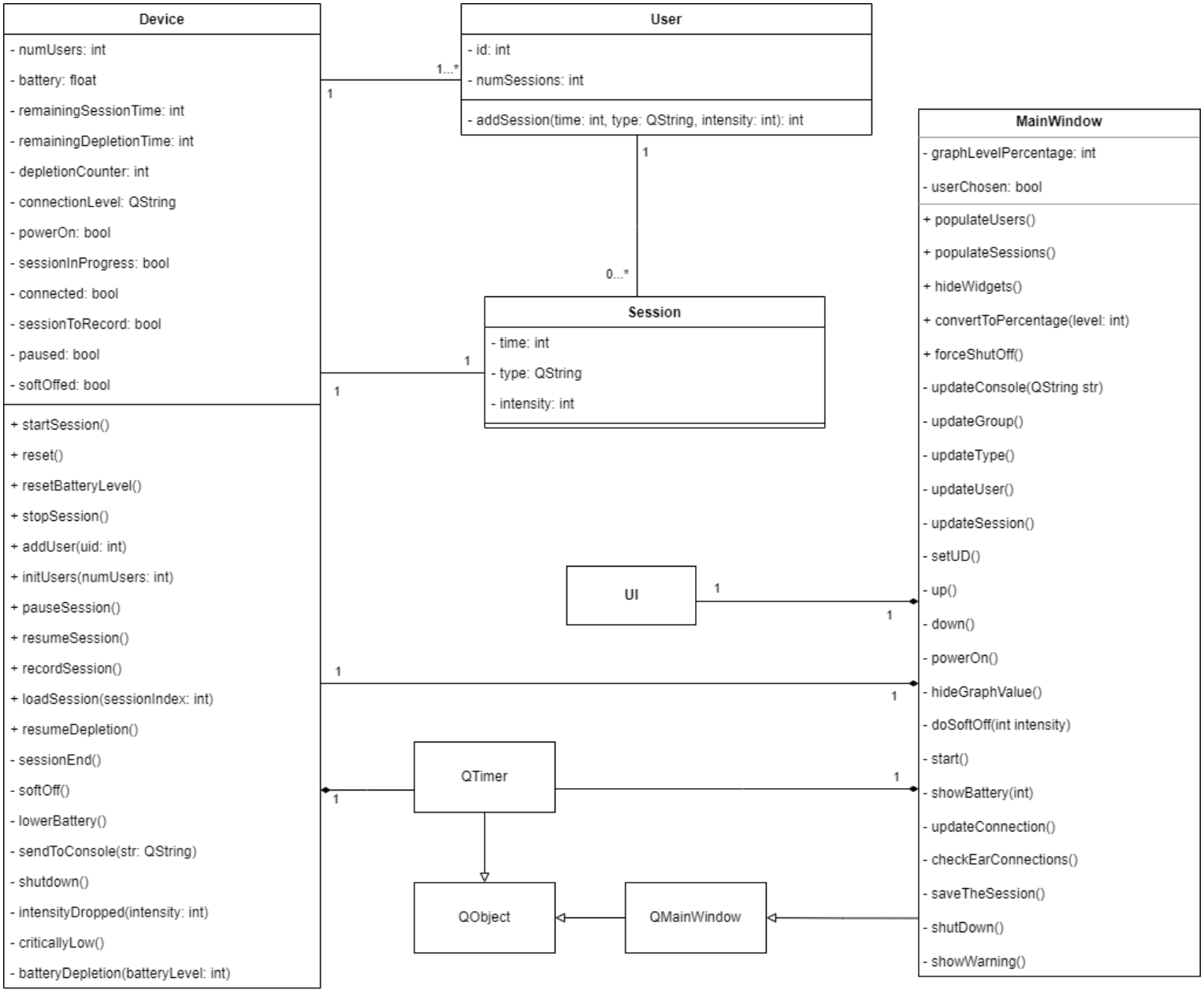
# Main Use Case

***Use Case 1:*** **Using the Oasis++**
***Primary Actor:*** Device user
***Precondition:*** User has device on hand
***Minimal guarantees:*** The battery is critically low and the device warns the user
***Postcondition:*** The device works as intended 
***Main Success Scenario:***

1) The device user clicks/presses the power button and turns on the device
2) The device briefly displays the battery level to the user
3) The device user selects their user id through the users combo box
4) The device user chooses a session group (25, 45, User Designated) and a session type (delta, theta, alpha, beta) by clicking their corresponding radio buttons
5) The device user connects the device to their ear lobes
6) The device user starts the session by clicking the start button
7) The device performs a connection test (Low, Medium, High)
8) The connectivity is displayed on the device
9) The session begins and briefly displays the battery level every 10 seconds
10) The device user adjusts the intensity using the up and down buttons (defaults at 0)
11) The session ends after its designated time expires
12) The device turns off softly (**Soft-Off** slowly drops intensity until it is 0, then powers off device)

***Extensions***:
1a) Battery is critically low (less than 12%)
    1a1) Warns user
4a) User chooses user designated group
    4a1) Types in a specified time in the text edit
    4a2) Click the set button to set the time
4b) The user selects a saved session from the combo box
    4b1) The device user sets the saved session to the current session
6a) The user checks the save session checkbox to record the session under their user id
6b) One or both earclip(s) are detached
    6b1) Session cannot start until both earclips are attached
7a) The connectivity is low
    7a1) Warns the user that they can't start a session on a low connection
9a) Connection status drops to low during session, warns user of low connection
9b) One or both earclip(s) are detached
    9b1) Session is paused until clips are reattached
9c) Battery gets critically low during the session
    9c1) Warns the user, ends the session, and powers off the device
11a) User ends session early by pressing power button
    11a1) The device shuts off immediately if the user ends session earlier

