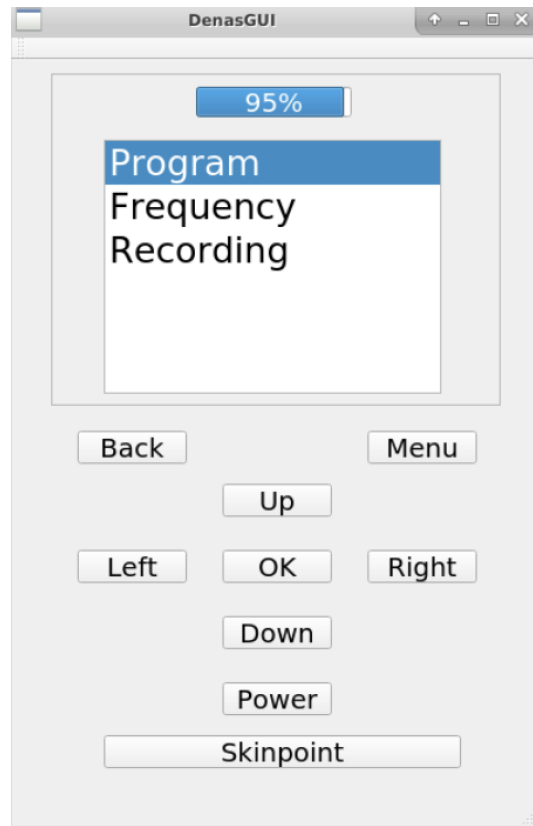


COMP3004 Final Project Design

MCT-Simulator



Group #34

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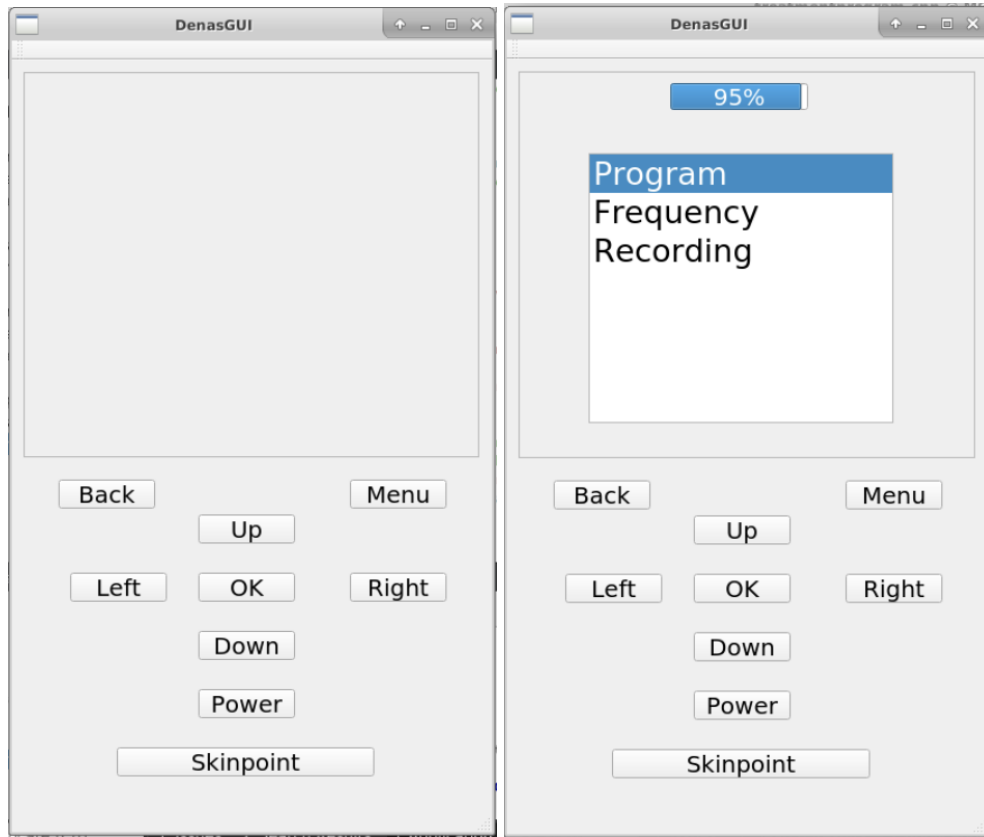


Image1.1

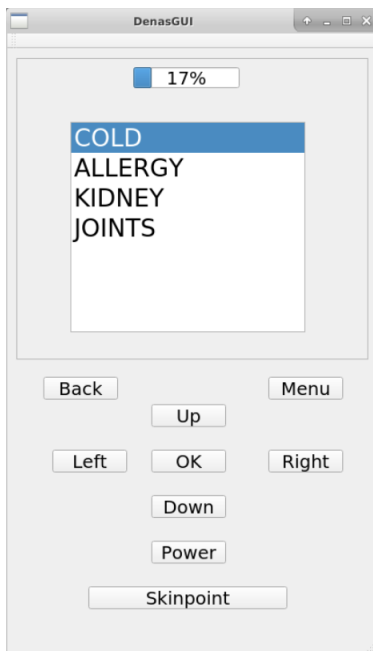
image1.2

Our MCT-simulator simulates the Denas device (image 1.1). We have a display screen, a power button, up/down/right/left button, back button, menu button, ok button, skinpoint button.

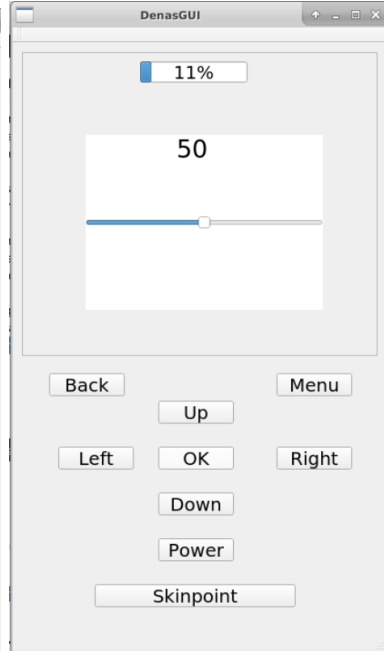
When users press the power button, the screen displays the menu (image 1.2). Users have 3 options.

