Final Project: RaDoTech

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Use Case: Using the RadoTech Device

Primary Actor: User

Stakeholders and Interests:

User - Monitor their health

RaDoTech - Creating a non-invasive device that provides detailed insights into each organ's performance, identifies potential issues, and offers suggestions for improving health.

Precondition: The user has purchased the RaDoTech kit & App is downloaded

Success guarantee: User can monitor their health and inform themselves about the performance of vital organs and overall body

Main success scenario:

1. Simulation prompts login into the app and the user logs in.
2. User clicks the Measure Now button on the simulation.
3. User sprays water on the areas being scanned.
4. User clicks the "Start Metering" button on the simulation.
5. User chooses their corresponding profile.
6. User scans areas indicated by the app with the device until the scan is complete
7. User takes notes about their current state during the scan
8. User clicks on the History Tab on the simulation app to view the body shot, circle, and chart of their past scans.
9. User taps on Indicator button to get a snapshot of the scan details
10. User clicks on the recommendations button to see health recommendations to improve health.

Extensions:

1a. The user does not have an account
    1a1. The user creates an account and fills out their information.

3a The kit didn't come with a water spray
    3a1. Get a new kit with the proper equipment

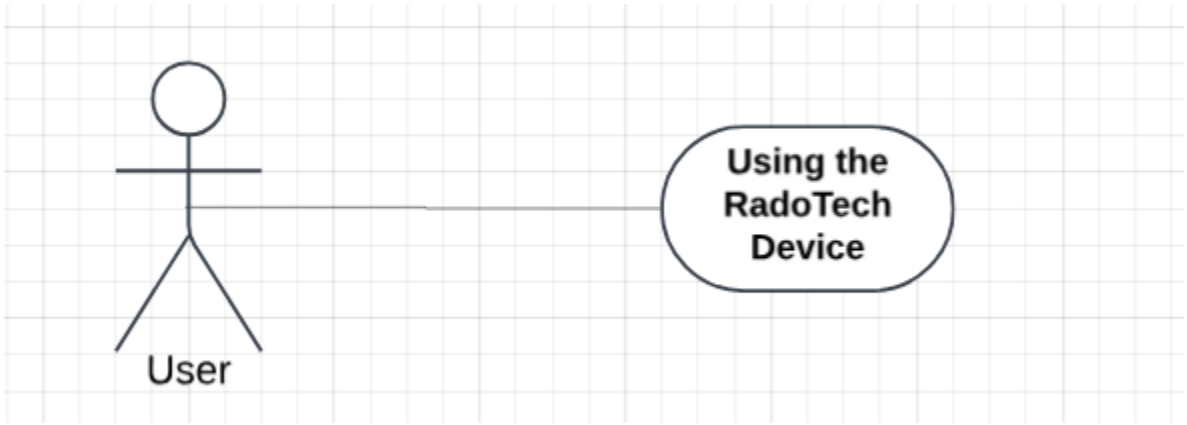
4a. Cannot start metering because the device is not connected to the app
    4a1. Connect the device by holding the power button for a couple of seconds

5a. Cannot reach certain areas with the device
    5a1. The top of the device can be pulled out for extended reach

6b. The User is getting weird measurements
    6b1. If the user is on Android, then turn the location on
    6b2. Take off all metal jewellery that may interfere with the scan
    6b3. Make sure they are holding the device overhand
    6b4. Make sure the user is quickly removing the device after every beep

