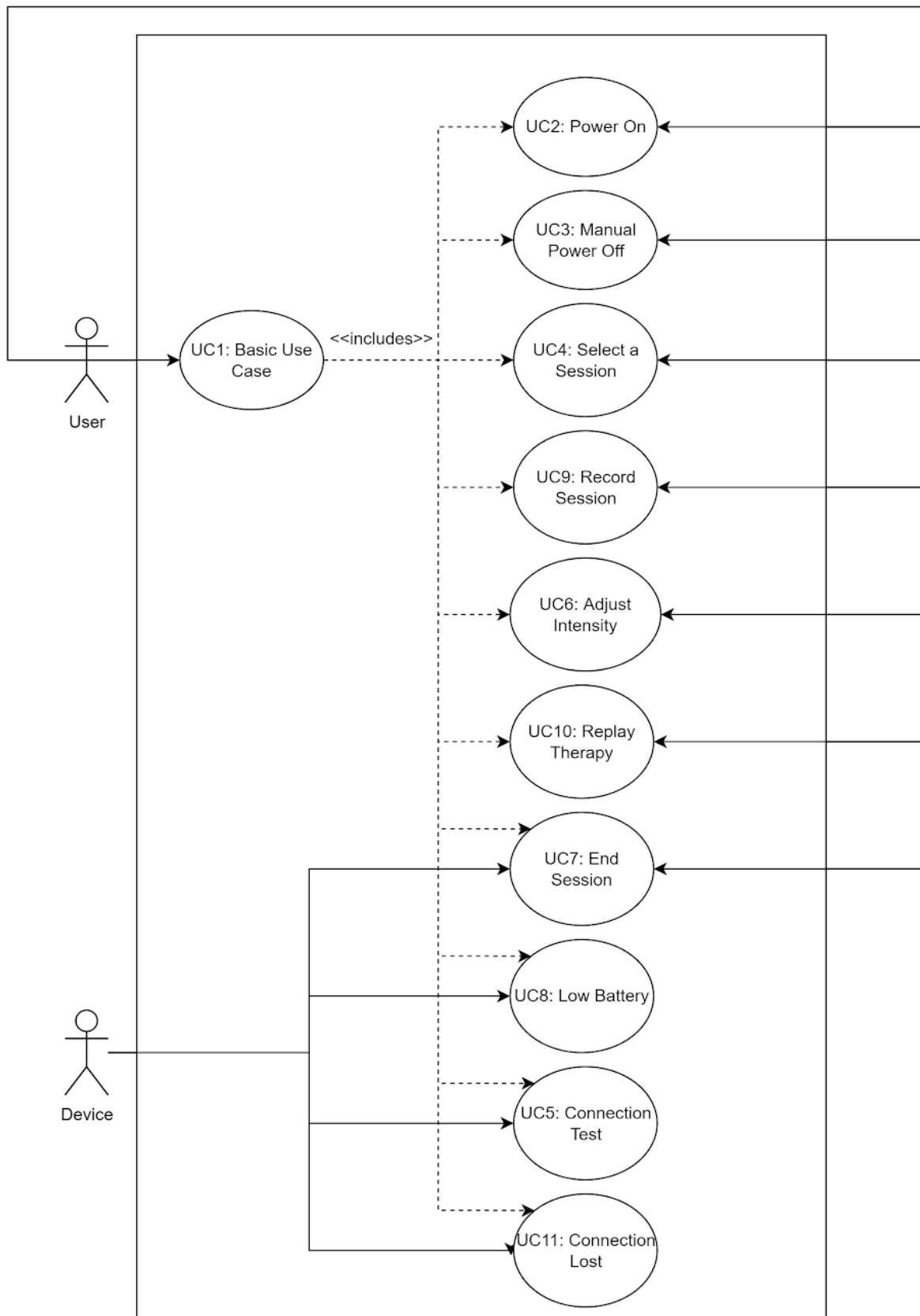
Primary Actor: Device

Preconditions: User disconnects ear clips during a session

Postcondition: Connection is restored and session is resumed

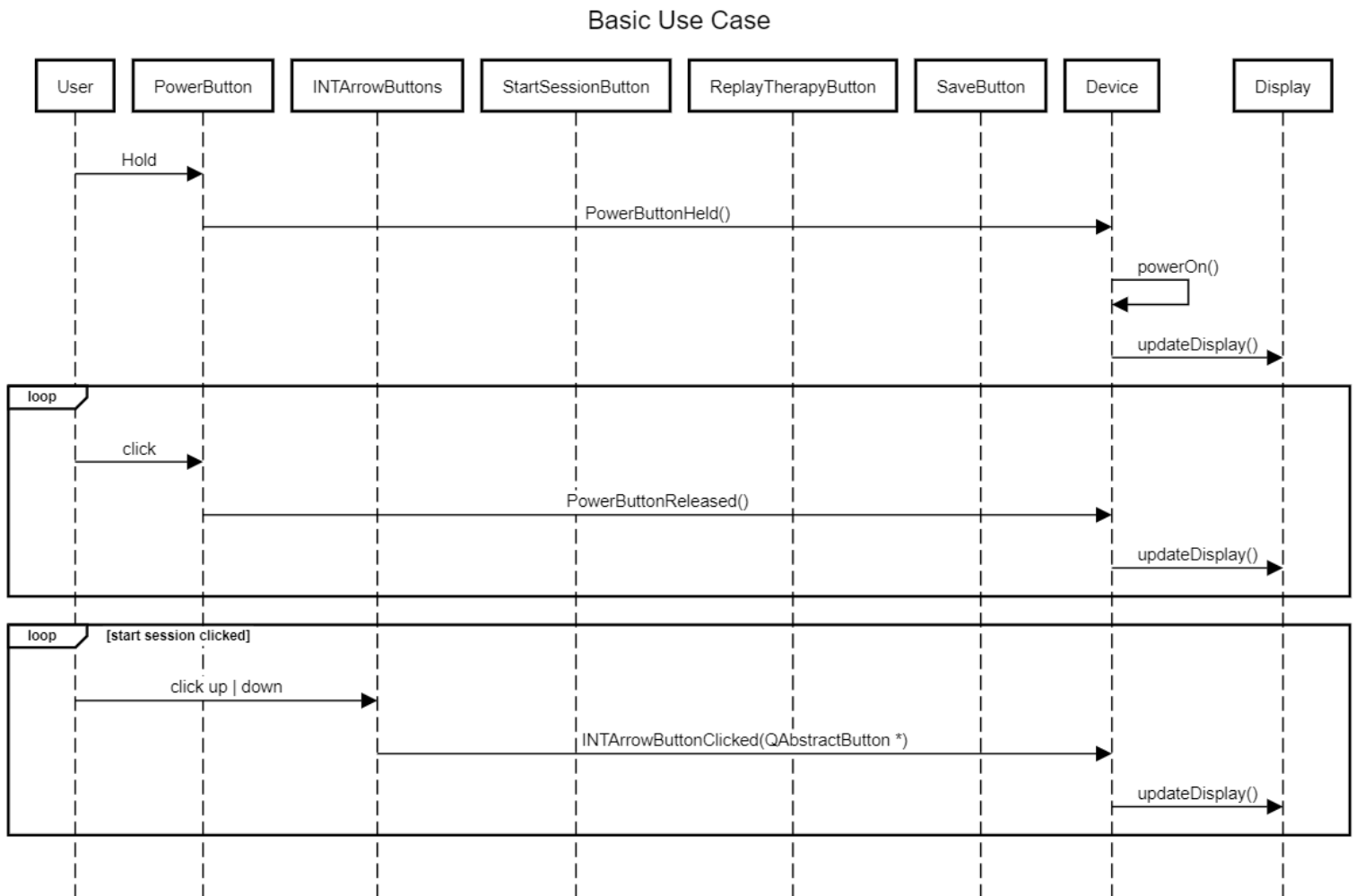
1. Device pauses session
2. Device graph displays no connection [7,8] for a couple seconds
3. Device returns intensity to safe voltage
4. Device graph displays scrolling animation while voltage lowers for 20 seconds
5. Session remains paused until connection is restored