## UML Diagram

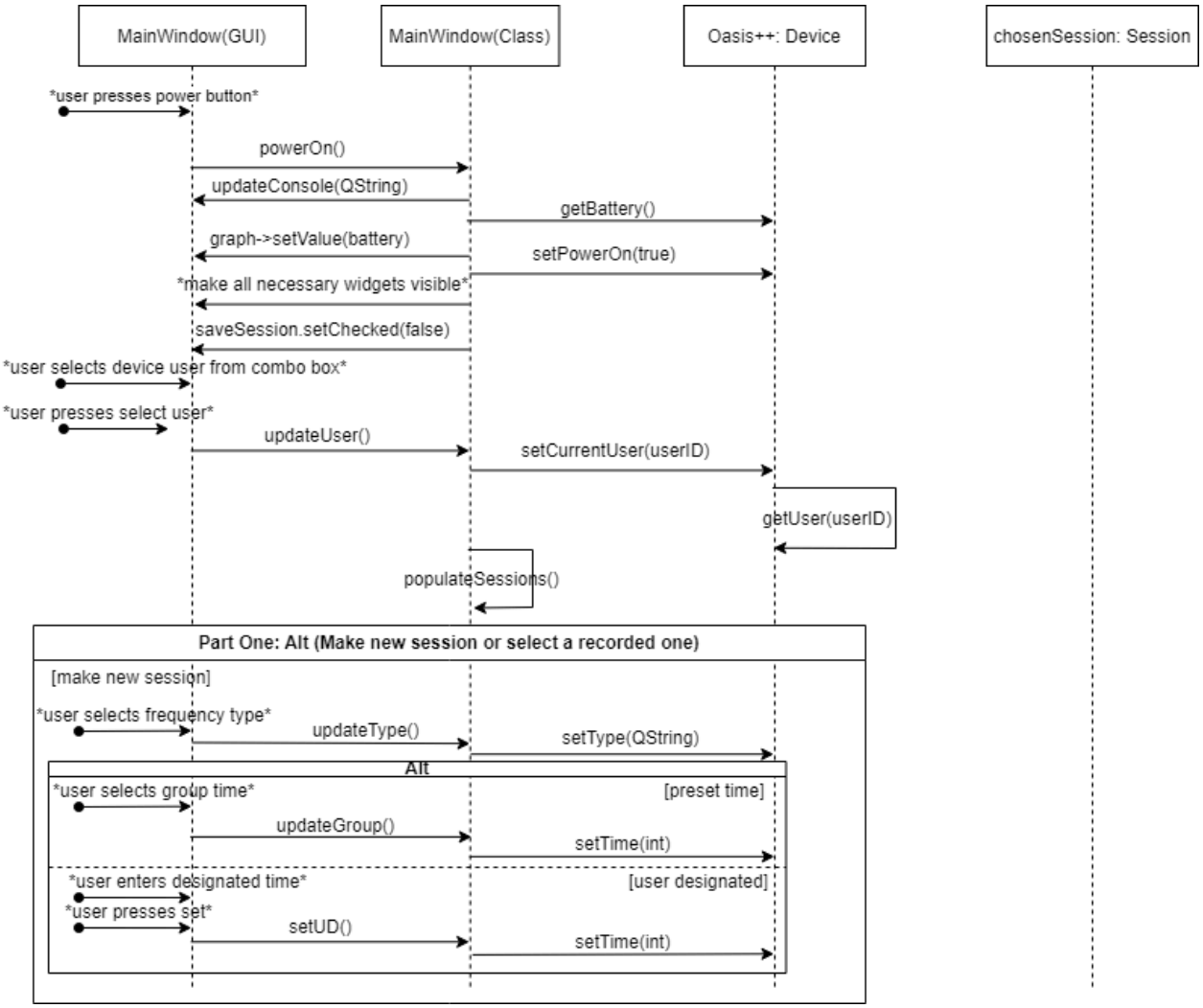



- We made extensive use of bool variables to capture the device's state. This state is then altered through the ui's interaction with the mainwindow class.
- The main functionalities were divided into the device to control the backend object handling and the MainWindow to handle the device user's interaction with the GUI.
- Many internal functions within Session, User, and Device classes were privatized to encapsulate functionality and be handled by the device internally.
- QTimers were utilized to simulate the passage of time observed in the actual physical device.
- The main abstracted objects were represented as classes within the code.

- The battery level was represented as a float value depicting the percentage of battery life left, with a maxim value of 100.
- The battery level was decreased as a function of intensity (as a scaled subtracted value) and time ( since the depletion continues as the QTimer runs).

# Sequence Diagrams

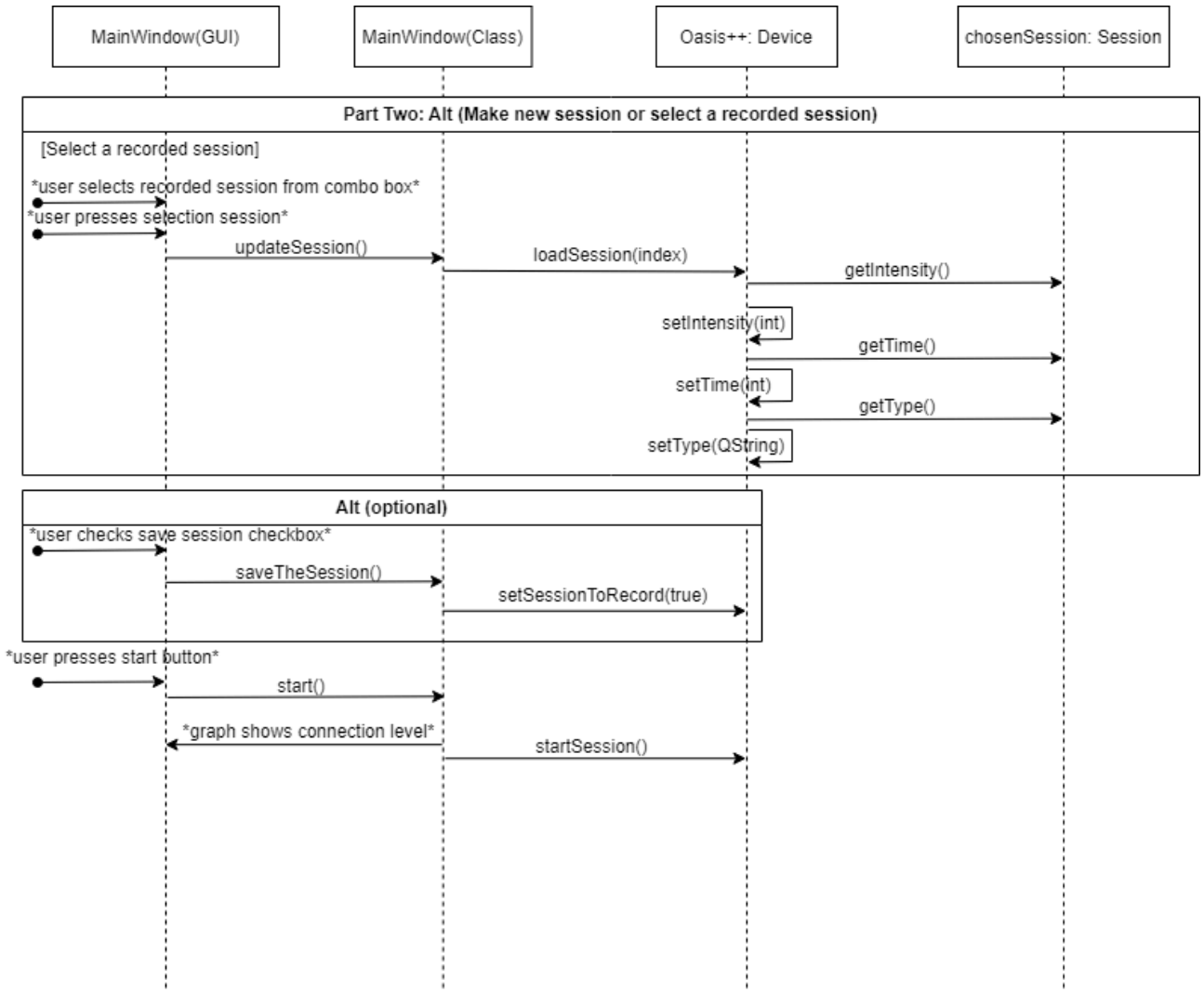
**Basic Use Case 1-1 Sequence Diagram**




**Note**:

- A high quality pdf can be found in the final project zip
- This sequence diagram shows the first set of steps the user does to start using the device
- It showcases the most important function calls and an example of the parameters they would take
- It is meant to showcase how a user could potentially use the device, there are other ways to test the device
- This sequence diagram shows the sequence of steps the program makes to create a new session
- **The part one alt shows the first condition which is making a new session. The second part of the alt statement is in the 1-2 basic use case diagram which is the condition that the user decides to start a previously recorded session. We split the alt statement since there was not enough space.**
- The alt statement within the part one alt is used to differentiate between the user choosing a preset time and a user designated time

