COMP3004 Group 36 Final Project

Use case:

<table>
<tr><td>Name</td><td>Perform a Neureset therapy session</td></tr>
<tr><td>Primary Actor(s):</td><td>The user who uses the device for a therapy session</td></tr>
<tr><td>Stakeholder and Interests:</td><td>
<table>
<tr><td>User</td><td>Wants to successfully complete a Neureset therapy session to improve brain function and cognitive performance.</td></tr>
<tr><td>Neureset device manufacturer</td><td>Wants the device to function properly and provide effective therapy to the user.</td></tr>
<tr><td>Regulatory agencies</td><td>Ensuring that the Neureset device is safe and effective for its intended use.</td></tr>
<tr><td>Insurance companies</td><td>If Neureset therapy is covered by insurance, these companies have an interest in the device's effectiveness and cost-efficiency.</td></tr>
<tr><td>Researchers and academics</td><td>They may have an interest in studying the effectiveness of Neureset therapy and its underlying mechanisms.</td></tr>
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</td></tr>
<tr><td>Precondition(s):</td><td>1. The Neureset device is fully charged.
2. The EEG headset is properly connected to the handheld device.
3. The therapist has placed EEG headset on the user’s head, ensuring proper contact with all 21 electrodes.</td></tr>
<tr><td>Success guarantee(s)</td><td>The Neureset device completes a full therapy session, delivering treatment to all 21 EEG sites.</td></tr>
<tr><td>Main success scenario:</td><td>1. The user selects "new session" from the device menu.