## Use Case Diagram:



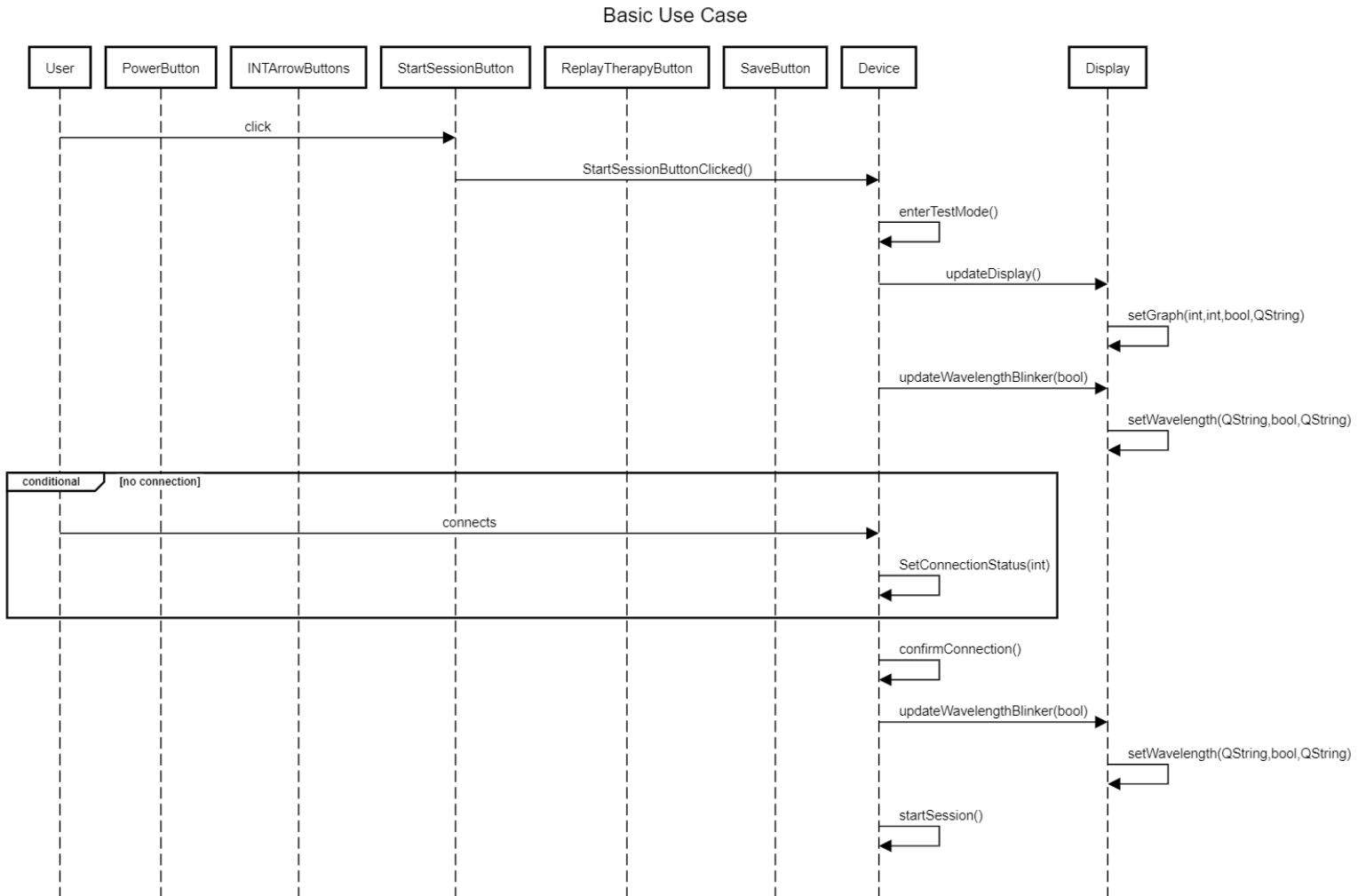
## Sequence Diagrams:

### Sequence Diagram 1.1: Basic Use Case (UC1, UC2, UC4)



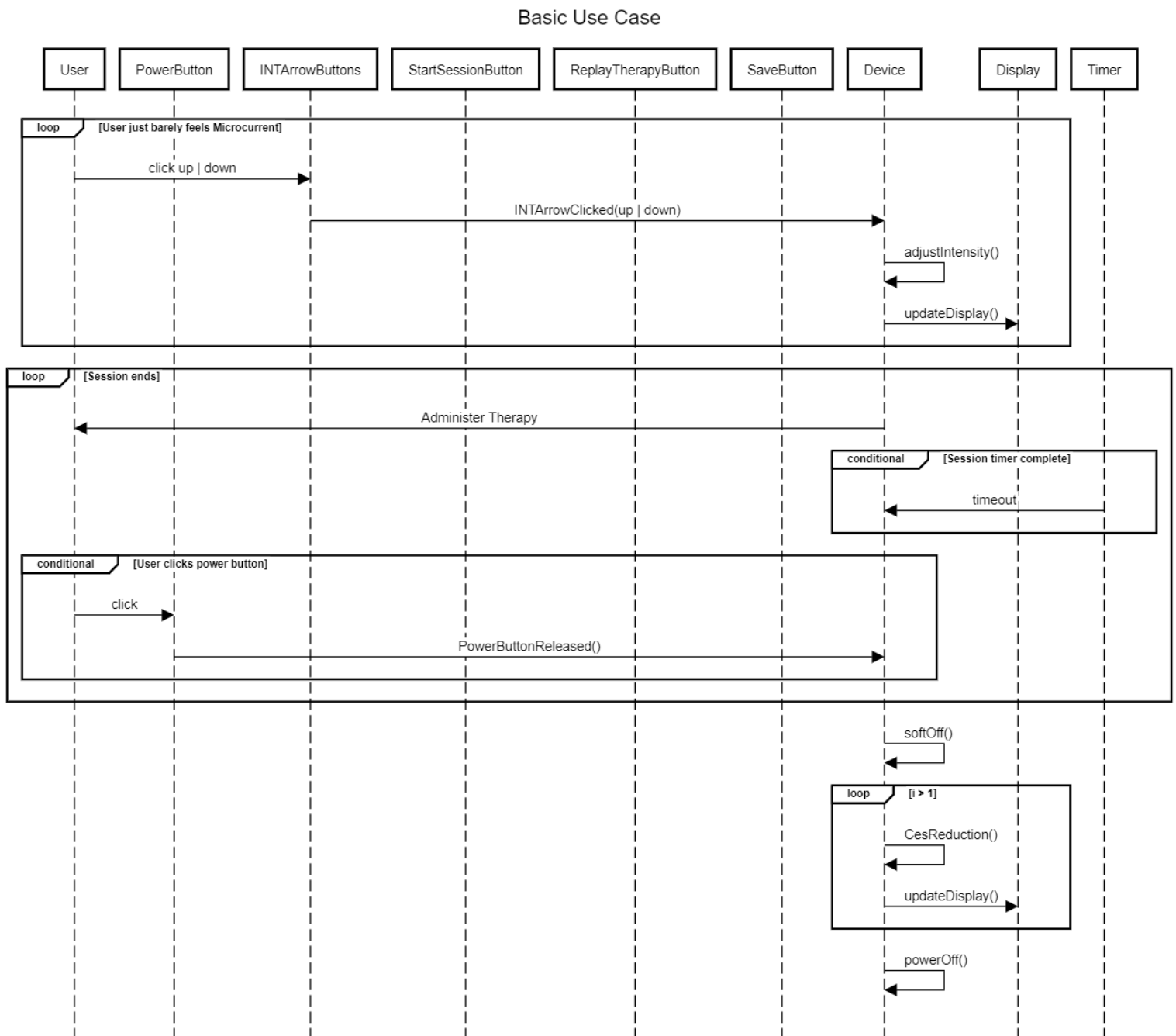
The above diagram shows the user powering on the device, selecting a session group (first loop), and then selecting a session type (second loop).