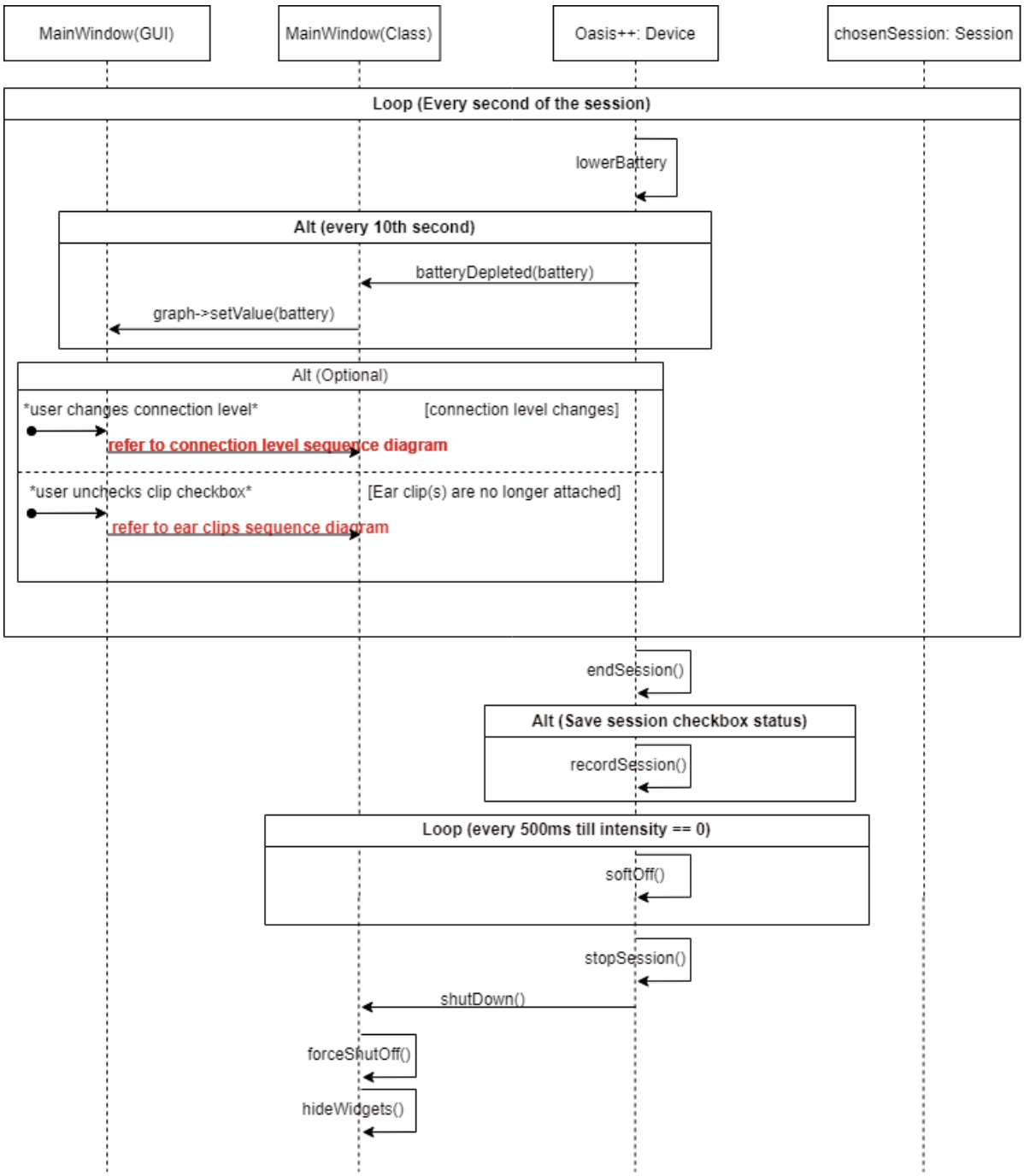
- **Basic Use Case 1-2 Sequence Diagram**




**Note**:

- A high quality pdf can be found in the final project zip
- This sequence diagram shows the first set of steps the user does to start using the device
- It showcases the most important function calls and an example of the parameters they would take
- It is meant to showcase how a user could potentially use the device, there are other ways to test the device
- The part two alt statement shows the series of steps the the program takes if the user chooses a previously recorded session
- Optional alt statement is an optional thing the user can do, which is ticking the save session checkbox
- Also, it shows the session starting (whether it was newly made or a previously recorded session)