2. The device initiates the session and begins establishing a baseline for all 21 EEG sites concurrently.
3. The device proceeds to the first EEG site, establishes a baseline average frequency over a period of one minute, and delivers the one-second treatment.
4. The device moves to the next EEG site and repeats step 3 until all 21 sites have received treatment.
5. The device establishes a final baseline for all 21 EEG sites.
6. The device ends the session and displays a "session complete" message.</td></tr>
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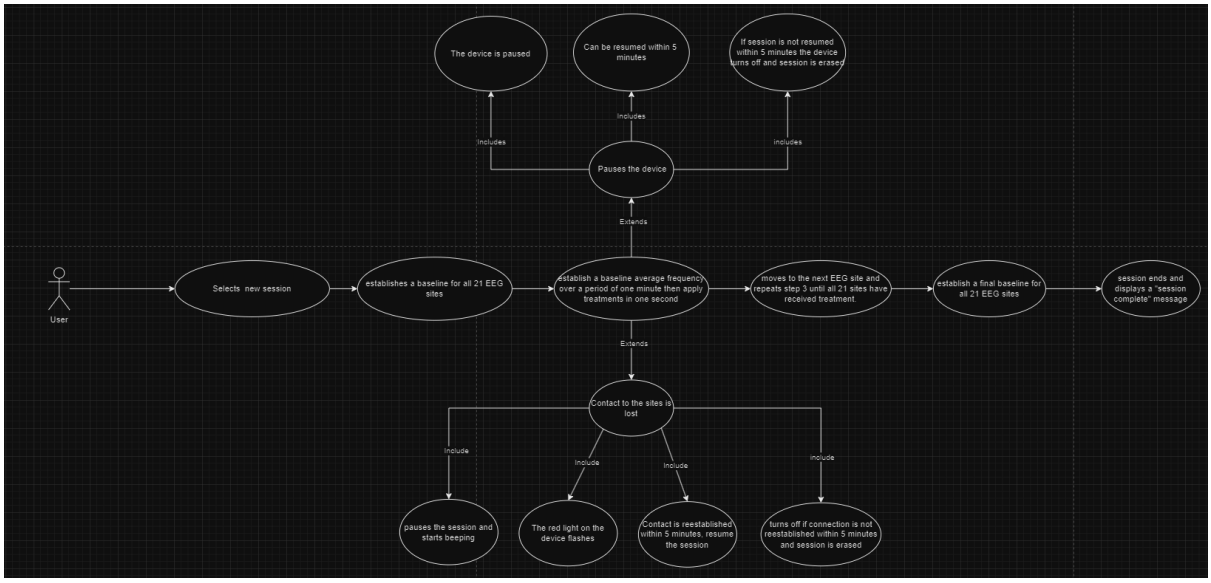
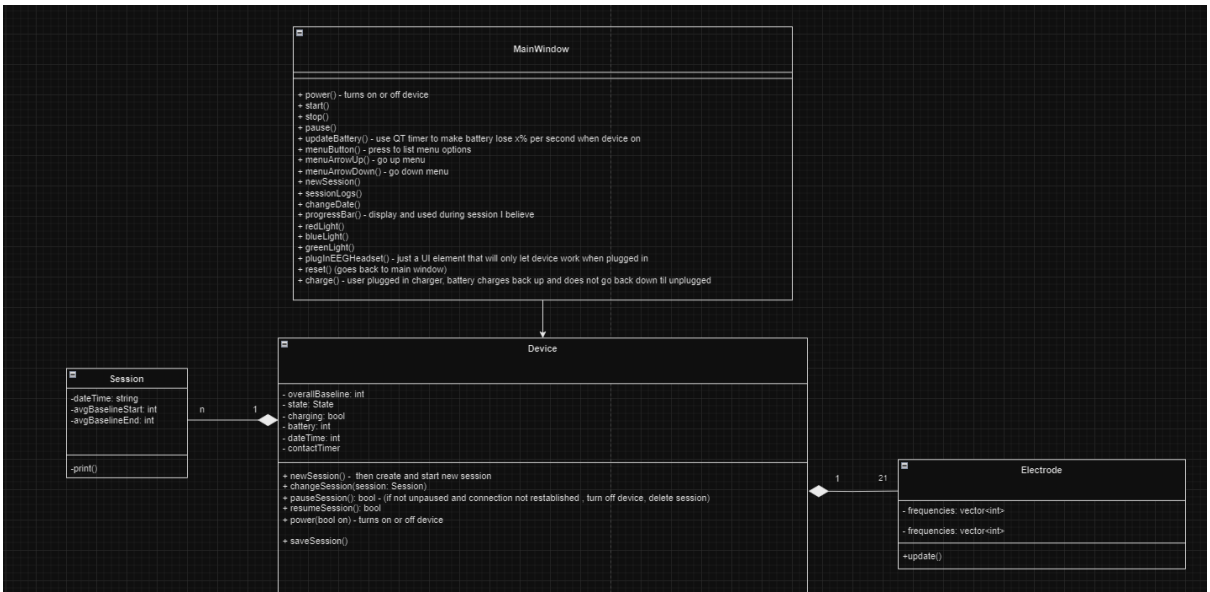
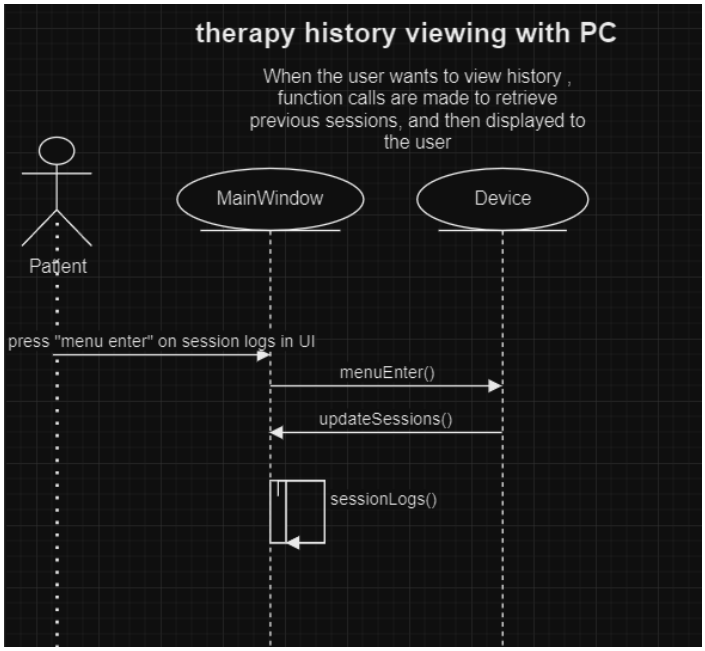
Post Condition:	The Neureset device has successfully completed a therapy session.
Extensions:	3a. If contact is lost during the baseline establishment or treatment delivery: 1. The device pauses the session and starts beeping. 2. The red light on the device flashes, indicating lost contact. 3. If contact is reestablished within 5 minutes, the session resumes from where it was paused. 4. If contact is not reestablished within 5 minutes, the device turns off automatically, and the session is erased. 3b. If the user voluntarily pauses the session: 1. The device pauses the session. 2. If session is resumed within 5 minutes, the session resumes from where it was paused. 3. If session is not resumed within 5 minutes, the device turns off automatically, and the session is erased.