## Sequence Diagram 1.2: Basic Use Case (UC1, UC5)



The above diagram shows the device performing a connection test before starting the session. The device enters test mode which tells the display to show the connection status on the graph and make the CES mode wavelength lights blink. Once a connection has been confirmed, the wavelength lights stop blinking and the session starts.

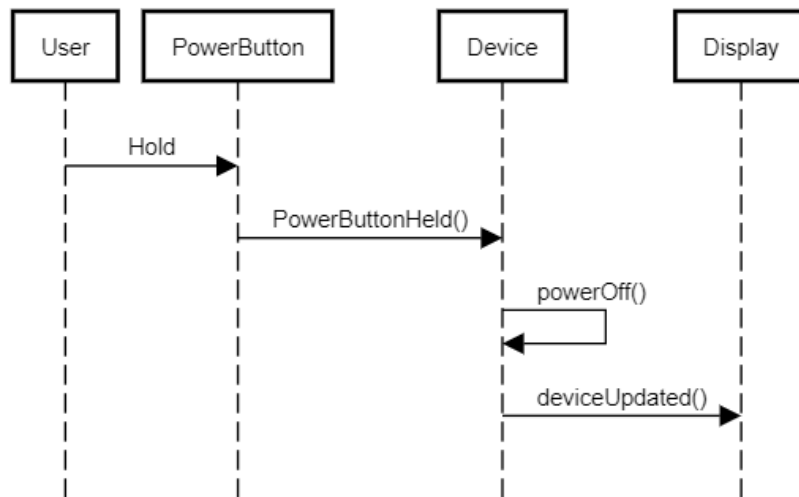
### Sequence Diagram 1.3: Basic Use Case (UC1, UC6, UC7)



The diagram above shows the remaining typical sequence of events until the device powers off. At any time during the session, the user is able to adjust the intensity. The session ends when either the timer runs out or if the user presses the power button. The device then performs a soft off before finally turning off.