**Basic Use Case 1-3 Sequence Diagram**

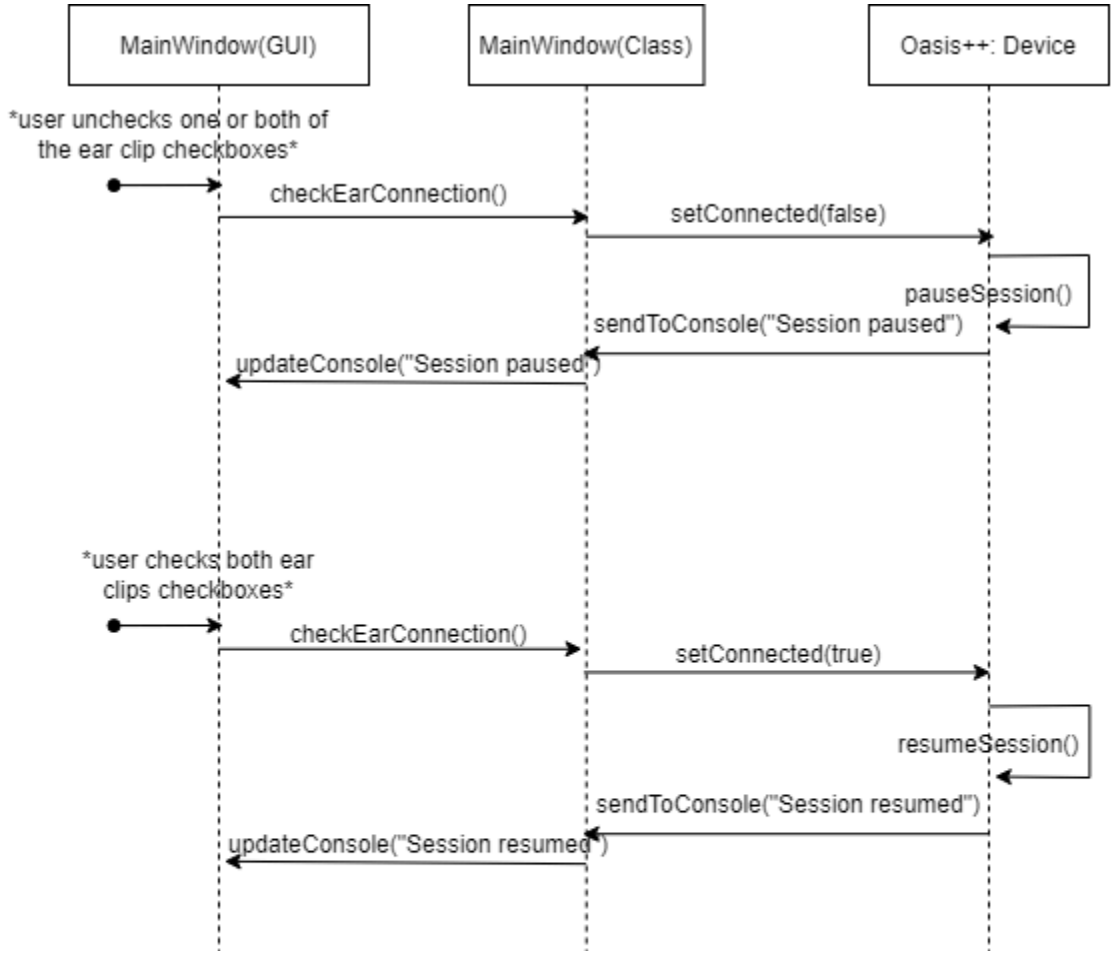



**Note**:

- A high quality pdf can be found in the final project zip
- This sequence diagram shows the first set of steps the user does to start using the device
- It showcases the most important function calls and an example of the parameters they would take
- This sequence diagram shows the sequence of steps the program takes the deplete the battery/power level and the process of a session ending and a soft-off taking place
- The loop at the top shows the battery depleting every second and the graph showing the battery being depleted every 10th second of the session

- The optional alt statement inside the loop shows the possibility of the user decrease the connection or completely losing the connection by unticking the one or both of the ear clip checkboxes.
- The soft of slot is being called every 500 ms to incrementally decrease the intensity, which is displayed to the GUI through the graph

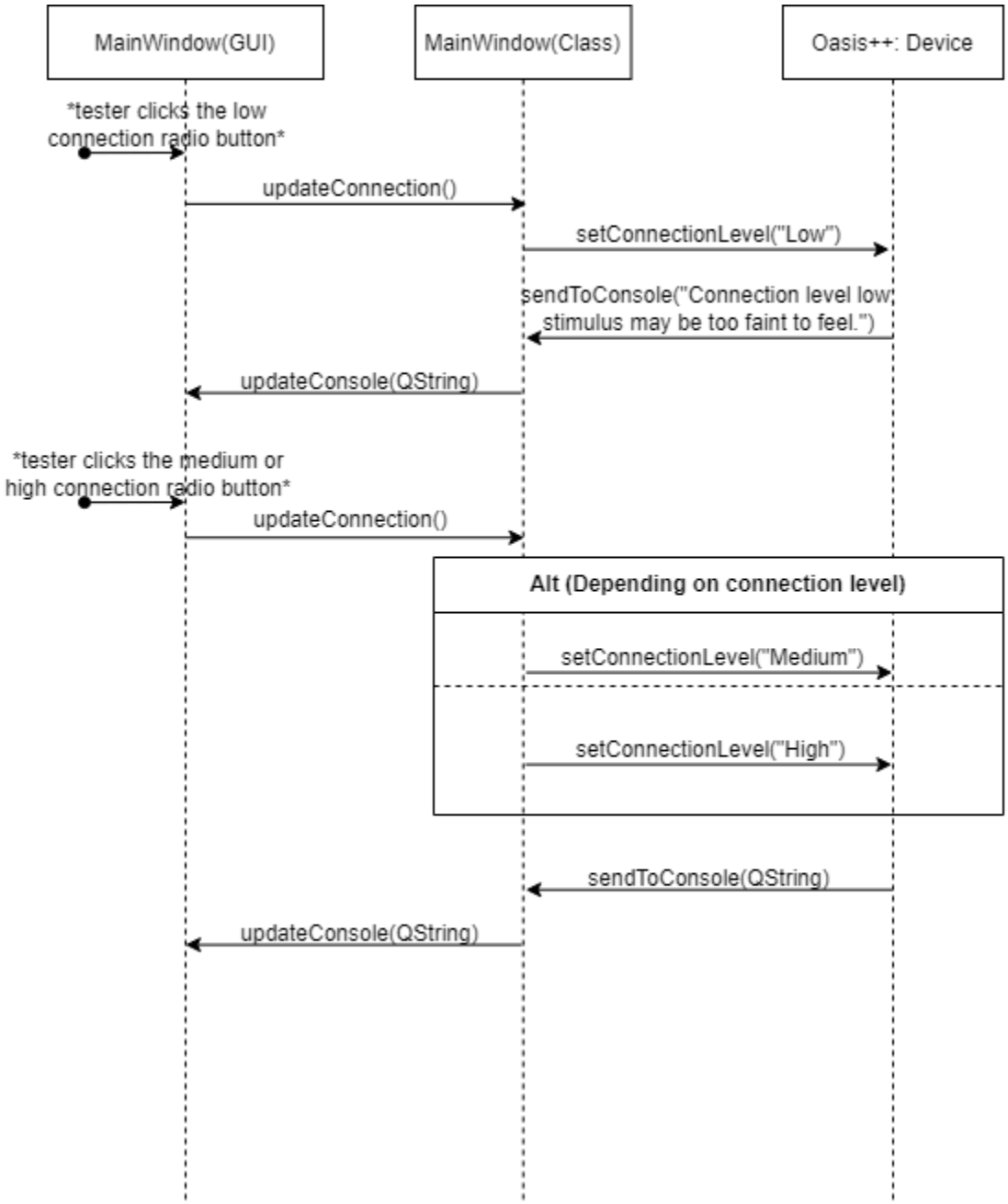
**Ear Clip Detached (Complete Connection Loss) Case Sequence Diagram**




**Note:**

- A high quality pdf version is available in the project zip
- This sequence diagram displays the sequence of events following an earclip becoming detached
- The diagram makes reference to the different functions (including their parameters) the software would use to respond to a disconnect
- It is meant to demonstrate how the device functions when encountered with a complete loss of connection from an ear clip being detached

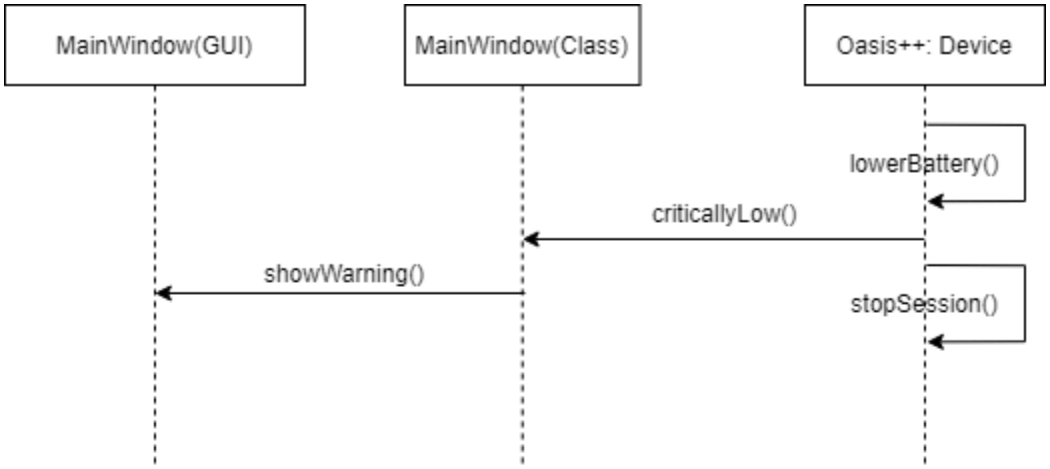
**Connection Level Drops Sequence diagram**




