COMP 3004: Group Project

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April 12, 2023

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Use Cases

Use Case 1: Normal Operation

Primary Actor: User
Goal in Context: Achieve higher coherence in heart-rhythm pattern
Precondition: User has access to device and knowledge on how to operate it
Postcondition/Success Guarantee: User achieve higher coherence
Main success scenario:

1. **User:** turn on the HeartWave
2. **User:** attach sensor to earlobe
3. **User:** navigate menu and enter session mode
4. **HeartWave:** display HRV graph, breath pacer, and metrics
5. **User:** press selector button to initiate new session
6. **HeartWave:** begin reading user heartbeat
7. **HeartWave:** calculate HRV
8. **HeartWave:** calculate coherence (use our own data)
9. **HeartWave:** update LED light color according to coherence level (low=red, medium=blue, high=green)
10. **HeartWave:** update breath pacer value
11. **HeartWave:** Loop through steps 7-9 until user termination
12. **User:** Stop session by pressing selector button
13. **HeartWave:** calculate percentage of time in different coherence levels (low, medium and high)
14. **HeartWave:** calculate average coherence
15. **HeartWave:** calculate achievement score
16. **HeartWave:** display session summary that includes percentage of time in different coherence levels (low, medium and high), average coherence, length of session, achievement score, entire HRV graph.

Extensions:
8a. New coherence level is reached

8a1. Beep goes off to indicate a new coherence level is reached

Use Case 2: Interruption due to Sensor Off

Primary Actor: HeartWave
Goal in Context: interrupt current session when sensor turns off
Precondition: user is currently in session
Postcondition/Success Guarantee: current session is interrupted when sensor turns off
Main success scenario:

1. **Sensor:** turns off/malfunctions
2. **HeartWave:** disable symbol to indicate loss of active pulse reading
3. **HeartWave:** end current session

Use Case 3: Battery Low

Primary Actor: HeartWave
Goal in Context: Warn the user the device is low on battery and will be shutting down
Precondition: The device is on and the user is currently using the device
Postcondition/Success Guarantee: user alerted of battery status
Main success scenario:

1. **User:** starts session
2. **HeartWave:** battery drops 1% every 10 seconds during use
3. **HeartWave:** warn user if battery reaches 20%
4. **HeartWave:** automatically end session if battery reaches 0% and power off

Use Case 4: Accessing a Session From Session Logs

Primary Actor: User
Goal in Context: view previous session information
Precondition: device is on and user has previously used the device and initiated sessions
Postcondition/Success Guarantee: user is able to view previous session information
Main success scenario:

1. **User:** select “view session history” from menu via selector button
2. **HeartWave:** display all previous sessions in the form of rows
3. **User:** select specific session
4. **HeartWave:** display all information for the chosen session

Use Case 5: Changing Breath Pacer Settings

Primary Actor: User
Goal in Context: Change breath pacer setting
Precondition: Device is on

Postcondition/Success Guarantee: User is able to change breath pacer settings

Main success scenario:

1. **User:** select “Settings” from menu via selector button
2. **HeartWave:** display device settings
3. **User:** select new breath pacer setting
4. **HeartWave:** update device settings to reflect the new setting

Use Case 6: Restoring Device to Initial Install Conditions

Primary Actor: User

Goal in Context: Restore the HeartWave to its initial install conditions

Precondition: Device is on

Postcondition/Success Guarantee: User is able to reset the device to initial install conditions

Main success scenario:

1. **User:** select “Settings” from menu via selector button
2. **HeartWave:** display device settings
3. **User:** push reset button in settings screen
4. **HeartWave:** reset all settings to their default value

Use Case 7: Turn On Device

Primary Actor: User

Goal in Context: Turn on the HeartWave

Precondition: User has a HeartWave and the HeartWaved is powered off

Postcondition/Success Guarantee: the HeartWave is turned on and is on the Main Menu screen

Main success scenario:

1. **User:** Press Power Button
2. **HeartWave:** turn on

Use Case 8: Turn Off Device

Primary Actor: User

Goal in Context: Turn off the HeartWave

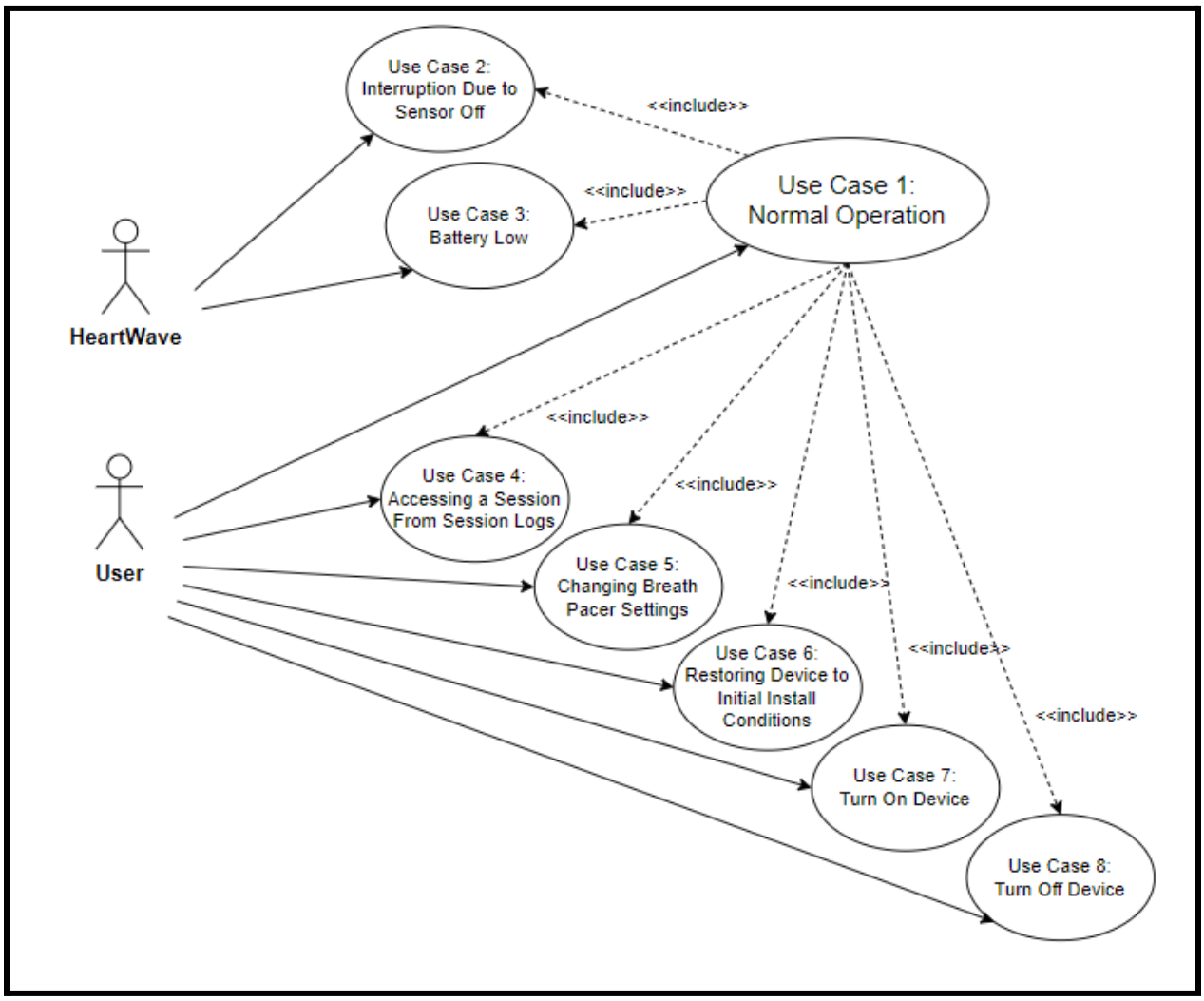
Precondition: User has a HeartWave and the HeartWave is powered on