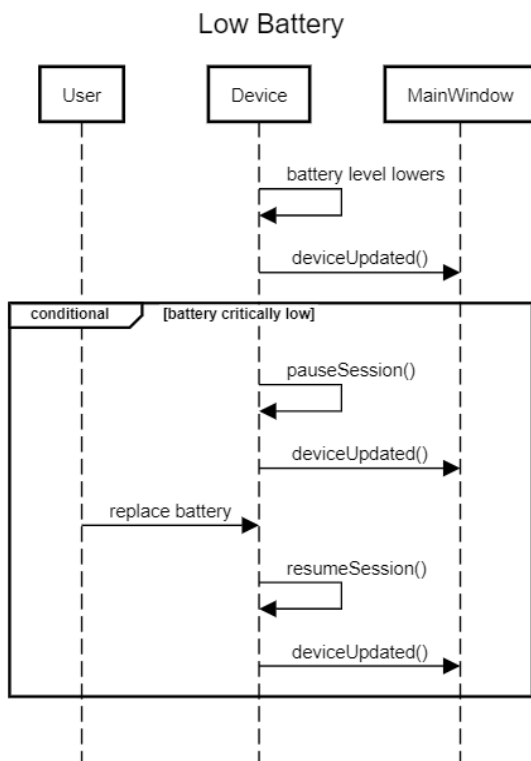


### **Sequence Diagram 2: Manual Power Off (UC3)**



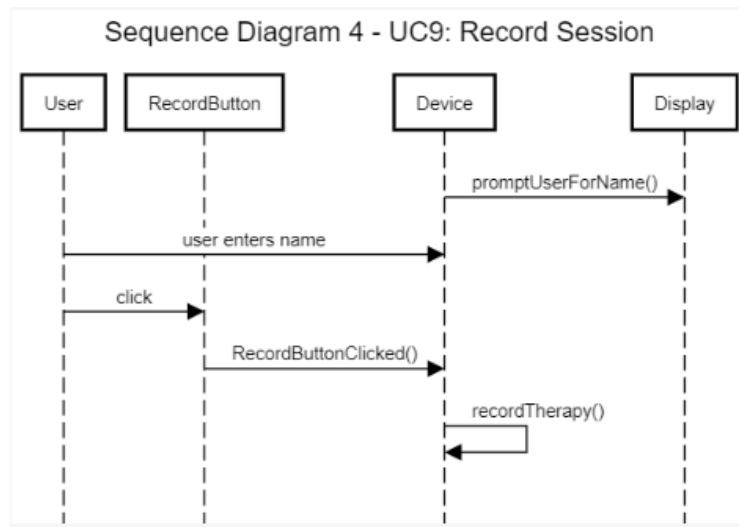
This sequence diagram represents the case where the user manually powers off the device. It starts with the user holding down the power button while the device is powered on, and results in the device being powered off.

### **Sequence Diagram 3: Low Battery (UC8)**



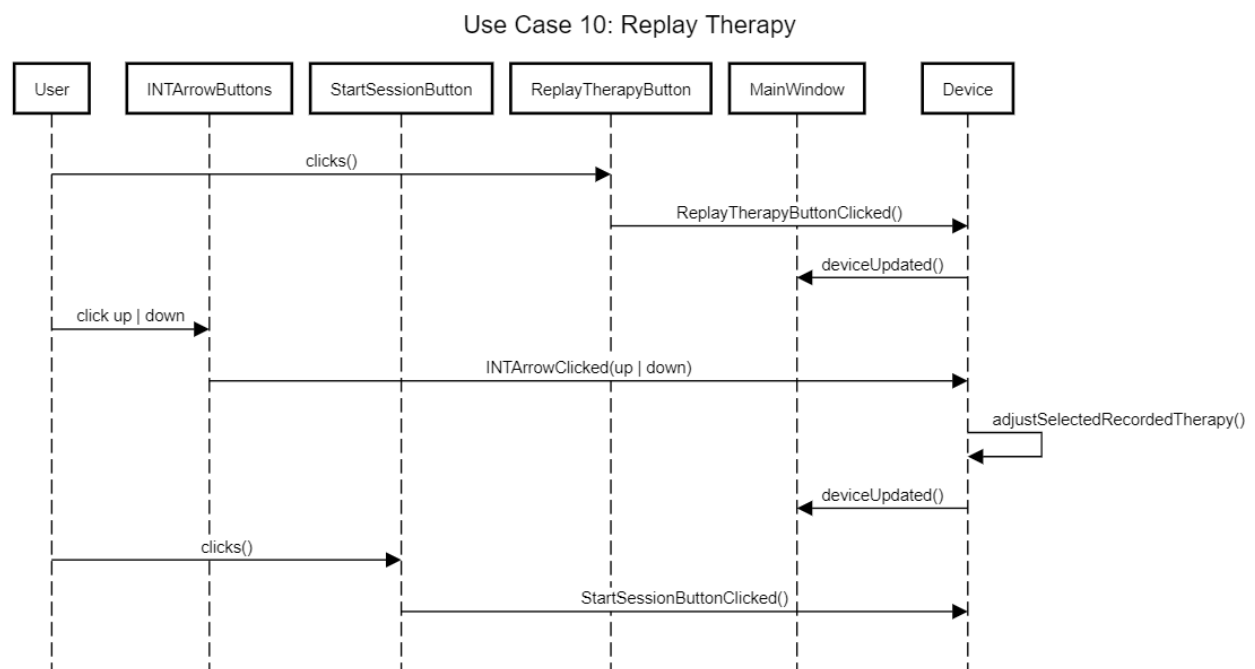
The above diagram starts when the device's battery is getting low and ends with the device's display informing the user and possibly requiring the user to replace the battery. Depending on whether the battery is low (25%) or critically low (12%) the device display will display different output and the device will pause the session until the battery is replaced.