Once users select Program, it is directed to the secondary menu where users can choose treatment programs that are predefined (image 1.3). Once users select one of the programs, users are directed to a page where users can edit the power level they want in the treatment (image 1.4). The default Power Level is 50. Once users select power level by clicking the left/right button, press OK to confirm. If OK is not pressed, it uses the default power level.

Once users click the skinpoint button, which means users have applied their skin on the machine. Treatment started, the screen displayed the current info of the treatment program (image 1.5). During the treatment users are able to change the power level and are able to **exit the program by clicking Back/Menu/Skinpoint buttons**. (or Power Button to shut down) Once users exit a program or program time out, it returns the menu.



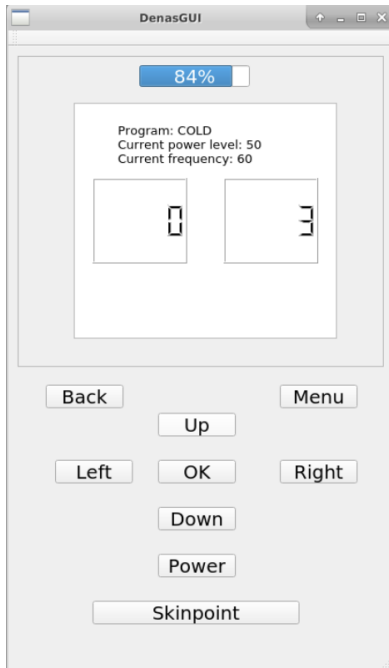
(image 1.3)



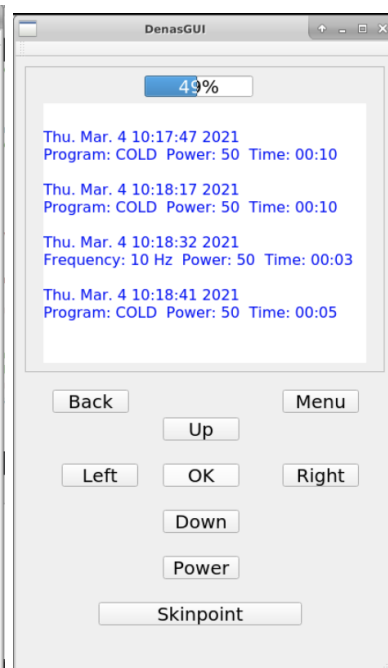
(image 1.4)

If users select to view the records, GUI shows up to 5 records from history(image 1.6).

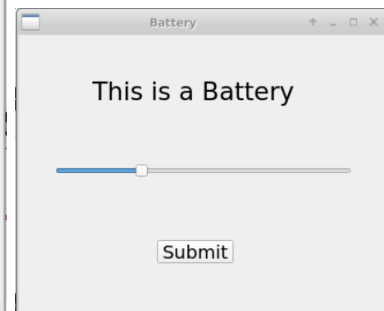
The last thing is Battery Override panel, where testers can test the system behavior under every power level(image 1.7).



(image 1.5)



(image 1.6)



(image 1.7)

Design Summary:

Our MCT-Simulator consists of the following classes: OS class, DenasGUI class, TreatmentProgram class and Battery class.

OS Class is responsible to create treatment programs and update the current information to GUI, and handle the request that is sent by GUI.

DenasGUI Class is the graphic interface that users can interact with the OS.

TreatmentProgram Class represents the treatment that MCT-simulator provides to users, it was created by the OS and has its lifecycle.

Battery Class is a GUI for testers to override the battery level for testing purposes. It does not store any information about battery level, OS owns the battery level.

Our MCT-Simulator is inspired by the MVC design pattern. The Models are OS class and TreatmentProgram Class. The View is Denas GUI where users interact directly. We do not have a controller class as Qt QObjects are communicated by signal and slot. Therefore, we treat the main function as our controller. By placing all connection functions between GUI and OS into the main function we can treat the main function as a controller class.

We also use the Mediator Design Pattern as the core design of our MCT-simulator. OS is the mediator where it handles all the changes that are made by users (externally) or the programs (internally).

Use Cases

UC-01	Base Use Case
Description	Abstract use case for normal use of the devices
Actors	Users, Battery
Pre-condition	The device is OFF
Post-condition	The device works properly as a user's command, and records the history to data.
Main Sequence	<ol style="list-style-type: none">1. The user pressed the power button to turn on the device.2. Device show list of menu on screen3. User selected the desired program from the menu.4. Display menu.5. The user pressed the power button to turn off the device.
Variation	4': When the battery drops to 0, the OS saves recording and the device turns off automatically.
Extension	<ol style="list-style-type: none">2a. At any step, if power level drop over a critical level, warning message "power low" is show3a. If the user selected "Frequency" from the menu, go to UC-023b. If the user selected "Program" from the menu go to UC-03.3c. If the user selected "Record" from the menu, go to UC-04.
Traceability	T1-4, T7,T11,T12,T13,T18,T20-22, T25, T28,T30-31, T46