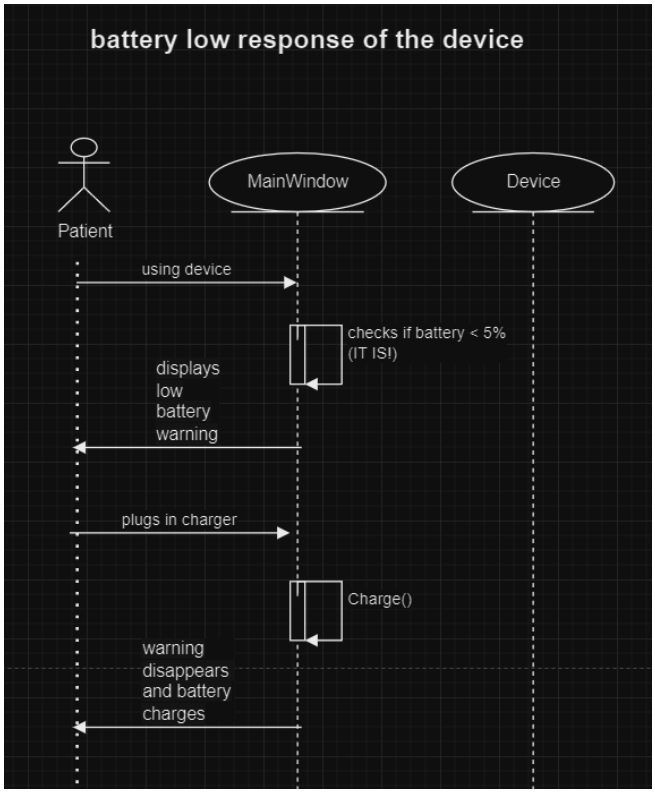


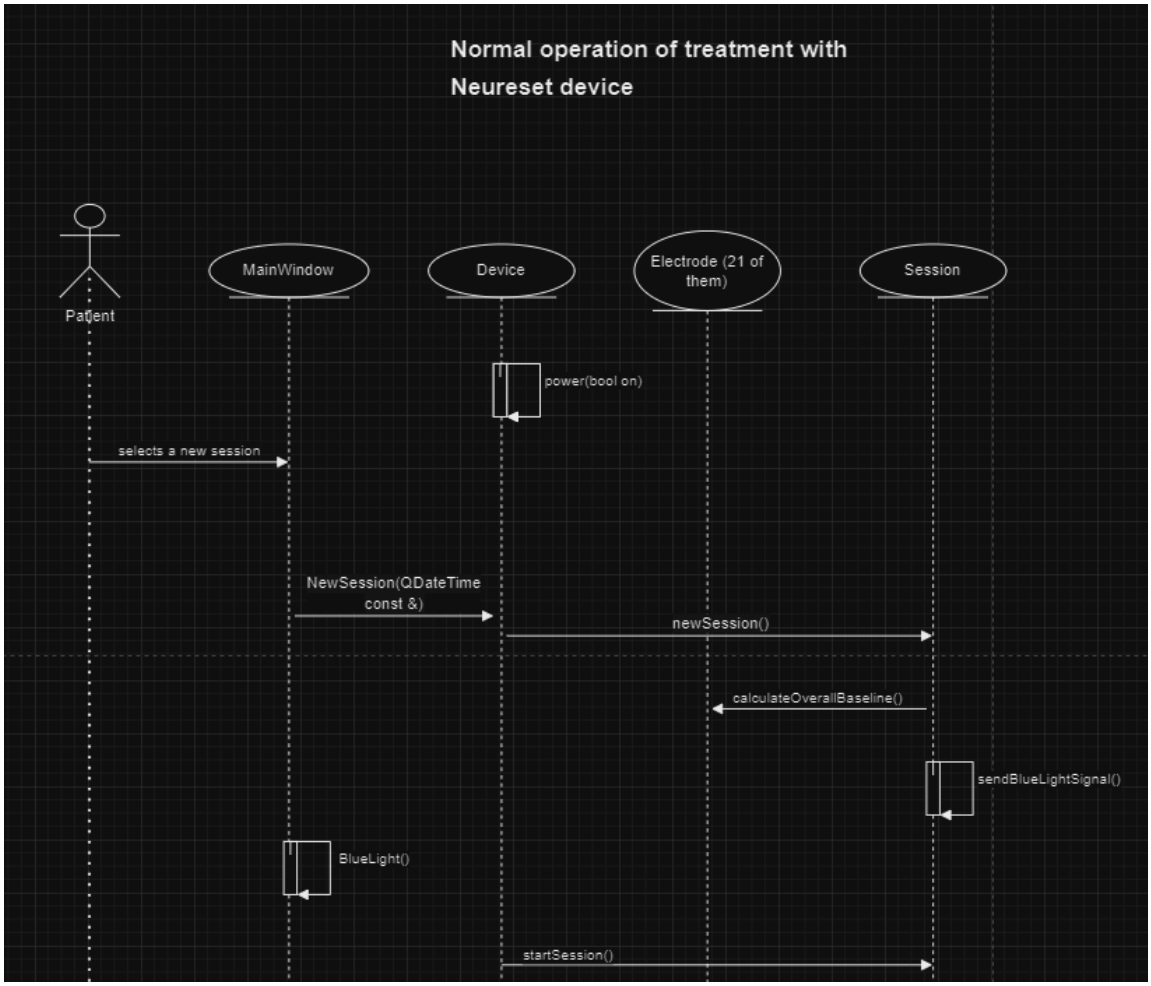
UML Class diagram:

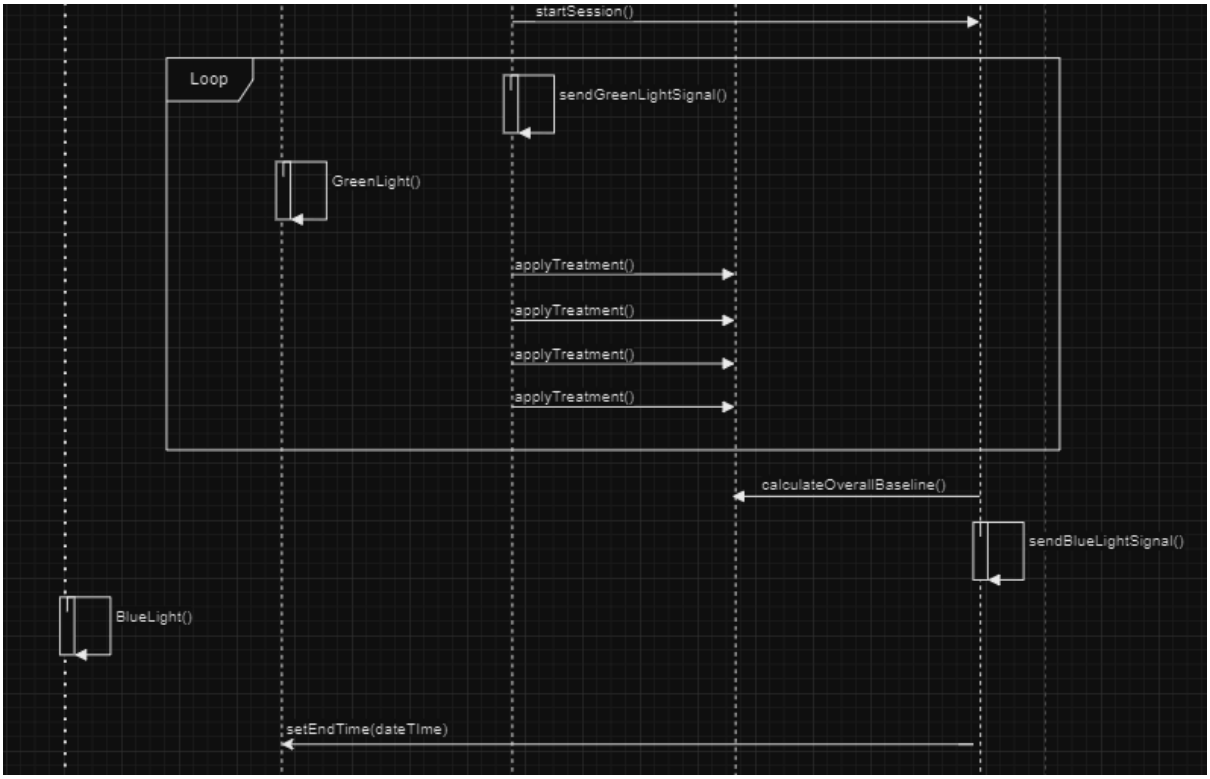