Postcondition/Success Guarantee: the HeartWave is turned off and the display is powered off

Main success scenario:

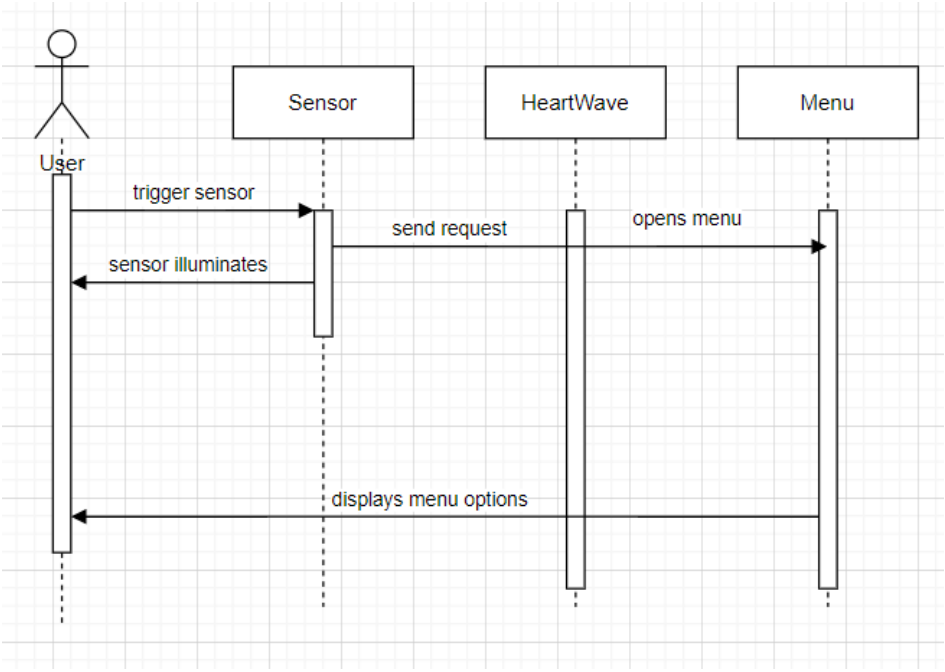
3. **User:** Press Power Button
4. **HeartWave:** Power off display
5. **HeartWave**: Power off