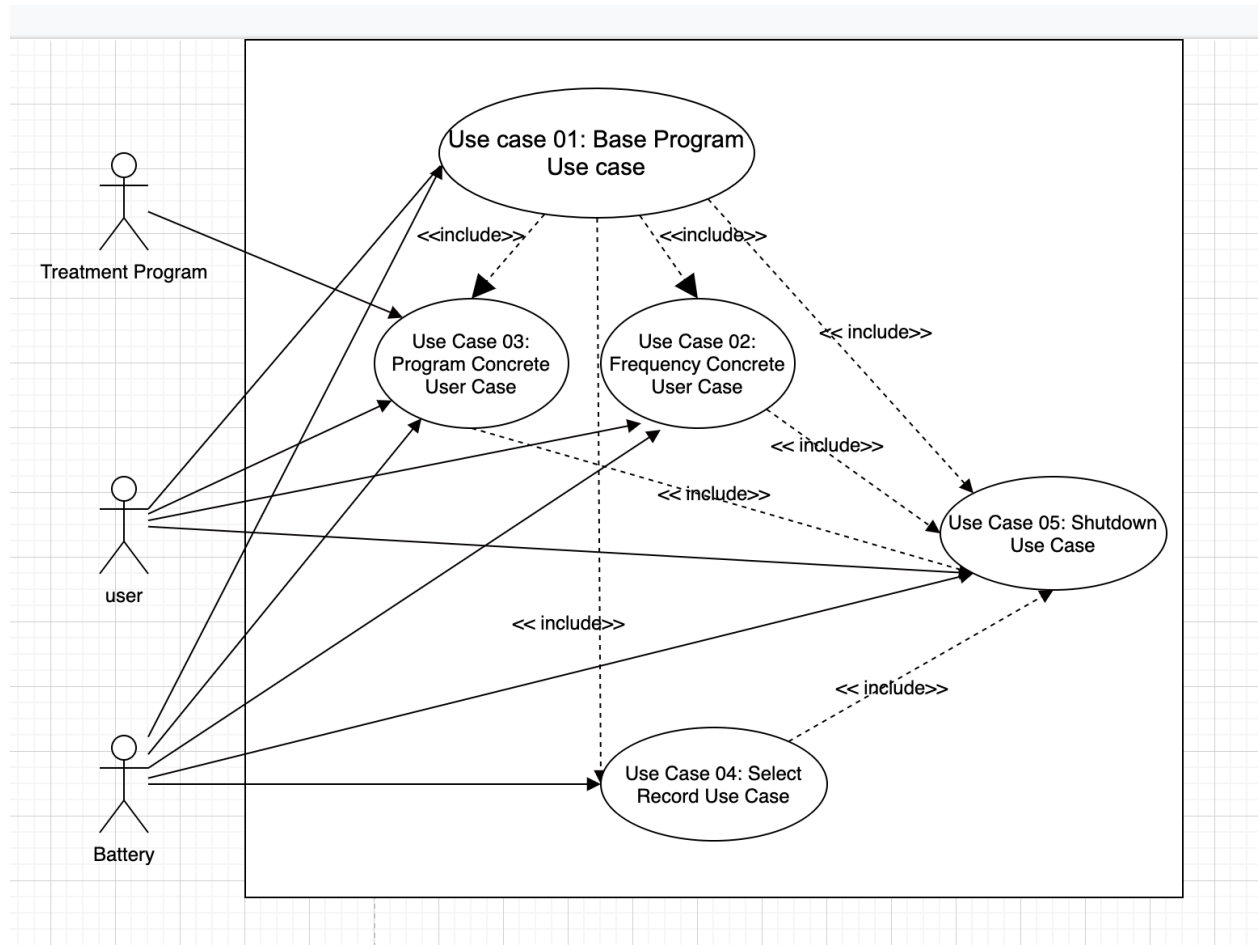
UC-02 Select Frequency Treatment Program Use Case	
Description	concrete user case for frequency treatment
Actors	Users, Battery
Pre-condition	Power ON, user selected "Frequency" from the menu
Post-condition	The device successfully delivers frequency treatment to the user and a record is sent in order to store. Treatment program exit.
Minimal guarantee	Treatment Program exit.
Main Sequence	<ol style="list-style-type: none"> 1. Users are given a list of frequency levels (4 presets included) to select from. 2. Users select one frequency from the list by using the Up or Down button and press OK to confirm. 3. Treatment initialized, show Power Level adjust page with default value of 50. 4. User may press ← / → button to adjust desired power level between 0-100. Power Level output changes accordingly. Users press OK to confirm. 5. Users connect devices to their skin. Timer shows current treatment time when it detects skin on 6. Treatment start 7. User press back button to finish treatment 8. Treatment is saved to recording 9. Back to UC1 step 2
Variation	<p>1'a: At any step, if the user presses the power button, current treatment stops and saves to recording(if exist), use case end.</p> <p>1'b: At any step, if the user presses the back button, current treatment stops and saves to recording(if exist), use case end.</p> <p>1'c: At any step, if the user presses the menu button, current treatment stops and saves to recording(if exist), use case end.</p> <p>1'd: At any step, if the battery has no power, current treatment stops and save to recording(if exist), use case end.</p> <p>6': if user press skin off button, current treatment stop</p>
Extension	6a. User may press ← / → button to adjust desired power level between 0-100. Power Level output changes accordingly. Users press OK to confirm.
Traceability	T3-4, T6,T8,T10-11, T13-20, T22-23, T25-30 T32-39, T42-45

UC-03 Select Program Treatment Program Use Case	
Description	concrete user case for program treatment
Actors	Users, treatment Program, Battery
Pre-condition	Power ON, user selected "Program" from the menu
Post-condition	The device successfully delivers program treatment to the user and a record is sent in order to store. Treatment program exit.
Minimal guarantee	Treatment Program exit.
Main Sequence	<ol style="list-style-type: none"> 1. Users are given a list of programmed treatments (4 presets included) to select from. 2. Users select one programmed treatment from the list by using the Up or Down button and press OK to confirm. 3. Treatment initialized, show Power Level adjust page with default value of 50. 4. User may press ← / → button to adjust desired power level between 0-100. Power Level output changes accordingly. Users press OK to confirm. 5. Users connect devices to their skin. Timer countdown from preset. 6. Treatment start 7. User press back button to finish treatment 8. Treatment is saved to recording 9. Back to UC1 step 2
Variation	<p>1'a: At any step, if the user presses the power button, current treatment stops and saves to recording(if exist), use case end.</p> <p>1'b: At any step, if the user presses the back button, current treatment stops and saves to recording(if exist), use case end.</p> <p>1'c: At any step, if the user presses the menu button, current treatment stops and saves to recording(if exist), use case end.</p> <p>1'd: At any step, if the battery has no power, current treatment stops and save to recording(if exist), use case end.</p> <p>6': if user press skin off button, current treatment stop</p>
Extension	6a. User may press ← / → button to adjust desired power level between 0-100. Power Level output changes accordingly. Users press OK to confirm.
Traceability	T3-4, T6,T8,T10-11, T13-20, T22-23, T25-30 T32-39, T42-45

UC-04 Select Record Use Case	
Description	User choice to show records or clear record use case
Actors	Users, Battery
Pre-condition	Power ON, user selected "Records" from the menu
Post-condition	The device successfully delivers the records to users or/and clears the record. Back to the menu.
Minimal guarantee	Treatment Program exit.
Main Sequence	<ol style="list-style-type: none"> 1. User select "show" from recording menu 2. GUI gets treatment history from recording and displaying them. 3. User presses back to the menu.
Variation	<ol style="list-style-type: none"> 1' If user select clear record from recording menu, all record clear 2' if there is no history then display "No record" 3' user press menu button and back to menu
Traceability	T7-9, T11, T13,T15, T20-21, T24, T39-41