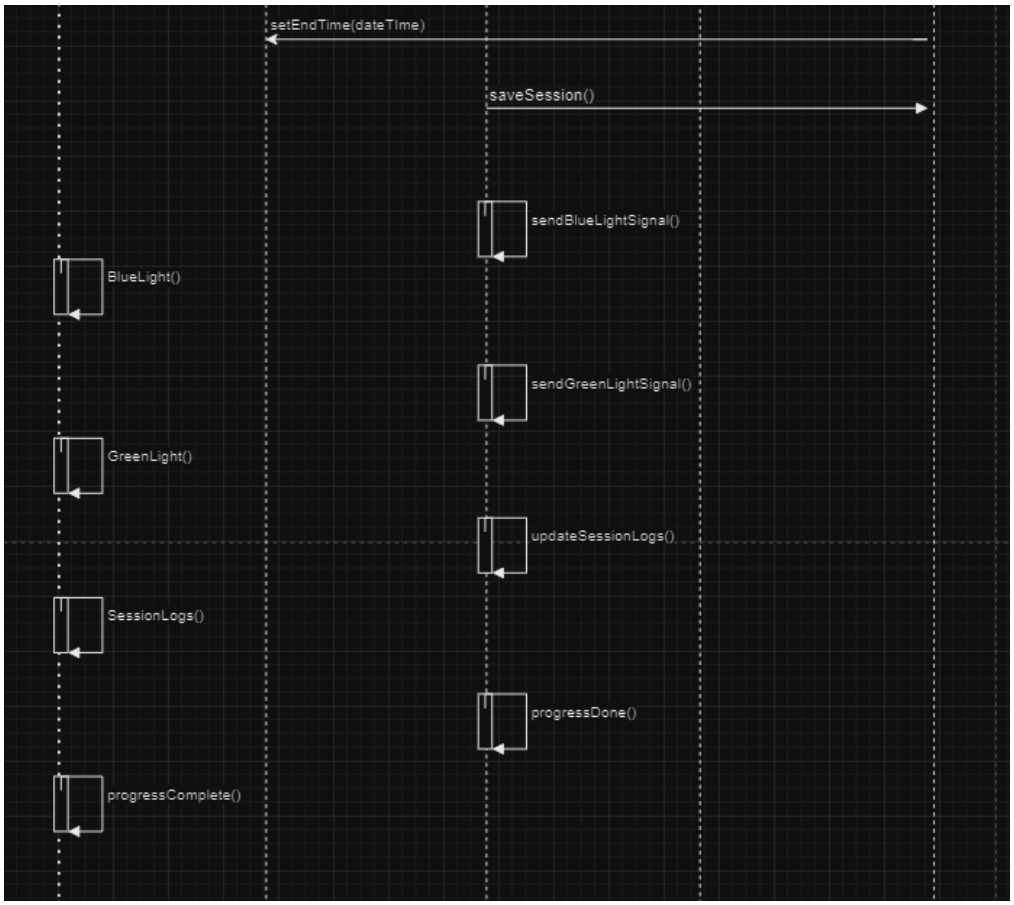
UML Sequence diagrams:

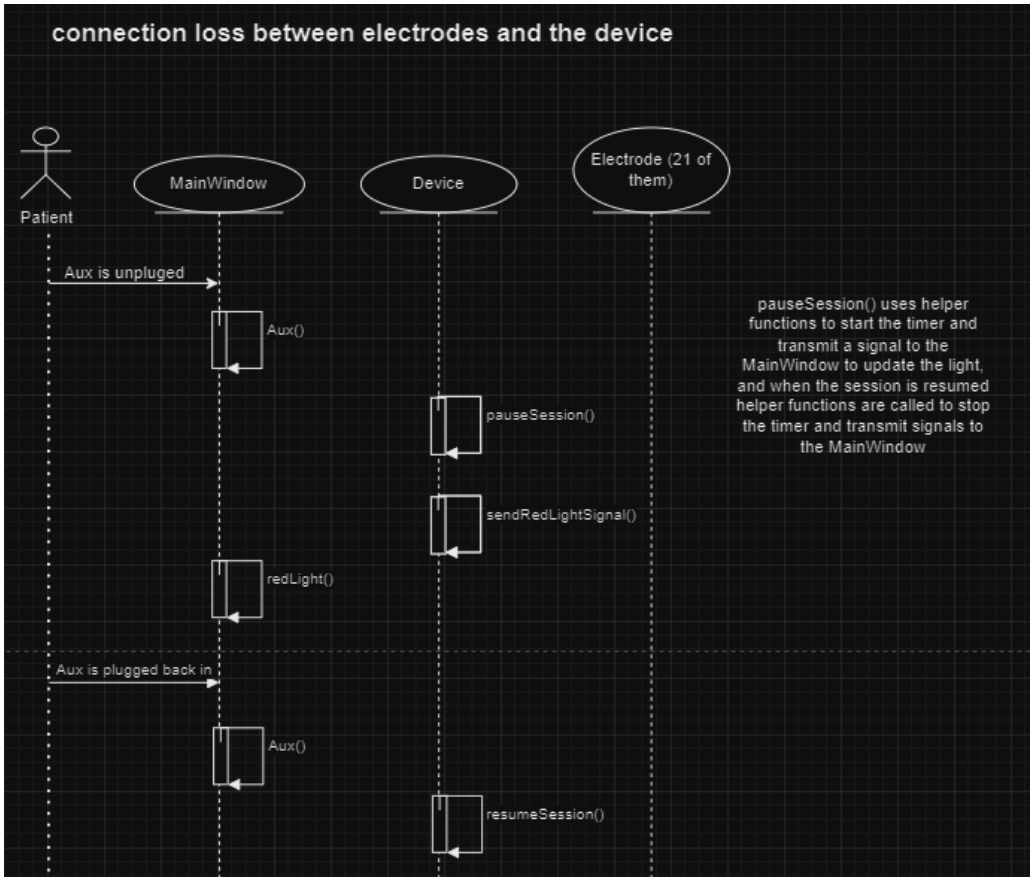




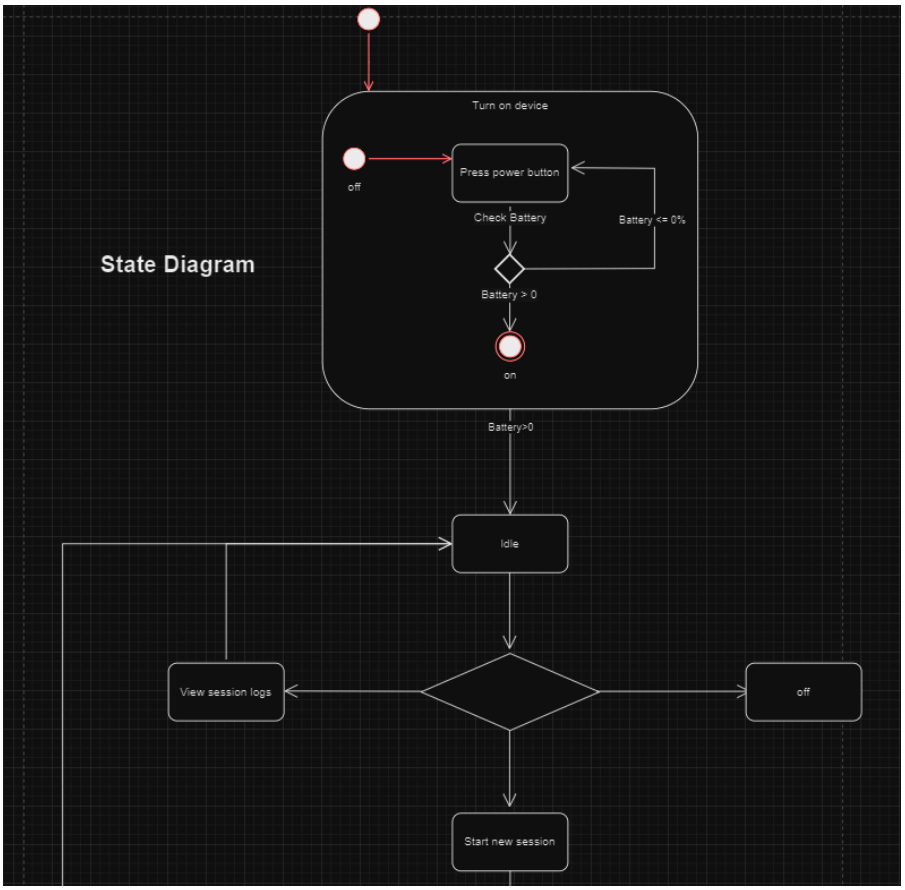

Normal operation of treatment with
Neureset device
Patient
MainWindow
Device
Electrode (21 of them)
Session
power(bool on)
selects a new session
NewSession(QDateTime const &)
newSession()
calculateOverallBaseline()
sendBlueLightSignal()
BlueLight()
startSession()

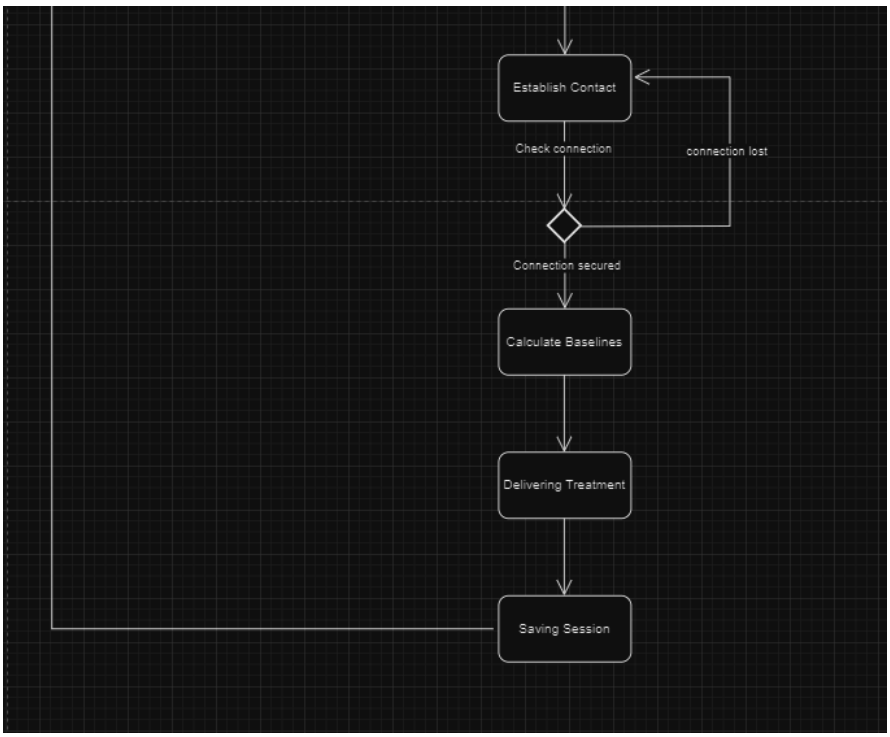

startSession()
Loop
sendGreenLightSignal()
GreenLight()
applyTreatment()
applyTreatment()
applyTreatment()
applyTreatment()
calculateOverallBaseline()
sendBlueLightSignal()
BlueLight()
setEndTime(dateTIme)


setEndTime(dateTIme)
saveSession()
sendBlueLightSignal()
BlueLight()
sendGreenLightSignal()
GreenLight()
updateSessionLogs()
SessionLogs()
progressDone()
progressComplete()


connection loss between electrodes and the device
Patient
MainWindow
Device
Electrode (21 of them)
Aux is unpluged
Aux()
pauseSession()
sendRedLightSignal()
redLight()
Aux is plugged back in
Aux()
resumeSession()
pauseSession() uses helper functions to start the timer and transmit a signal to the MainWindow to update the light, and when the session is resumed helper functions are called to stop the timer and transmit signals to the MainWindow

UML State machine diagram:





Textual explanation of your design decisions

Mediator Pattern:

The Mediator pattern was chosen to promote loose coupling between the classes and to centralize the communication and coordination logic. By using the Mediator pattern, the individual classes (Electrode, MainWindow, and Session) do not need to communicate directly with each other. Instead, they communicate through the mediator (Device class), which simplifies the interactions and makes the system more maintainable. The Device class acts as the mediator, encapsulating the communication and coordination logic between the other classes. This allows for easier modification and extension of the system, as changes can be made in the Device class without affecting the other classes directly.