**Note:**

- A high quality pdf version is available in the project zip
- This sequence diagram displays the sequence of events following a drop in the connection level
- The diagram makes reference to the different functions (including their parameters) that the software would use to respond to a disconnect
- It is meant to demonstrate the response of the device when encountered with a drop in connection level

**Critically Low Sequence Diagram**

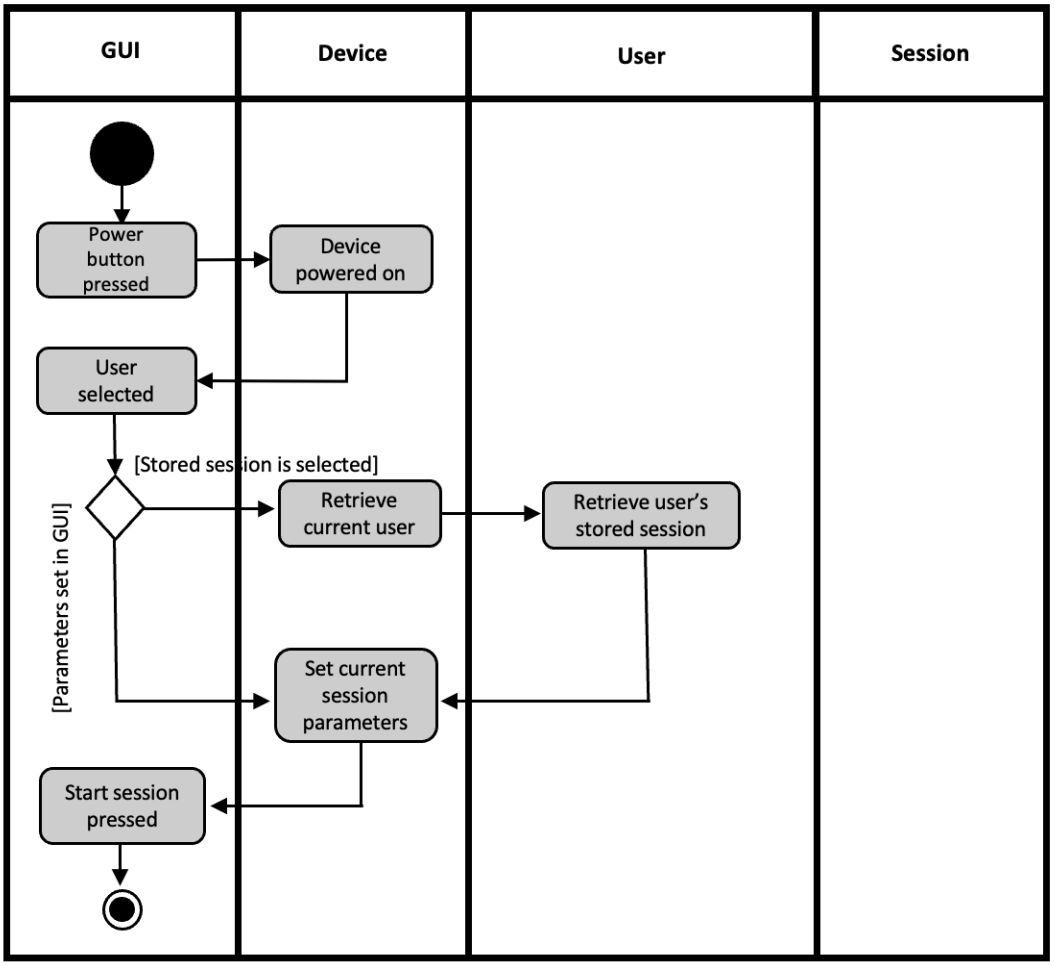



**Note:**

- A high quality pdf version is available in the project zip
- This sequence diagram shows how the program would react to a critically low (<= 12%)