UC-05 Shutdown Use Case	
Description	concrete user case for shutdown device
Actors	Users, Battery
Pre-condition	Power ON
Post-condition	Device successfully shutdown.
Main Sequence	<ol style="list-style-type: none"> 1. Users press the shutdown button. 2. Current treatment is stopped and saved if there is a treatment program running. 3. Shutdown device
Variation	1a: battery level is low to a certain level.
Traceability	T3-4, T18,T42,T43

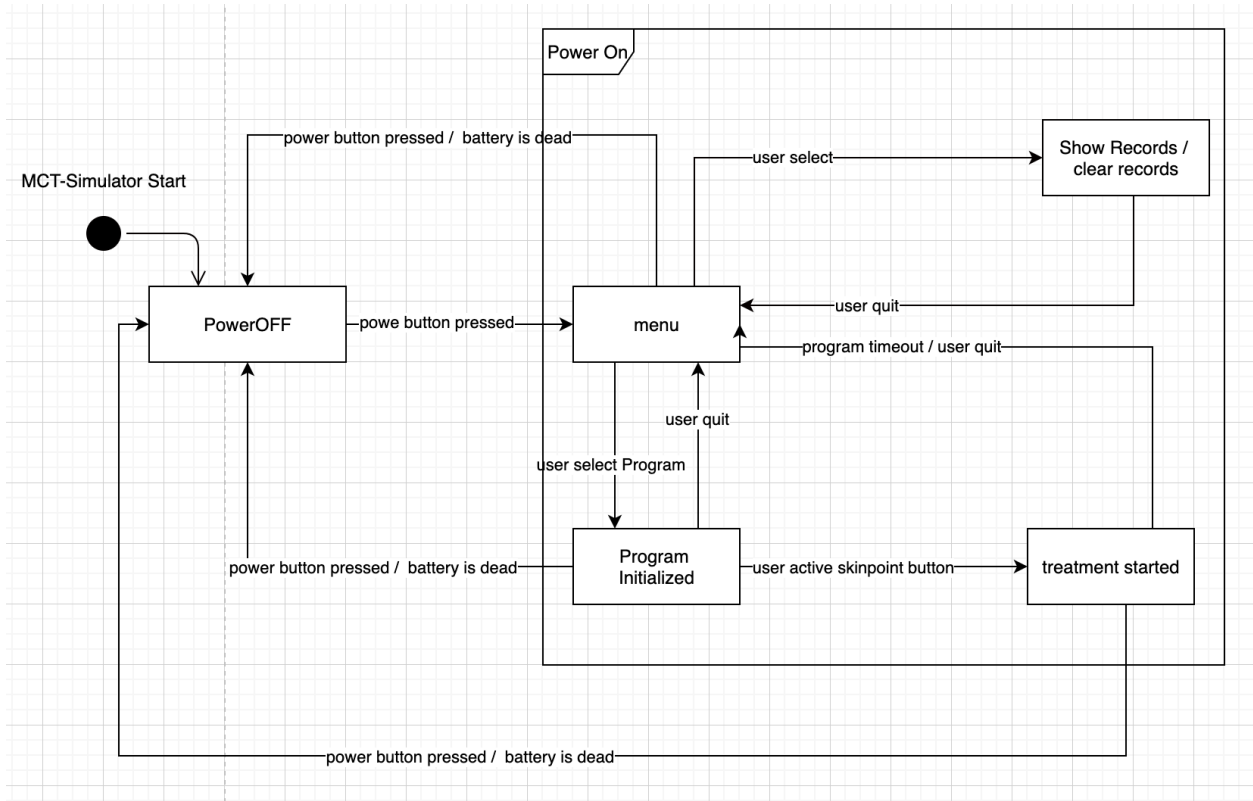
Use Case Diagram



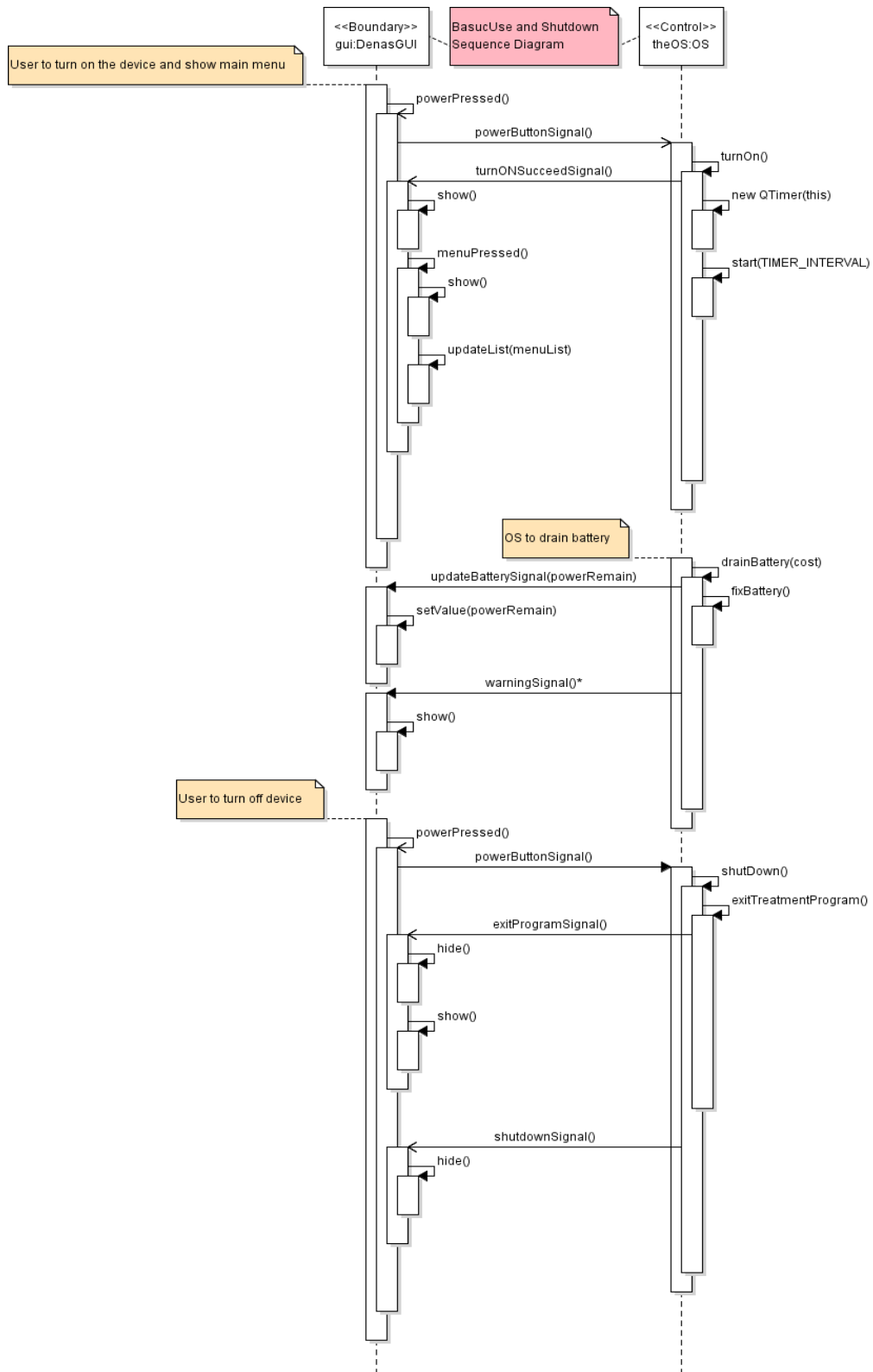
State Diagram

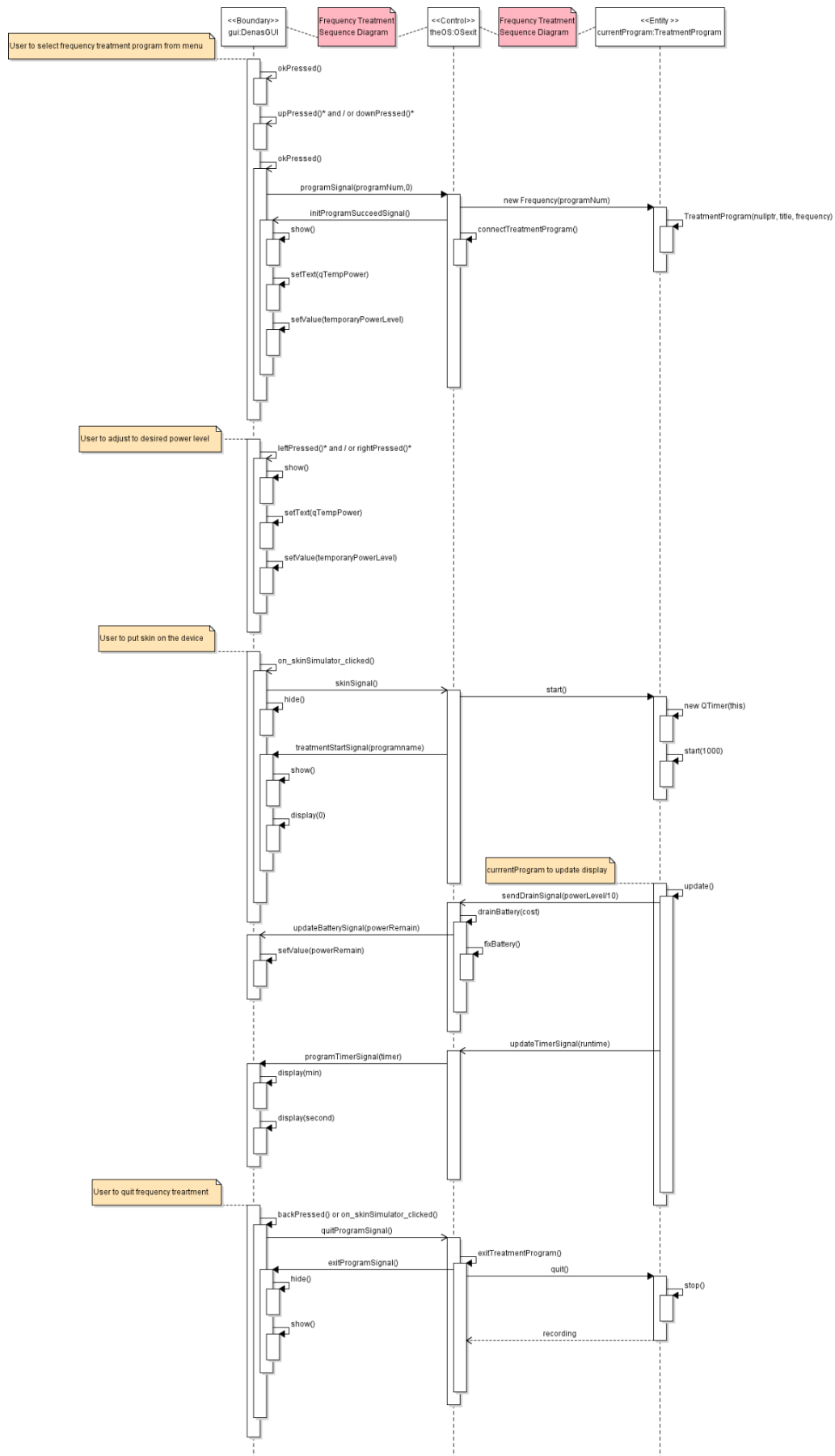
The following state diagram shows how the state of our project changed.