Use Case Diagram

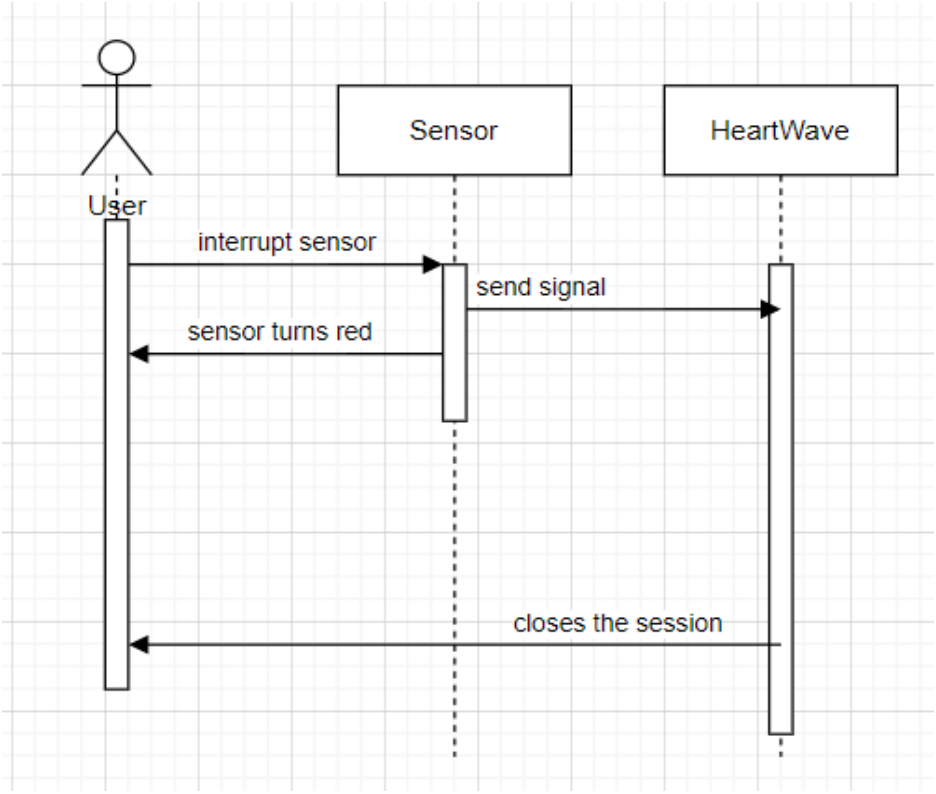


Sequence Diagrams

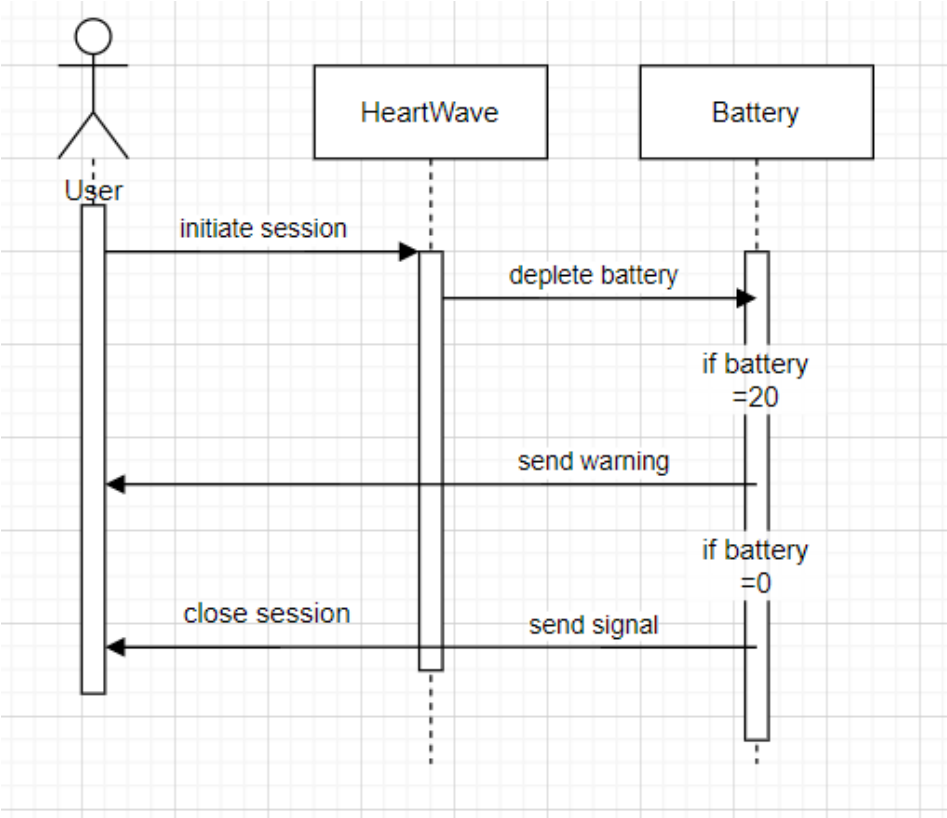
Sequence Diagram 1: Normal Operation



Sequence Diagram 2: Interruption Due to Sensor Off



Sequence Diagram 3: Battery Low

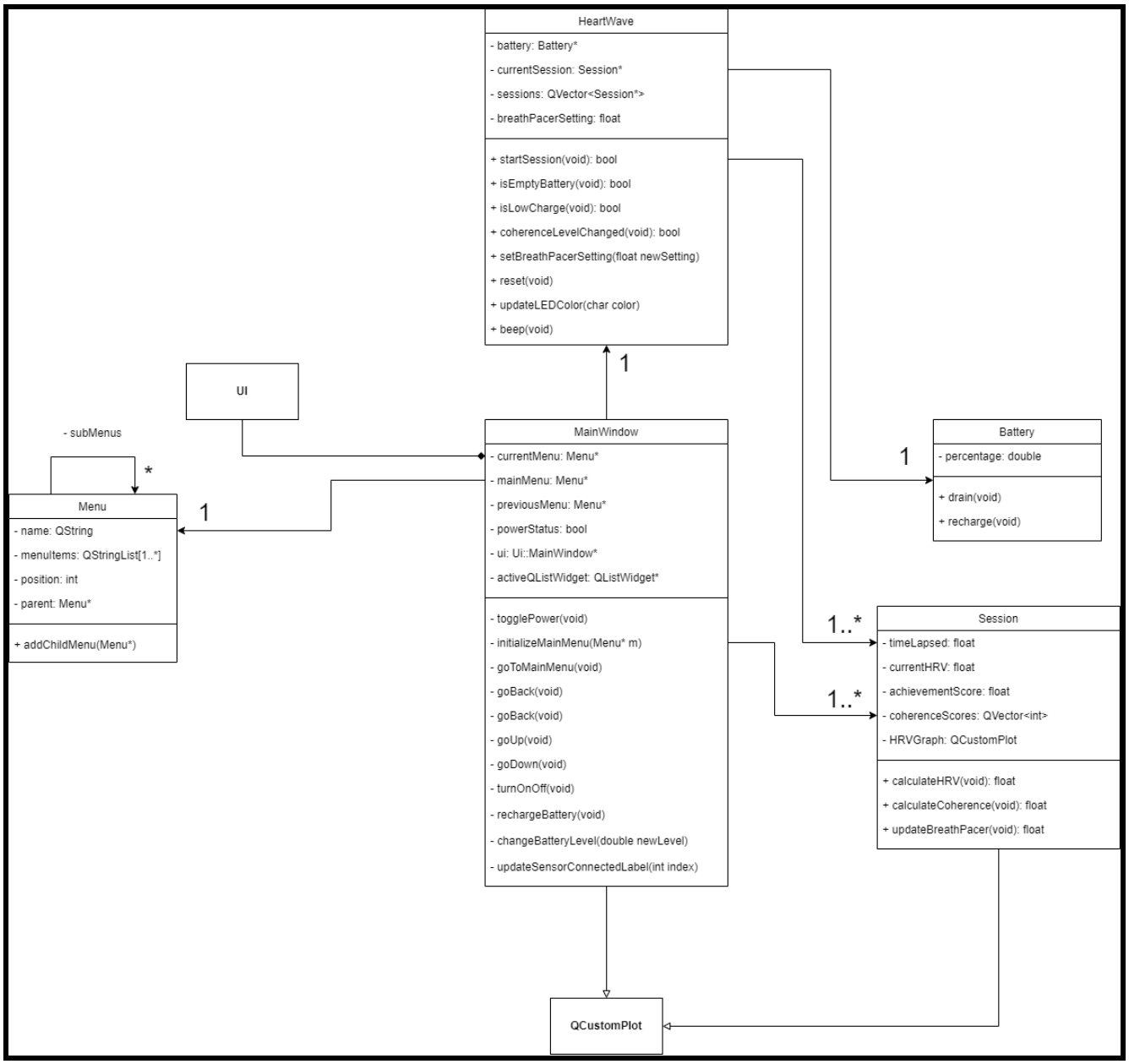


Traceability Matrix

ID	Requirement	Related Use Case	Fulfilled By	Test	Description
1	HeartWave is powered on by a user	Use Case 1: Normal Operation	Mainwindow.h Mainwindow.cpp HeartWave.h HeartWave.cpp Menu.h Menu.cpp Battery.h Battery.cpp Session.h Session.cpp Qcustomplot.h Qcustomplot.cpp mainwindow.ui	User turns on the device and is able to open the menu, adjust the battery, disconnect the sensor, and use the buttons to change the graph's coherence.	User presses the on button to initiate the session, the initial graph will appear and the user will be able to adjust the coherency, disconnect the sensor, deplete and recharge the battery, and access the menu.
2	Sensor is interrupted by the user/malfunctions	Use Case 2: Interruption due to sensor off.	Mainwindow.ui Mainwindow.h Mainwindow.cpp HeartWave.h HeartWave.cpp	Tested by toggling sensor connectivity in the Admin tab within the UI	If the sensor is disconnected/interrupted by the user, indicate that the pulse reading has been disabled and the session will then terminate.