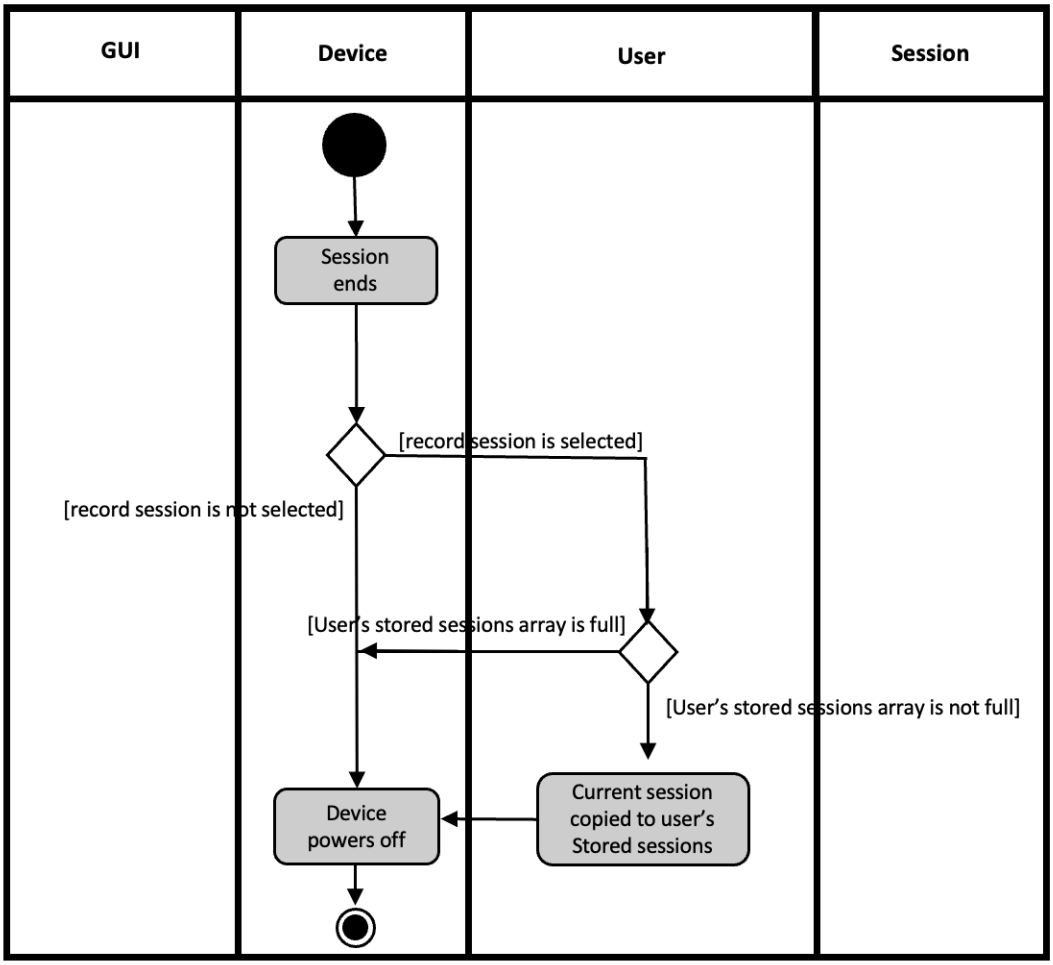
## Activity Diagrams

# Activity Diagram 1: Selecting Stored Session



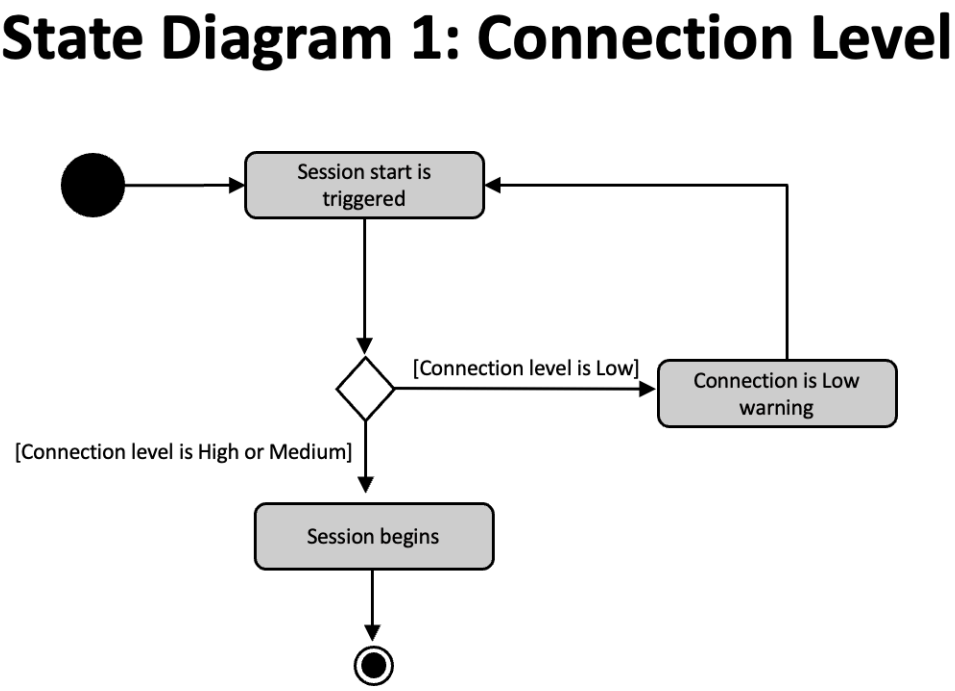

Activity diagram 1 depicts the difference in behavior of the program depending on whether the parameters of the current session is set by a previously saved session or those set within the GUI itself.

# Activity Diagram 2: Session recording



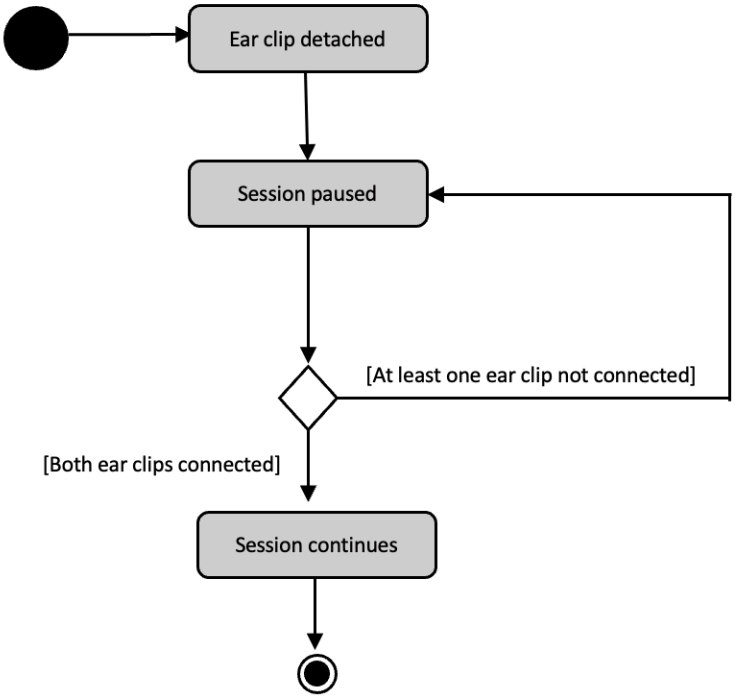

Activity diagram 2 depicts the difference in behavior of the program depending on whether the session has been set to be recorded. If the session ends and the user can store more sessions, then the current session is stored, otherwise the device ends normally.

## State Diagrams



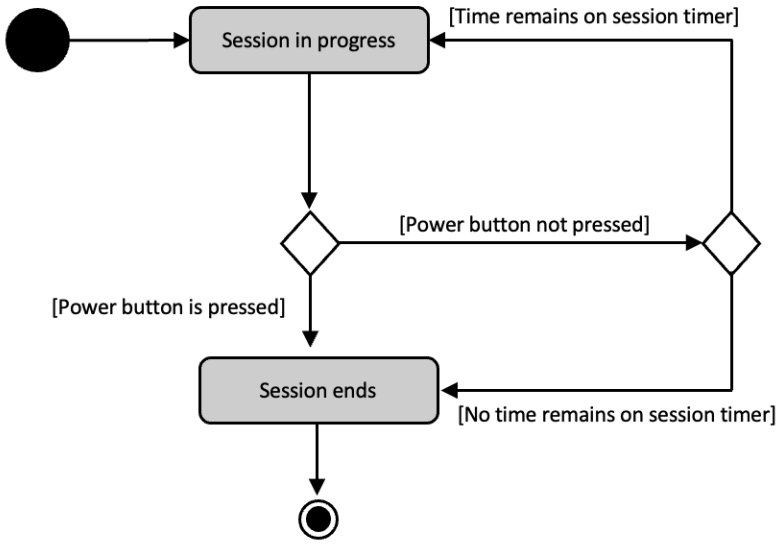

State diagram 1 depicts the difference in the progression of the device's state depending on whether the connection level is Low, or Medium or High when a session is triggered.

# State Diagram 2: Ear Clips Detached




State diagram 2 depicts the difference in the progression of the device's state depending on whether the earclips become detached in the course of a session.

# State Diagram 3: Early Power Off




State diagram 3 depicts the difference in the progression of the device's state depending on whether the power button is pressed early during the session.