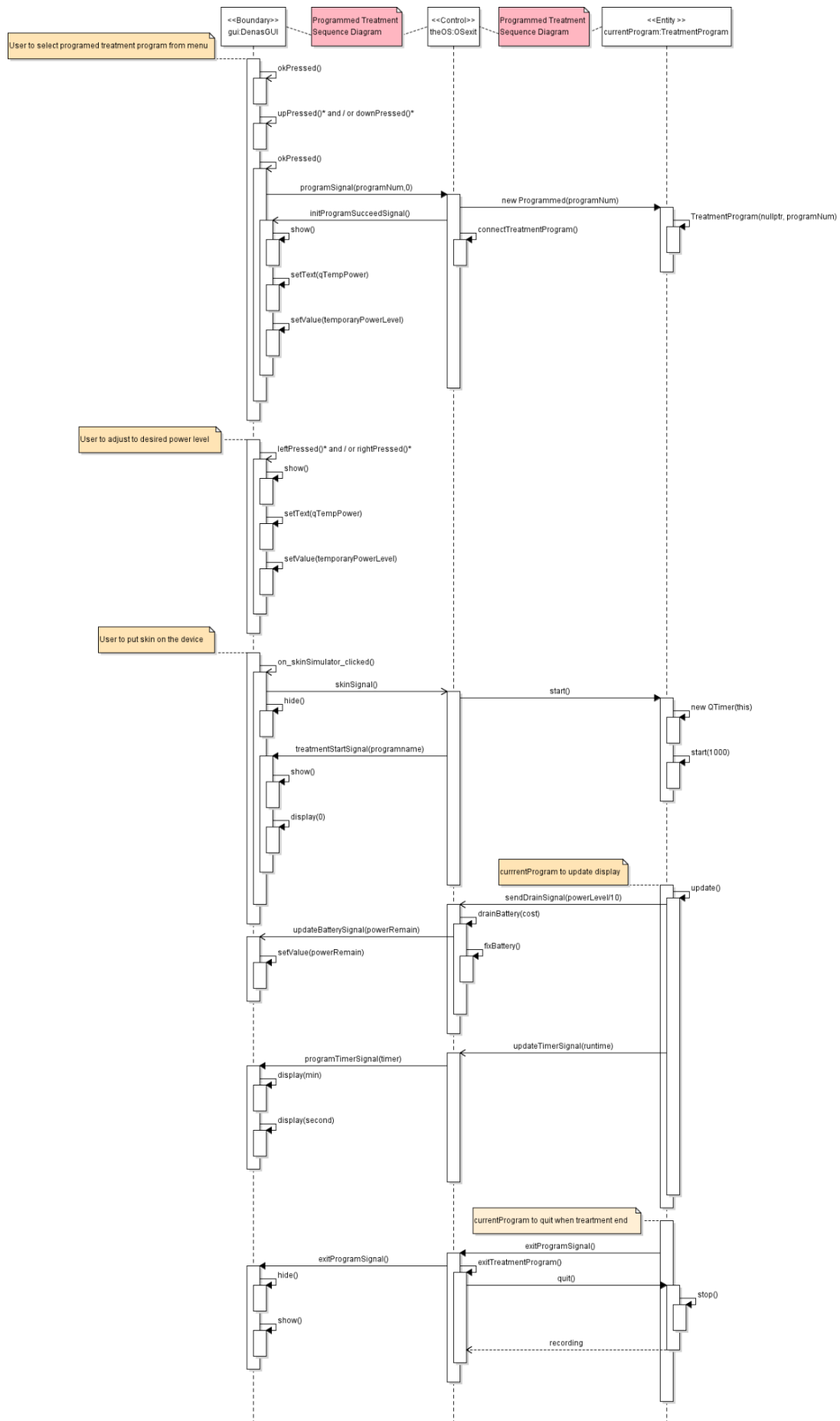
For a clear version, use draw.io to open the uml diagrams under the 'uml' folder in the MCT-Simulator project in Github.

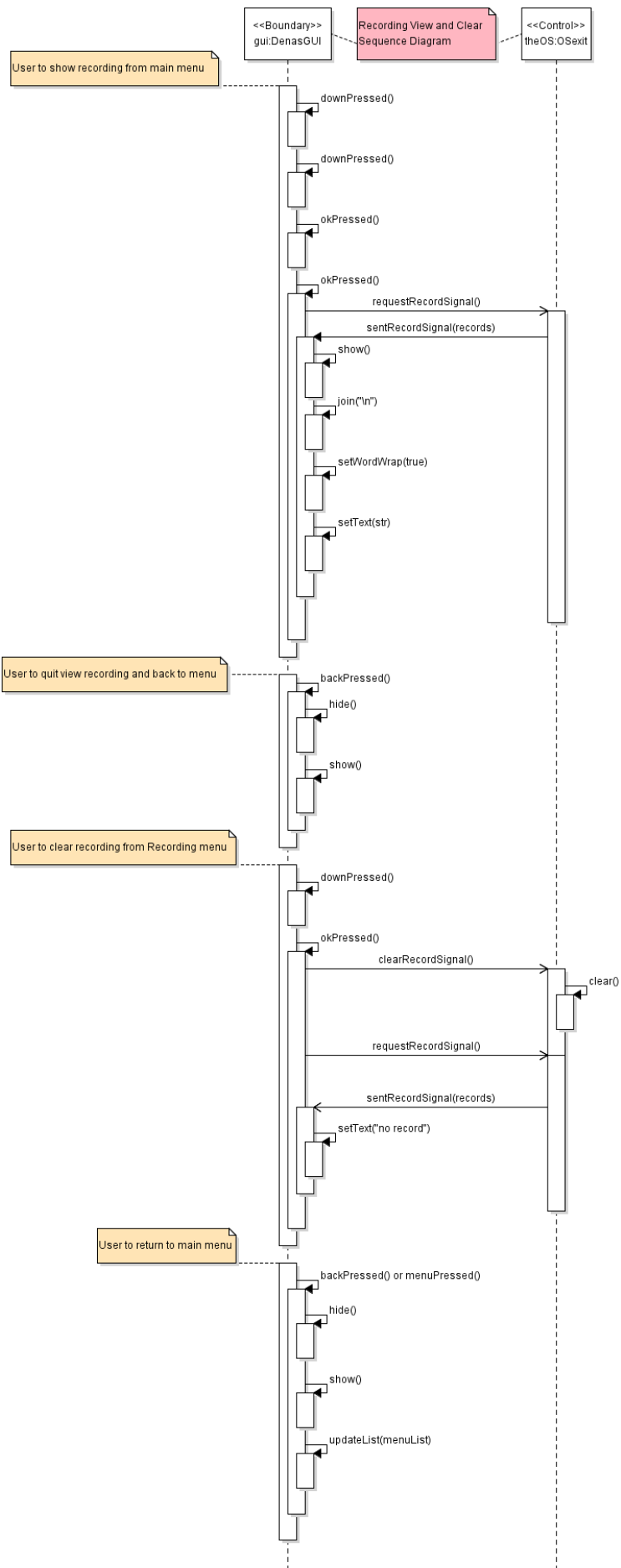


Sequence Diagram (Refer to PNGs attached for bigger image)