3	The battery of the HeartWave device is <=20%.	Use Case 3: Battery low.	Mainwindow.ui Mainwindow.h Mainwindow.cpp Battery.h Battery.cpp	User drains the device battery to 20% and receives a warning, they can recharge or keep draining to 0% to shut off the program.	If the device is used until the battery reaches 20%, a warning will be issued to the user to indicate low battery and the need to recharge the device. If the user ignores this warning, the session will terminate at 0%.
4	User accesses a session from the session logs in the HeartWave device.	Use Case 4: Accessing a Session From Session Logs.	Mainwindow.ui Mainwindow.h Mainwindow.cpp Session.h Session.cpp Menu.h Menu.cpp	User clicks on the menu, goes to view session history, selects this option, and then selects which session to view.	The user is able to view previous session logs by clicking "view session history". They can use the arrow buttons to select the session they want to view and the information will display.

5	User opens the device menu to switch the settings of the HeartWave.	Use Case 5: Changing Breath Pacer Settings.	Mainwindow.ui Mainwindow.h Mainwindow.cpp Menu.h Menu.cpp	User goes to the menu and selects settings, the settings will be displayed and they can select the changes and apply them to the device.	User goes to the menu and selects settings, the settings will be displayed and they can select the changes and apply them to the device.

UML Diagram


HeartWave
- battery: Battery*
- currentSession: Session*
- sessions: QVector<Session*>
- breathPacerSetting: float
+ startSession(void): bool
+ isEmptyBattery(void): bool
+ isLowCharge(void): bool
+ coherenceLevelChanged(void): bool
+ setBreathPacerSetting(float newSetting)
+ reset(void)
+ updateLEDColor(char color)
+ beep(void)
1
UI
- subMenus
*
Menu
- name: QString
- menuItems: QStringList[1..*]
- position: int
- parent: Menu*
+ addChildMenu(Menu*)
1
MainWindow
- currentMenu: Menu*
- mainMenu: Menu*
- previousMenu: Menu*
- powerStatus: bool
- ui: Ui::MainWindow*
- activeQListWidget: QListWidget*
- togglePower(void)
- initializeMainMenu(Menu* m)
- goToMainMenu(void)
- goBack(void)
- goBack(void)
- goUp(void)
- goDown(void)
- turnOnOff(void)
- rechargeBattery(void)
- changeBatteryLevel(double newLevel)
- updateSensorConnectedLabel(int index)
1
Battery
- percentage: double
+ drain(void)
+ recharge(void)
1..*
1..*
Session
- timeLapsed: float
- currentHRV: float
- achievementScore: float
- coherenceScores: QVector<int>
- HRVGraph: QCustomPlot
+ calculateHRV(void): float
+ calculateCoherence(void): float
+ updateBreathPacer(void): float
QCustomPlot