Traceability Matrix

ID	Requirements	Related Use Case(s)	Implemented by	Tested by
1	Once the session is initiated, it reads a signal from one of the 21 EEG sites on the headset.	“Perform a Neuroset Therapy Session”	Device class, Electrode class	Press “start” button, check application output for “session started” message
2	It establishes a baseline average frequency over the period of one minute and then delivers the treatment in a single second according to the LENS protocol outlined above. To repeat here, it adds an offset frequency of 5hz to the baseline frequency every 1/16th of second, recalculating the brainwave frequency, adding the offset and repeating the process every 1/16th of a second for the duration of one second.	“Perform a Neuroset Therapy Session”	Device class, Electrode class	Can select session logs from UI to ensure correct baselines
3	It then proceeds to the next EEG site and repeats the process, establishing the baseline frequency for one minute and then applying the rapid one second treatment until all 21 sites have been activated.	“Perform a Neuroset Therapy Session”	Device class, electrode class	View test ui after treatment to see EEG results
4	The device is very simple. It only informs the user of session progress,	“Perform a Neuroset	Device class	View UI when running

	no technical information.	Therapy Session”		session
5	The menu has three options: new session, session log, and a date and time setting. Pressing the new session option opens a timer that begins once contact is initiated, indicated by the blue light on the device.	“Perform a Neuroset Therapy Session”	MainWindow class	View UI after clicking start session button
6	If contact is lost, the red light flashes, the session is paused and the device starts beeping until contact is reestablished.	“Perform a Neuroset Therapy Session”	Device class, MainWindow class	Click button to lose contact and observe UI
7	If contact is not reestablished after 5 minutes, the device turns off automatically and the session is erased.	“Perform a Neuroset Therapy Session”	Device class	Press button to lose contact and wait until screen goes black
8	The timer shows approx. time remaining and session progress bar indicated by a percentage.	“Perform a Neuroset Therapy Session”	MainWindow class	View UI during session
9	The user can press pause voluntarily during a session. The same rule applies, if after 5 minutes contact is not reestablished the session is terminated and the device turns off automatically.	“Perform a Neuroset Therapy Session”	MainWindow class, Device class	Press pause button to lose contact and wait until screen goes black
10	During the second of treatment for a single electrode, the green light flashes indicating treatment is being delivered. It then moves on to the next site.	“Perform a Neuroset Therapy Session”	MainWindow class, Device class	Start a session and observe UI during treatment
11	At the beginning of a session there is an overall baseline calculated for all 21 EEG sites, concurrently, at the same time. At the end of the session, a baseline is once again calculated for all 21 EEG sites.	“Perform a Neuroset Therapy Session”	Device class, Session class, Electrode class	Observe application output at start of session, it will inform user of overall baseline calculation (this occurs at the end as well)

12	The menu also has a session log history. Pressing this button displays the time and date of the sessions and the user can scroll through them, although no further information is provided on the device itself.	“Perform a Neuroset Therapy Session”	MainWindow class, Session class	Press button to view session logs and ensure UI works as desired
13	The before and after baselines are recorded and can be uploaded to a PC with the date and time log information. The baseline’s show the before and after dominant average frequencies for each EEG site, taken during the overall baselines at the beginning and end of the session, compared side by side as a numerical value. The UI on the PC end is left for you to design.	“Perform a Neuroset Therapy Session”	Session class, MainWindow class	Press button to view sessions logs and ensure UI works as desired
14	The third menu option is simply a date and time setting. The user inputs the current date and time so the device clock can accurately track the sessions.	“Perform a Neuroset Therapy Session”	MainWindow class, Device class, Session class	Use UI options to set date and time