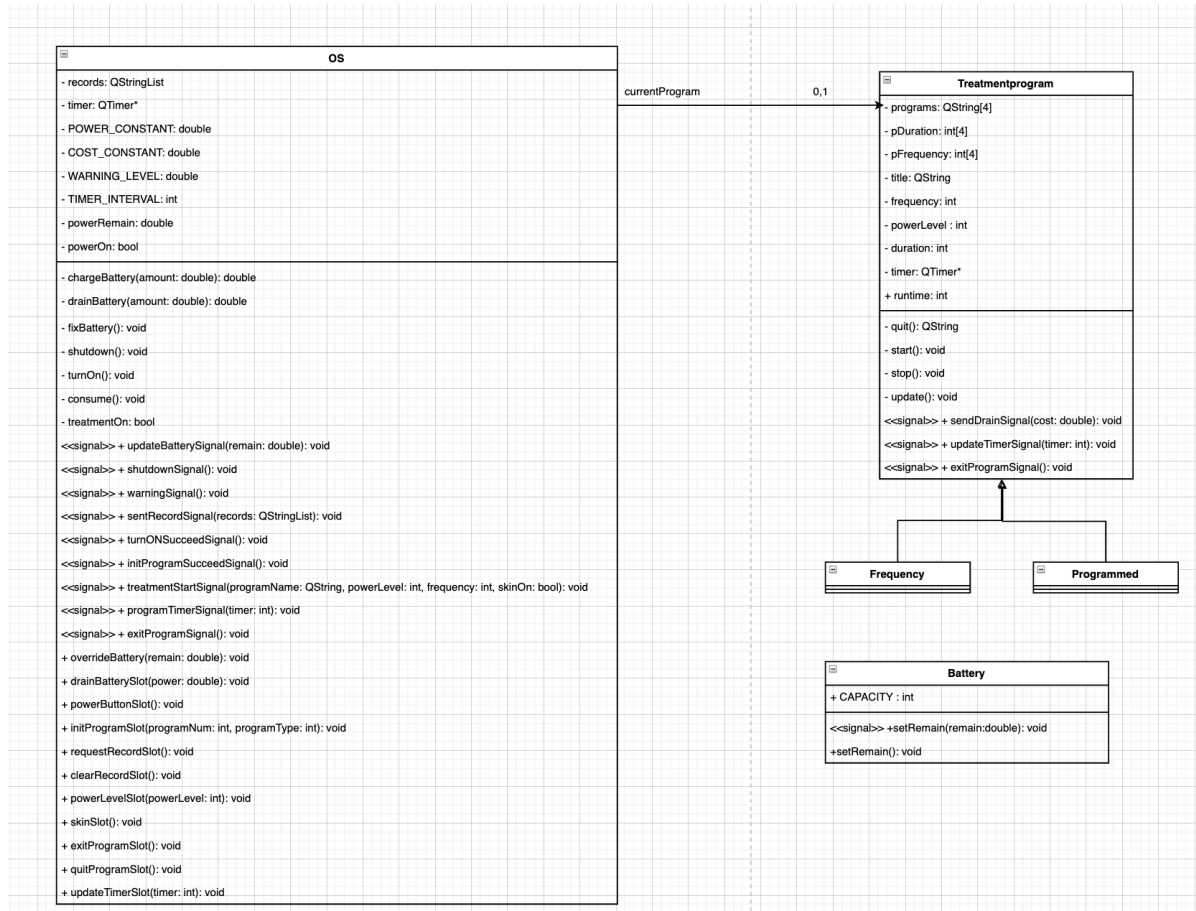


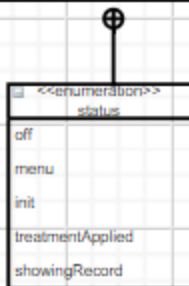
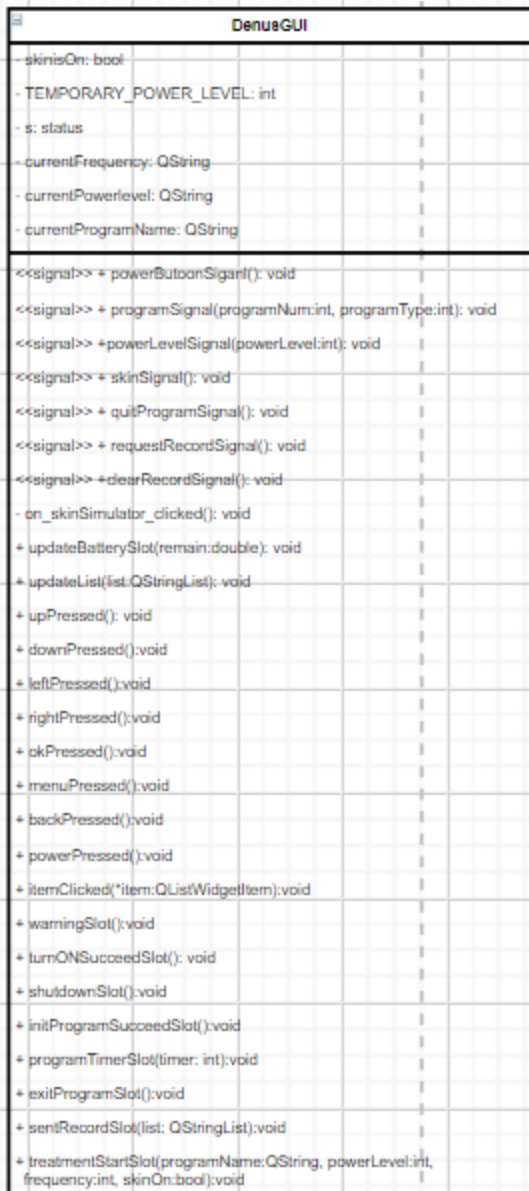


UML Diagram

Clear bigger version: [follow this link](#)

The UML Class Diagram is too large so we split into 2 images.