# Traceability Matrix

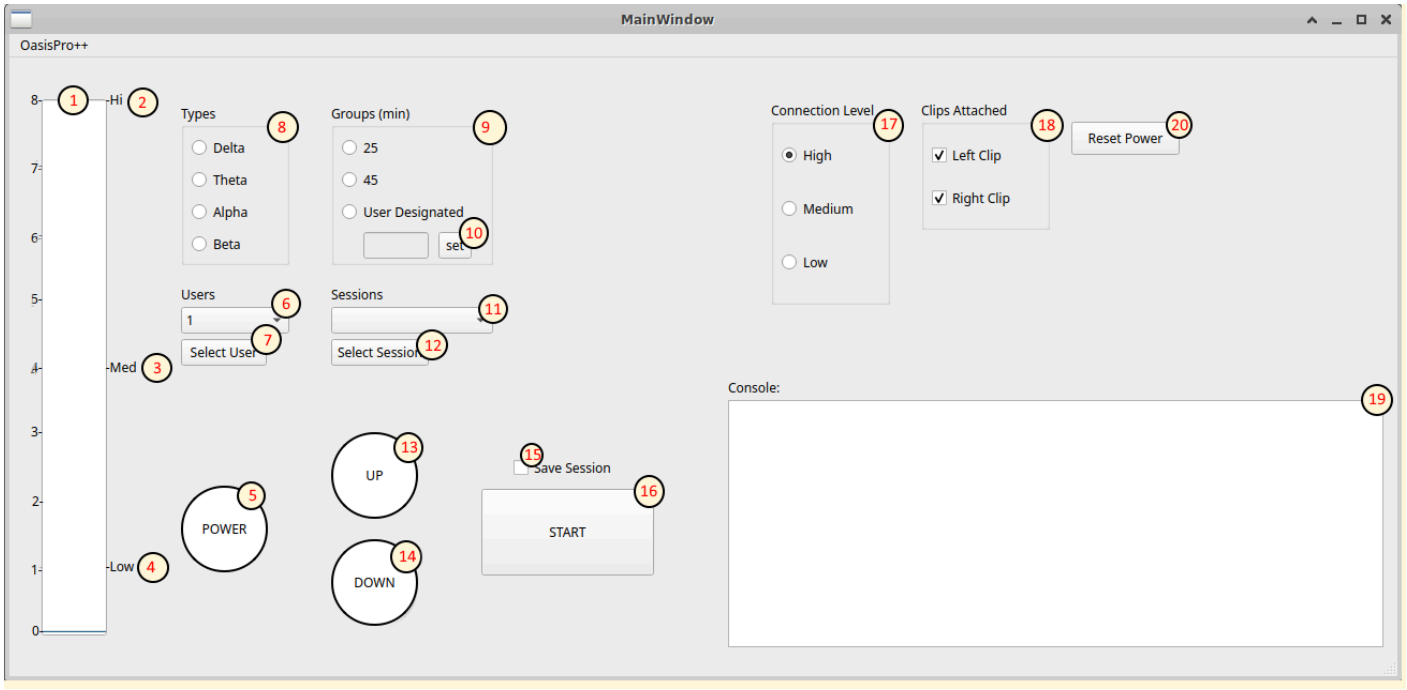
| REQUIREMENTS | RELATED USE CASE | FULFILLED BY | IMPLEMENTED BY | TESTED BY |
|---|---|---|---|---|
| 👍 | 🌴 | ⚡ | 🖥️ | :) |
| Press and hold the power button until the device turns on. | UC1 | mainwindow, device | The “Power” button on the GUI. When this is clicked, the widgets will appear on the GUI and the device will be powered on. | Clicking the pushButton labeled “power”. |
| The graph will briefly display the battery level when you first turn on the unit. | UC1 | mainwindow | The progress bar on the GUI will briefly display the battery level for 1.5 seconds using qTimers. | Clicking the pushButton labeled “power”, the battery level will be displayed on the graph for 1.5 seconds. |
| To turn off the Oasis Pro at any time, press and hold the power button until the unit shuts off | UC1 | mainwindow, device | The power button on the GUI. When this is clicked while the device is on, the widgets will be hidden and the device will be powered off. | Clicking the pushButton labeled “power” at any time while the device is powered on. A message will be displayed on the console and the GUI widgets will be hidden to simulate the device being off. |
| All sessions end with Soft Off™ | UC1 | mainwindow | The progress bar on the GUI will display the current intensity level and decrease one level at a time until it reaches 0 to simulate a soft off. | Select all the session values then start the session. Increase the intensity during the session to any level above 1. When the timer runs out for the session, the intensity of the session will decrease one level at a time to simulate a soft off. |
| The battery level is also monitored and displayed periodically while the session is running. | UC1 | mainwindow, device | Every 10 seconds, a signal is sent to the mainwindow class from the device class to deplete the battery which will also display the battery level on the progress bar. | Start a session with any time higher than 10. The battery level will be displayed on the graph every 10 seconds. |
| When the battery level is critically low, the graph will display a single (1) blinking bar. | UC1 | mainwindow, device | When the progress bar on the GUI reaches 1, the device battery level will be updated and send a signal to display a critically low message in the console of the mainwindow. | Start a session with a user designated time of 120, any type, and full intensity. The battery will drain and by the end of the session, the device will forcefully power off and warn the user in the console that the battery is critically low. |
| Your simulation should handle battery depletion as a function of length of therapy, intensity, and connection to skin. | UC1 | mainwindow, device | The progress bar on the GUI will display the current battery level which will be depleted by the device depending on the intensity, time, and connection to skin | Start a session with any preferred value. While the session runs, the battery will be drained depending on the selected intensity, connection to skin, and length of therapy. |
| The Oasis Pro has 3 standard session groups (20 minute, 45 minute, and user designated) | UC1 | mainwindow | The radioButtons on the GUI are grouped together in a groupBox. There is a groupGroupBox to group the group radioButtons together. | Displayed on the GUI. |
| Press and release the power button to switch between groups. The lit group icon will change. | UC1 | mainwindow, device | The groups are displayed on the GUI as radioButtons. The user will have to select between the group radioButtons. The mainwindow will update the device’s group value. | After powering on the device, select a radioButton from the groups. The button will indicate that it has been clicked. |

| | | | | |
|---|---|---|---|---|
| Press the INT or to highlight a session type. (Delta, Theta, Alpha, Beta) | UC1 | mainwindow, device | The session types are displayed on the GUI as radioButtons. The user will have to select between the type radioButtons. The mainwindow will update the device's type value. | After powering on the device, select a radioButton from the types. The button will indicate that it has been clicked. |
| Press the select button to start the session. | UC1 | mainwindow, device | The "Start" button on the GUI can be clicked to start a session once all the values are selected. The device will be notified that a session has started. | After selecting all the session values, click the pushButton labeled "Start" to start the session. |
| At the start of each session, the Oasis Pro checks for an electrical connection by entering a test mode. | UC1 | mainwindow, device | Before the mainwindow starts a session, it will check the connection level. This value is sent to the device to check as well. | After starting a session, the graph will display a connection test to show the connection level of the user to the device. This can be changed on the admin side of the interface with the connection level radioButtons. |
| The graph will display the status of the connection | UC1 | mainwindow | The progress bar on the GUI will display the connection level as either high, medium, or low. | After starting a session, the graph will display a connection test to show the connection level of the user to the device. This can be changed on the admin side of the interface with the connection level radioButtons. |
| Once a connection has been confirmed, the display will go blank. | UC1 | mainwindow | The mainwindow only displays the battery level on the progress bar for 1.5 seconds at the beginning of the session. | The connection level will be displayed on the graph after starting a session for 1.5 seconds. |
| The intensity may be adjusted as soon as the connection test ends. | UC1 | mainwindow, device, session | There are up and down buttons on the GUI which can be clicked when the session begins. These will increase the intensity of the device's current session. | After the connection test ends, the user can click the buttons labeled "up" or "down" to adjust the intensity of the running session. |
| If the ear clips are disconnected, the Oasis Pro will pause the session and wait for the ear clips to be reconnected. | UC1 | mainwindow, device | The admin side of the interface has checkboxes for the clips attached. If either of these are unchecked, a signal will be sent to mainwindow to check ear connection and then update the connection of the device. | While a session is running, the user can disconnect the earclips but unchecking the clips attached checkboxes on the admin side of the interface. |
| To increase the intensity of the stimulus, press the "up" button | UC1 | mainwindow, device, session | There is an up button on the GUI which can increase the intensity of the current running session. This progress bar increases to display this change and the value for the device's current session is updated. | While a session is running, the user can click the pushButton labeled "up" which will increase the intensity of the running session. The console will indicate this change as well as the graph. |
| To decrease the intensity, press the down button. | UC1 | mainwindow, device, session | There is a down button on the GUI which can decrease the intensity of the current running session. This progress bar decreases to display this change and the value for the device's current session is updated. | While a session is running, the user can click the pushButton labeled "down" which will decrease the intensity of the running session. The console will indicate this change as well as the graph. |
| The graph lights 1 to 8 only show an approximate | UC1 | mainwindow | The progress bar on the GUI displays an intensity level from 1 to 8. This is | While a session is running, the user can click either the up or down button to adjust |