#### **Sequence Diagram 4: Record Session (UC9)**



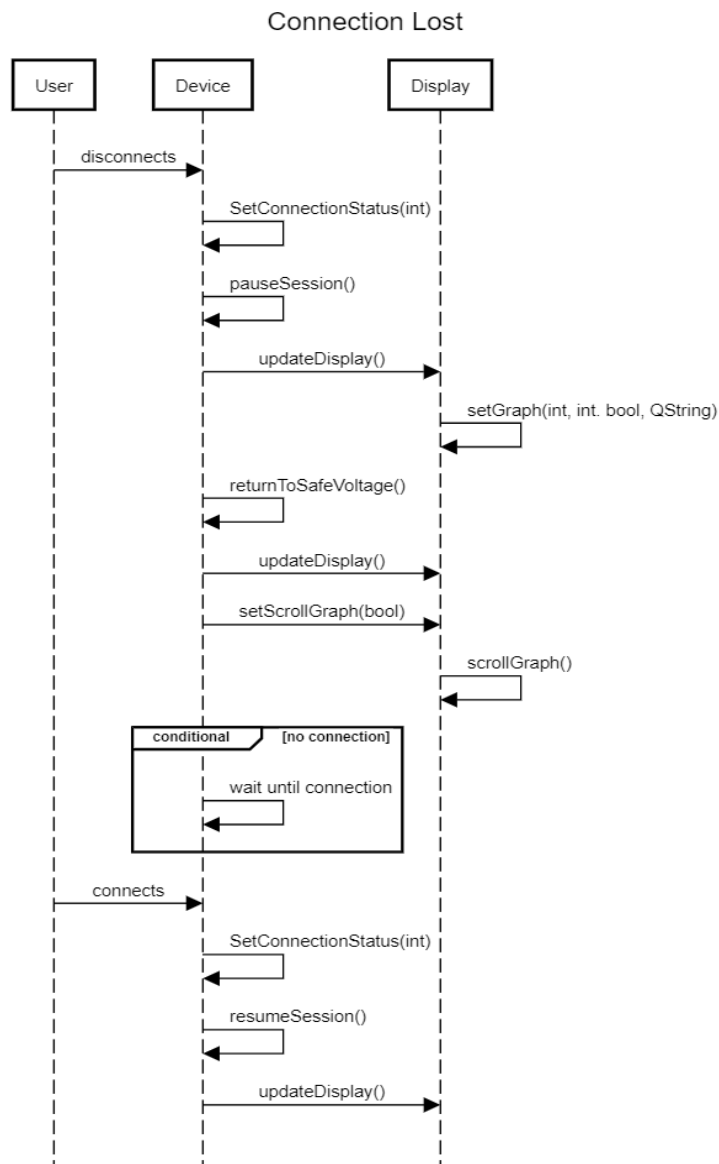
The above sequence diagram represents the most typical sequence of events for when a user wants to record and save their therapy session. The sequence begins with the device prompting the user to enter a username then continues with the user clicking the SaveButton on the device after inputting a username and finally, the sequence finishes with the device saving the user's name, session type, session duration, and session intensity.