Traceability Matrix

Traceability Number	Requirement ID	Requirement description	Test case ID	Test case description	Test case Status
T1	1	Turn On Device	1	Device can be turn on by pressing Power Button when remaining power is above the critical power level value	Passed
T2			2	Power is under a critical level, turn on device should fail	Passed
T3	2	Turn Off Device	1	Pressing the power button to turn off at any time should power off the device. If there is one treatment going on, the treatment will stop and be recorded. And there should be no memory leak. After shutdown, there is no current program, the battery should stop consuming, and the display will be off.	Passed
T4			2	the battery level hit to 0 will result in shutdown. After shutdown, there is no current program, the battery should stop consuming, and the display will be off.	Passed
T5	3	The interface	1	Buttons	Passed
T6			1-1	Left/right button is only used to adjust power level during treatment or before it starts. If users press the left/right button on any other situation, there will be no response.	Passed
T7			1-2	The Up/Down button is only used in the primary menu or secondary menu. If users press the up/down button on any other situation, there will be no response.	Passed
T8			1-3	The back button is used in any situation except Power OFF and sends the user to the primary menu. It should exit the program and back to the menu after users init a program.	Passed

T9			1-3-1	(1) Users are in the secondary menu. (2) Users press the back button. (3) Display should show the primary menu.	Passed
T10			1-3-2	(1) Users initialized any treatment program (2) Users pressed back button (3) Program will stop if it started, record is saved if it started. (3) User are now in menu	Passed
T11			1-4	Ok button implemented	Passed
T12			1-4-1	(1) user in primary manu (2) users press OK (3) user in secondary menu	Passed
T13			1-4-2	(1) user in secondary menu (2) users press OK (3) user is in program	Passed
T14			1-4-3	(1) user initialized treatment program (2) user pressed OK button (3) The current power level is saved and the display has been updated.	Passed
T15			1-5	The menu button is used in any situation except Power OFF and sends the user to the primary menu. It should exit the program and back to the menu after users init a program.	Passed
T16			1-5-1	(1) Users are in the secondary menu. (2) Users press the menu button. (3) Display should show the primary menu.	Passed
T17			1-5-2	(1) Users initialized any treatment program (2) Users pressed menu button (3) Program will stop if it started, and the record is saved if it started. (3) User are now in menu	Passed
T18			1-6	Power button refer to Req 1 and Req 2	Passed
T19			1-7	Skin button refer to Req7	Passed
T20			2	Display	Passed

T21			2-1	Display shows menus as selected	Passed
T22			2-2	Display shows battery level going down during treatment	Passed
T23			2-3	Display shows timer start when a treatment program is chosen, power level is selected and skin is attached	Passed
T24			2-4	Display recording (refer to Req 9)	Passed
T25			2-5	Display shows warning message (refer to Req 11)	Passed
T26			2-6	Display program detail during treatment, if power level is adjust, detail is updated	Passed
T27			3	Display as skin is attached	Passed
T28	4	Battery Level (0-100)	1	Drain power when Power is ON	Passed
T29			2	Drain power proportional to power level of the treatment program	Passed
T30			3.	Drain 10% of maximum power when remaining power is <10%, the remaining should be equal to 0%. (And powerRemain should never be some negative number)	Passed
T31			4.	Try to charge power to some number above 100, this will never happen as the maximum value of battery slide that provides is 100.	Passed
T32	5	Time of therapy	1	displayed and advanced only during skin on,treatment program start	Passed
T33			2	Timer Stop when skin off, treatment program stop	Passed
T34	6	Power level (0-100)	1.	Power level can be adjusted before treatment start	Passed
T35			2.	Adjust power level during treatment program	Passed
T36	7	Electrodes	1	Simulate output (Delivery treatment) and input (skin on/off)	Passed

T37	8	Therapies	1	4 frequency treatment program included	Passed
T38			2	4 programmed treatment included	Passed
T39	9	Recording	1	Therapy will be recorded automatically and added to the list of treatment history after a treatment is completed. If treatment has not started, it will not be recorded.	Passed
T40			2	Users can clear recorded therapy history.	Passed
T41			3	Show “no recording” when no recorded treatment after the user selects clear or display.	Passed
T42	10	Exit treatment program	1-1	(1) treatment has started (2) users pressed the Menu/Back/Power/Skinpoint Button OR no battery remain (3) treatment program exit and current treatment will be recorded.	Passed
T43			1-2	(1) treatment has been initialized but not started yet (2) users pressed the Menu/Back/Power/Skinpoint Button OR no battery remain (3) treatment program exit and nothing should be recorded.	Passed
T44			2	Programmed Treatment Program will automatically exit when preset time is up. If treatment started, save it to the records.	Passed
T45	11	Warning	1	Warning message is display if skin is not attached during treatment	Passed
T46			2	Warning when Power lower than a critical level	Passed

OS test case:

Receive PowerButton signal: turnON OS successfully, power consumed normally.

Receive initProgram signal: init a program signal, tell GUI that the program has been initiated.

Connect signals in TreatmentProgram and slots in OS

Branch 1:

Users proceed to change powerLevel and skin ON.

Branch 2: Users don't want to start the program. And decide to quit the program.

Table of how GUI should interact with user

Following chart is not a formal State diagram but it helps you to understand the behavior that GUI will react to with users by button press.

Status	left/right	up/down	back	menu	skinON	OK	power
0:off	N/A	N/A	N/A	N/A	N/A	N/A	On/Off
1: menu	N/A	Change menu item	Back to menu	Go to menu	N/A	Go in	
2: init	adjust power level	N/A	Quit program (for OS and program: should not record this treatment)		Start treatment	Send powerLevelSignal(int powerLevel)	
3: treatment Applied	adjust power level	N/A	quitProgram		Pause(?)	Send powerLevelSignal(int powerLevel)	
4: showingRecord	N/A	N/A	Back to menu		N/A	N/A	

Tables of how components communicate

Signals in GUI	Slots in OS
powerButtonSignal()	powerButtonSlot()
programSignal(int programNum (0,1,2,3, 10,20,60,77), int programType(1,0))	initProgramSlot((int programNum (0,1,2,3, 10,20,60,77), int programType(1,0)) programmed : 1 Frequency: 0
powerLevelSignal(int powerLevel)	powerLevelSlot(int powerLevel)
skinSignal()	skinSlot() //startProgram
quitProgramSignal()	quitProgramSlot()
requestRecordSignal()	requestRecordSlot()
clearRecordSignal()	clearRecordSlot()
signals in OS	Slots in GUI
warningSignal()	warningSlot()
shutdownSignal()	shutdownSlot()
initProgramSucceedSignal()	initProgramSucceedSlot()
programTimerSignal(int timer)	programTimerSlot(int timer)
exitProgramSignal()	exitProgramSlot()
sentRecordSignal(QStringList list)	sentRecordSlot(QStringList list)
turnONSucceedSignal()	turnONSucceedSlot()
treatmentStartSignal(QString programName, int powerLevel, int frequency, bool skinOn)	treatmentStartSlot(QString programName, int powerLevel, int frequency, bool skinOn)

Possible signals in Program	Slots in OS
updateTimerSignal(int timer)	updateTimerSlot(int timer)
exitProgramSignal()	exitProgramSlot()