| | | | | |
|---|---|---|---|---|
| intensity level. | | | shown whenever the up or down button is pressed or at the end of a session when the device is in soft off. | the intensity. This change will be displayed on the graph to the left. |
| Users can choose to record a therapy and add to treatment history. | UC1 | mainwindow, device, | A checkbox is displayed on the GUI which can be checked if the user wants to save the session and its current values. The device will be notified if the user wants to save a session. | Before starting a session or during a session, the user can choose to save the session by clicking the save session checkbox to check it. If this is checked, the current running session will be saved. |
| Therapy session information to be recorded: session type, duration and intensity level (if changed during therapy choose last selected intensity level). | UC1 | mainwindow, device, user, session | If the save sessions checkbox is checked, then the mainwindow will notify the device. The device will add the current session to the current user's list of sessions. | If the save session checkbox is checked, then the session and its current values will be saved to the current user's list of saved sessions. |
| Replay: users can replay selected treatments from history of treatments | UC1 | mainwindow, device, user, session | There is a sessions comboBox on the GUI which will be populated with a list of sessions once the user has been selected. The session is obtained from the user's list of sessions if there are any. By clicking the select session button, it will set the values of the current session to whatever the selected session's values are. | When the device is powered on, the user can select a device user from the userComboBox and then once that is selected, the sessionsComboBox will be populated. The user can then select a saved session (if any) from the comboBox and click the "select session" button to set the current session to the saved session. All the information will be displayed on the GUI and the user will be able to start this saved session. |
| Support different users. | UC1 | mainwindow, device, user | There is a users comboBox on the GUI which will be populated with a list of device users. These users are initialized at the beginning of the mainWindow and obtained from the device's list of users. | When the device is powered on, there will be a userComboBox which will be populated with a fixed number of users for the device. To select a user, the "Select User" button underneath the combobox will have to be clicked to set the current device user. |

# How To Test

**Note** that minutes on our device is actually seconds (this is so you don't have to wait 25 more or less minutes to test things)




The above is our application's GUI, this is what you will interact with to test the various scenarios of the oasis device 🏝. As you can hopefully see, the various buttons and displays are numbered 1 through 20 for your convenience 🙂. I will reference these numbers when outlining how to test our device below.

You can open our project file in qt creator, and run it. The GUI will pop up.

## Test Main Use Case:

Turn on the device by pressing the power button (**5**), the device will briefly show you the power level on the graph (**1**). Choose the user by picking a user from the drop down menu (**6**), then hit select user (**7**). The console (**19**) displays the current user. Next, select the session type (**8**) and group (time) from **9**. Refer to the test below for user designated time instructions. Press the start button (**16**) to start the session. The device performs a connection test, the result of this test is displayed on the graph (**1**), and will be: Low (**4**), Med (**3**), or Hi (**2**)**.** If Medium (med) or High (hi), the session begins (refer to connection level test for more info). **The intensity defaults at 0**, you must adjust the intensity using **13** for up, or **14** for down (maximum is 8, minimum is 0). Nothing is felt at intensity 0. The graph (**1**) displays the current intensity as you change it. The console (**19**) informs that the intensity is updated. Every 10 seconds the graph (**1**) displays the current battery. The session ends after the set time has expired. The device performs a soft off,

slowly lowering the intensity until it reaches 0 and powers off. The graph (**1**) displays this drop in intensity.

## Test User Designated Time:

Follow the main use case test, but when you select a group (time) from (**9**) select user designated. Enter in your desired session time (will be in seconds for testing purposes) and hit set (**10**) to set the time. Continue as the main use case test does.

## Test Saving a Session:

Before or during a session check the save session box (**15**). Whenever the next (if checked before a session) or current session ends, it will be saved to the current user. The console (**19**) tells you when a session has been recorded. It will also inform you if the current user has reached the maximum number of saved sessions. You can follow the main use case test, and check this box (**15**) once you power on the device, or at some point during the session, to test this functionality.

## Test Replaying a Saved Session:

Power on the device (**5**), then choose a user from the drop down menu (**6**) who has previously saved a session. Select that user (**7**)**,** the session drop down menu (**11**) will populate with that user's saved sessions. Choose from this drop down menu and hit select session (**12**). You can now press the start button (**16**) to start the session.

## Test Earclips Detaching:

You can use **18** to simulate the left or right earclips detaching. By default these boxes are checked meaning the earclips are connected. To detach an ear clip uncheck one or more of these boxes. Before starting a session, you can uncheck one or both of these boxes, and try to start the session by pressing **16**. The session wont start if any earclip is disconnected, the console (**19**) will tell you this, it will also inform you when there is no connection. Recheck the unchecked boxes (in **18**), and press start again (**16**). This time the session will begin because both clips are attached.

To test in session behavior ensure a session is in progress (you can follow the main use case test instructions). While in session, uncheck one or both boxes in **18**. The console (**19**) will inform you there is no connection and that the session has paused. To continue the session, recheck the unchecked boxes (in **18**). The console will inform you of the reconnection, and that the session has resumed.

## Test Connection Level:

The device performs a connection test at the start of each session. Use **17** to set the connection level. You can do this during a session, or before one. Follow the main use case test but before you start the session set the connection level to “Low”. The console will inform you of the change. Try to start the session by pressing **16**, the connection test will show “Low” (**4**) on the graph (**1**), and the console will inform you that you must have a higher connection to start a

session. Set the connection level to “Medium” or “High” on **17**, then press start again. The connection test will occur, and the graph will show either “Med” (**3**) or “Hi” (**2**) depending on your selection. The session will begin as normal.

To test in session behavior ensure you are in a session (you can follow the main use case test instructions). While in session, set the connection level to any level on **17**. The console will inform you of this change, with additional information on how the change in connection level may affect how the intensity feels. “High” is perfect connection strength, whereas with “Medium” you may need to turn the intensity up to feel the same as “High”. On “Low” the stimulus may be too faint to feel.

## Test Critically Low Battery:

After all this testing the battery should be getting low. If not, start a long session (to set a custom time refer to test user designated time) with intensity set to 8. This should drain the battery somewhat quickly. Refer to the graph (**1**) to see the battery every 10 seconds as it drains. If you have not started a session yet, start one, you can follow the main use case test for this as well. Once the battery is <= 12% (around 1 on the left hand side of the graph) the console (**19**) will inform you that the battery is critically low, and that you should replace it before use. The console will also tell you the session has stopped, and the device will power off. If you power on the device again before resetting the battery (**20**) the console will inform you that the battery is critically low, however the device won't power off. In an effort to squeeze out the remaining juice of the battery start a session (follow main use case test). You will feel only for a moment the sweet electricity, until the console informs you yet again that the battery is critically low, the session stops, and the device powers off. The console tells you that you must replace the battery before use, listen to it and hit the rest power button (**20**). The battery is now full and you can use the device as normal.