#### **Sequence Diagram 5: Replay Therapy (UC10)**



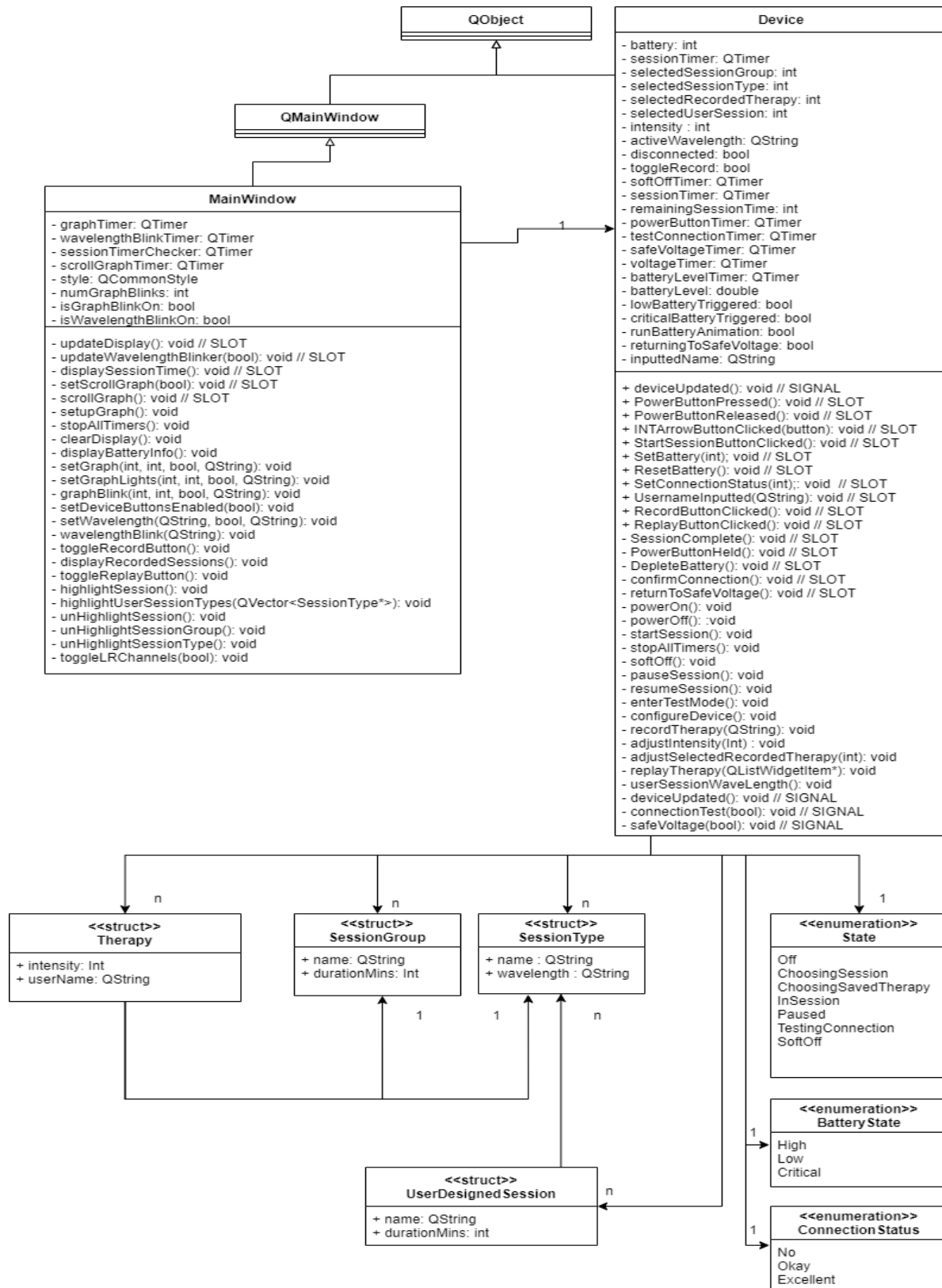
The above sequence diagram represents the sequence of events when a user wants to replay a previous therapy. The user will first click on the Replay Therapy button, then the device will update with the display accordingly. The user will then can use the up and down buttons to cycle through the saved therapies, once again the device will be updated, once a user clicks on start button the chosen saved therapy will begin.

## Sequence Diagram 6: Connection Lost (UC11)



The diagram above shows the case where the user disconnects during a session. The device first pauses the session and then notifies the display which updates the graph to show that there is no connection. The device then starts returning to a safe voltage level and notifies the display which shows a scrolling animation on the graph. The device resumes the session once the user has reconnected.

## UML Class Diagram 1: Overview



We use the Observer pattern, where the MainWindow is observing the Device Subject. Enum variables are used for different states of the device, the battery, and the connection status. We make use of structs to group related data into composite types like SessionGroups or recorded Therapies which don't have behaviour.

### **Traceability Matrix:**

<b><u>ID</u></b>	<b><u>Requirement</u></b>	<b><u>Related Use Case(s)</u></b>	<b><u>Design Elements</u></b>	<b><u>Implementation</u></b>	<b><u>Testing</u></b>
1	Device can be powered on	UC1, UC2	Sequence Diagram 1.1	Device, MainWindow	If the device is off: 1. Press and hold the Power button for 1 second
2	Device can be manually powered off	UC3	Sequence Diagrams 1.3, 2	Device, MainWindow	If the device is on: 1. Press and hold the Power button for 1 second If the device is in a session 1. Press and hold the Power button for 1 second OR 1. Click the Power button to perform a Soft Off
3	Device monitors battery level	UC1	Class Diagram	Device	While the device is on: 1. Use device normally (choosing sessions, recording sessions etc) 2. Watch the battery LCD decrease
4	Battery depletes based on usage	N/A	Class Diagram	Device	While the device is on: 1. Use the device in its various states (Choosing Session, In Session, Paused) 2. Compare battery depletion based on usage (session, intensity, connection) 3. Battery depletes more in session the worse the connection and the higher the intensity
5	Device warns user when low battery	UC8	Sequence Diagram 3	Device, MainWindow	While the device is on: 1. Use the device normally or make use of the battery level slider on the right 2. When the battery depletes below 25% the Graph blinks yellow on the bottom two bars 3. When the battery depletes below 12% the Graph blinks

					red on the bottom bar
6	User has ability to select a session	UC1, UC4	Sequence Diagram 1.1	Device, MainWindow	<ol style="list-style-type: none"> <li>1. Turn the device on, it is now in the Choosing Session state</li> <li>2. Click the Power button to cycle through Session Groups</li> <li>3. Click the INT Arrow buttons to cycle through Session Types</li> <li>4. Click the Start Session (check mark) button to start</li> <li>5. Now that the session has started use the INT Arrow buttons to select an intensity</li> </ol>
7	Selecting a session involves choosing between the 3 groups	UC4	Sequence Diagram 1.1	Device, MainWindow, SessionGroup	<p>While the device is in Choosing Session state:</p> <ol style="list-style-type: none"> <li>1. Click the Power button to cycle through the Session Groups</li> </ol>
8	Selecting a session involves choosing between the 4 types	UC4	Sequence Diagram 1.1	Device, MainWindow, SessionType	<p>While the device is in Choosing Session state:</p> <ol style="list-style-type: none"> <li>1. Click the INT Arrow buttons to cycle through the Session Types</li> </ol>
9	The device performs a connection test before starting a session	UC1, UC5	Sequence Diagram 1.2	Device	<ol style="list-style-type: none"> <li>1. Select a connection level with the slider on the right</li> <li>2. Bring the device into one of the Choosing Session or Choosing Saved Therapy states</li> <li>3. Start a session</li> </ol> <p>The Device will only start the session if the connection is Okay or Excellent and displays this status on the Graph</p>
10	User has ability to alter intensity during session	UC1, UC6	Sequence Diagram 1.3	Device, MainWindow	<ol style="list-style-type: none"> <li>1. Start a session</li> <li>2. Use the INT Arrow buttons to select an intensity, displayed on the graph</li> </ol>
11	Device pauses session if connection to user is lost	UC11	Sequence Diagram 6	Device	<ol style="list-style-type: none"> <li>1. Start a session</li> <li>2. Use the Connection Strength slider to bring the connection to None, thus disconnecting the user</li> </ol>

12	Device pauses if battery is critically low	UC8	Sequence Diagram 3	Device	<ol style="list-style-type: none"> <li>1. Use the device normally or make use of the battery level slider on the right until the battery is below 12%</li> </ol>
13	Session ends after specified amount of time	UC1, UC7	Sequence Diagram 1.3	Device	<ol style="list-style-type: none"> <li>1. Start a session, session time corresponds to group</li> <li>2. Observe the timer on the right displaying how many “minutes” are remaining in the session</li> <li>3. Wait for the full session length to observe Soft Off</li> </ol>
14	User has ability to record a therapy to treatment history	UC9	Sequence Diagram 4	Device, MainWindow, Therapy	<ol style="list-style-type: none"> <li>1. Start a session</li> <li>2. Enter username in the username text field</li> <li>3. Press the Record Therapy button</li> </ol>
15	User has ability to replay a recorded therapy	UC10	Sequence Diagram 5	Device, MainWindow, Therapy	<p>With a therapy already saved to Treatment History</p> <ol style="list-style-type: none"> <li>1. Power the device on</li> <li>2. Press the Replay Therapy button</li> <li>3. Use the INT Arrow buttons to select highlight a specific therapy</li> <li>4. Press the Start Session (checkmark) button</li> </ol>
16	Device correlates different users to their recorded therapies	UC10	Sequence Diagram 4	Device, MainWindow, Therapy	<ol style="list-style-type: none"> <li>1. Start a session</li> <li>2. Enter username in the username text field</li> <li>3. Press the Record Therapy button</li> <li>4. Observe username included in the Treatment history table</li> </ol>
17	User is notified when connection is lost	UC11	Sequence Diagram 6	MainWindow	<ol style="list-style-type: none"> <li>1. Start a session</li> <li>2. Use the Connection Strength slider to bring the to None, thus disconnecting the user</li> <li>3. Observe Graph and CES icons showing lost connection</li> </ol>
18	Display continuously shows state of device	NA	Sequence Diagrams 1.1, 1.2, 1.3, 2, 3, 4, 5, 6	MainWindow	<ol style="list-style-type: none"> <li>1. Use the Device normally</li> <li>2. Observe the display updating to reflect state of device</li> </ol>

## **Testing**

### **UC1: Basic Use Case (includes UC2, UC4, UC5, UC6, UC7)**

Test requirements: #1 → #3 → #6 → #9 → #10 → #13

### **UC3: Manual Power Off**

Test requirements: #2

### **UC8: Low Battery**

Test requirements: #5 → #12

### **UC9: Record Session**

Test requirements: #14

### **UC10: Replay Therapy**

Test requirements: #15

### **UC11: Connection Lost**

Test requirements: #11 → #17