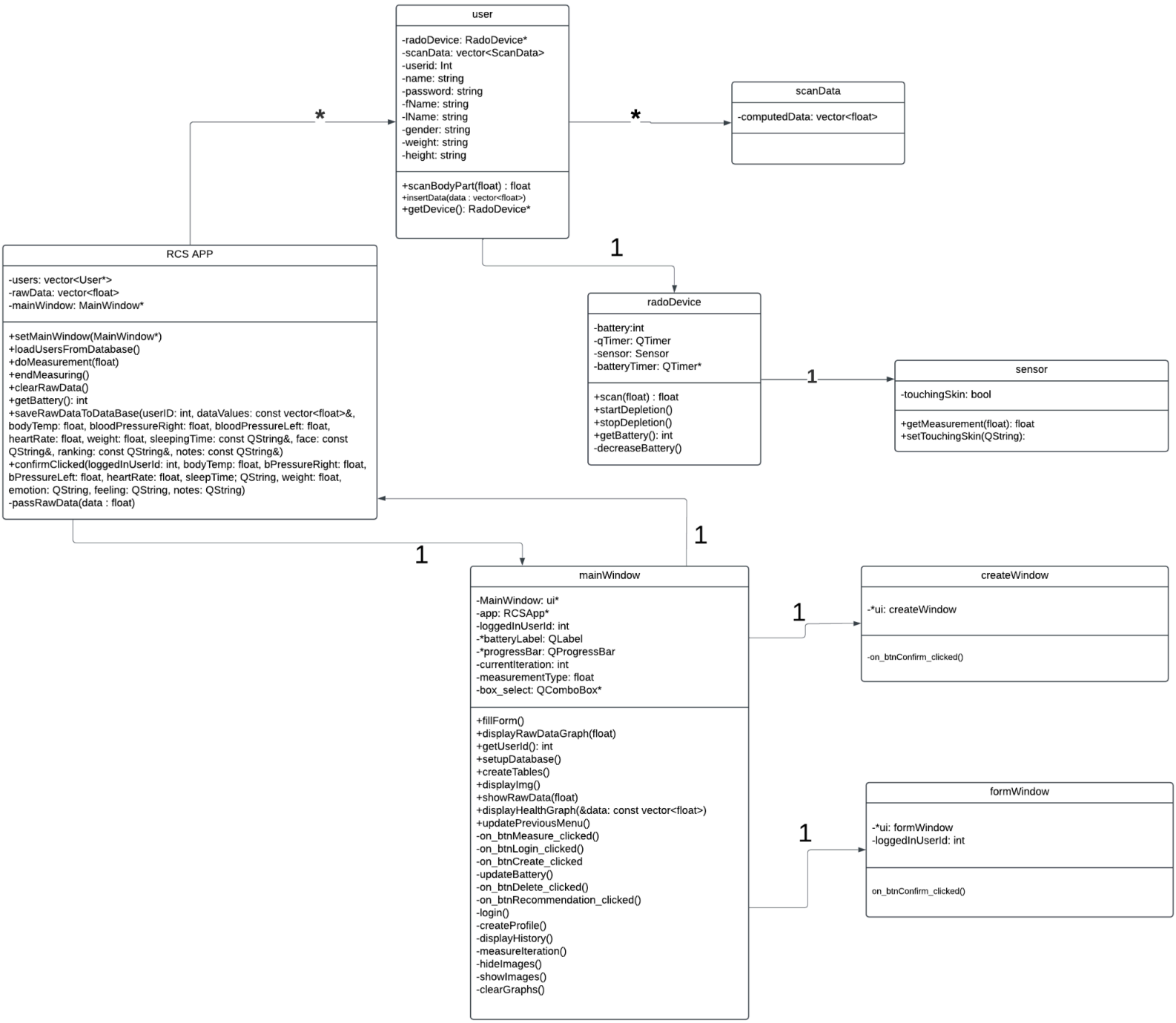
6c. The user accidentally scanned the wrong area
    6c1. Restart the scanning process from the start
6d. User doesn't get any measurements
    6d1. Make sure that the device sensor is touching the skin properly
7d. Device is unable to turn on (The battery is depleted)
    7d1. Charge the device
8a. Past scans don't show up
    8a1. Restart app
    8a2. Restart scans

Use case Diagram:



Design Documentation:

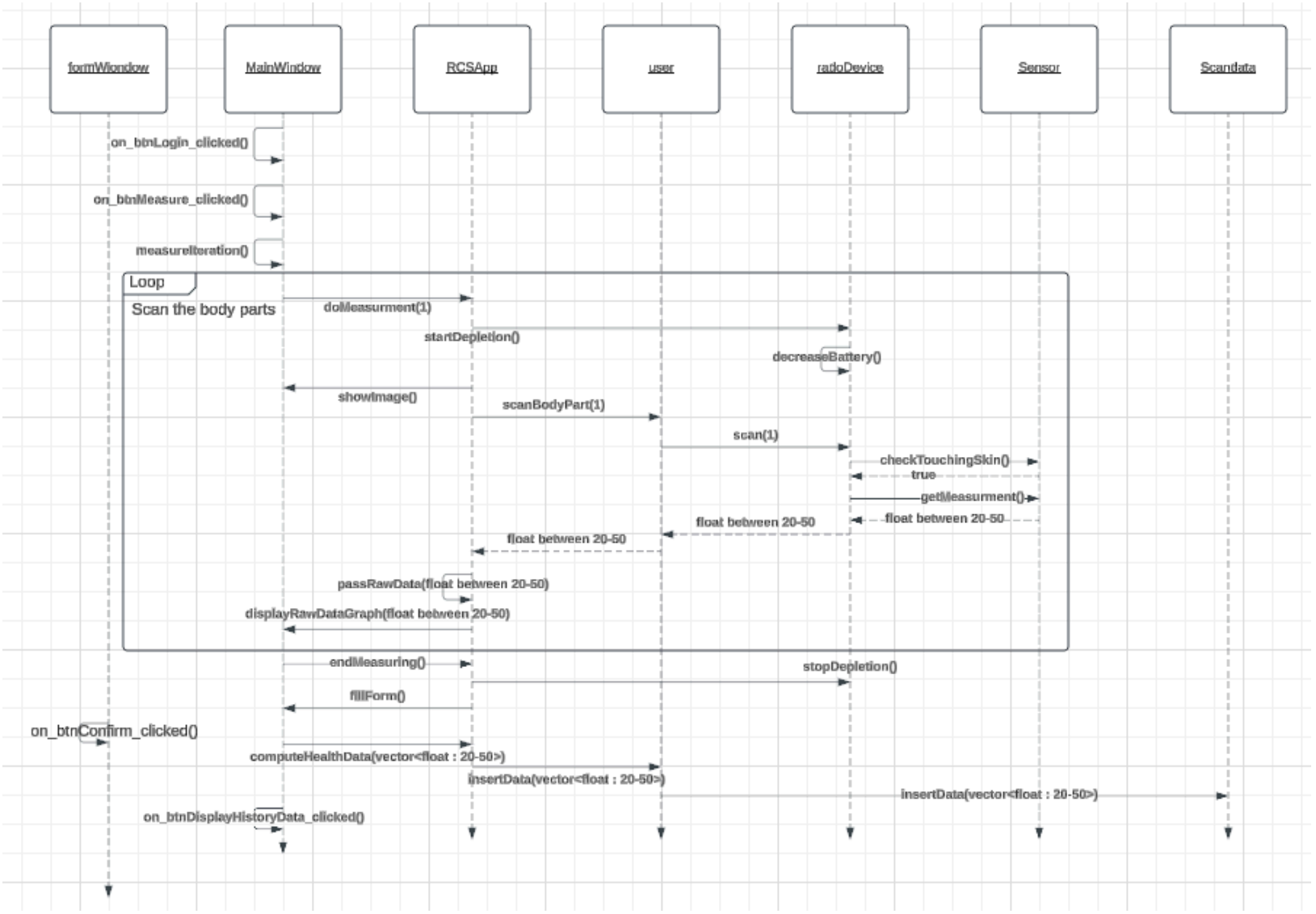
UML Class Diagram



UML Sequence Diagrams

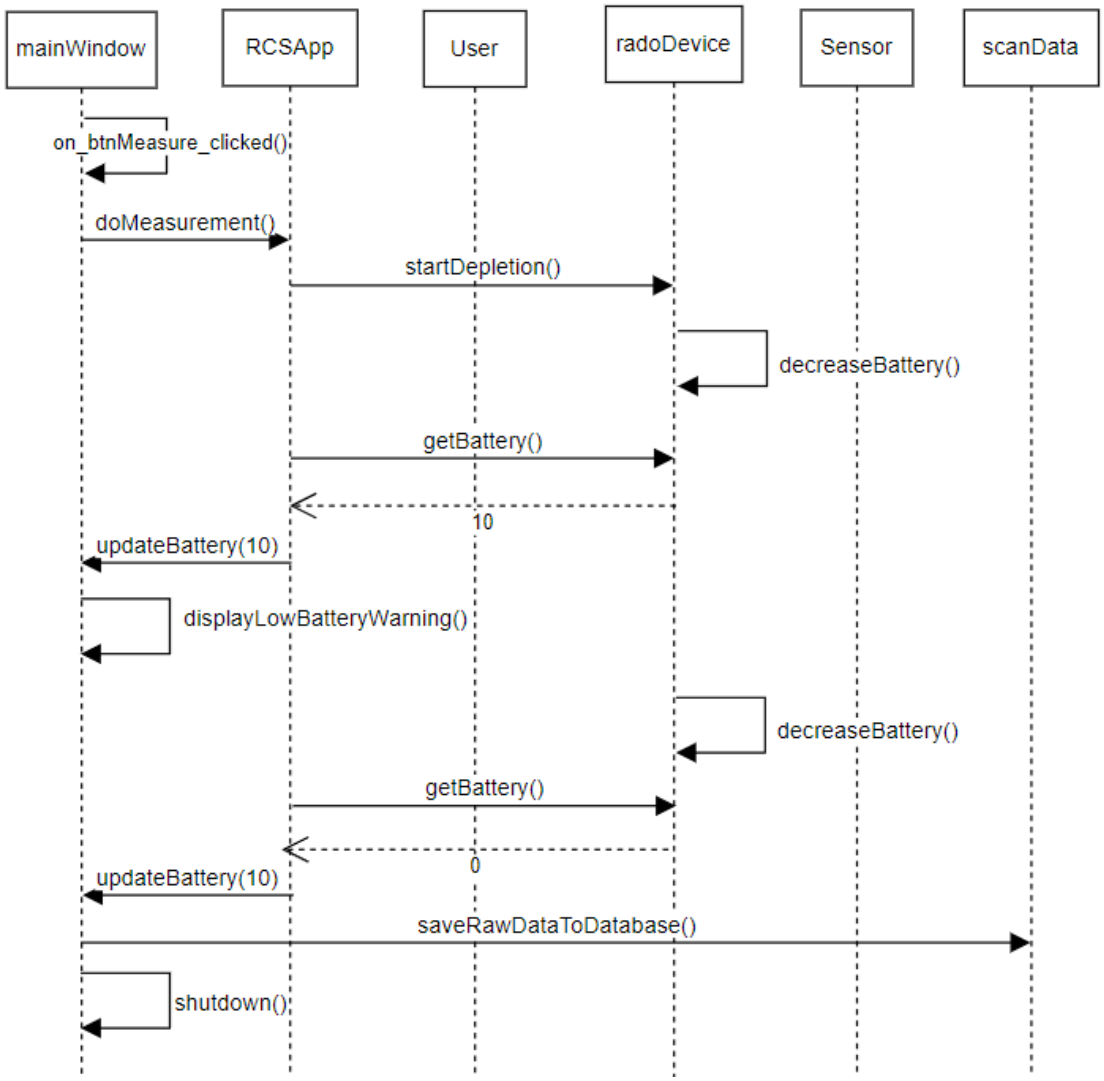
Cover normal success behaviour

The main window prompts the user to login and the user logs in. The user clicks on the measure now button on the simulation. The user sprays water on the areas they have to scan. The user clicks the “start metering” button on the simulation. The user chooses their profile. The user follows the prompts from the screen and scans the areas they are told to scan until it is complete. The user takes notes about their current state during the scan. The user now clicks on the history tab in the simulation app to view the body shot, circle, and chart of their past scans. The user taps on the indicator button to get a snapshot of the scan details. The user clicks on the recommendations button to see health recommendations to improve health. The user then closes the app.

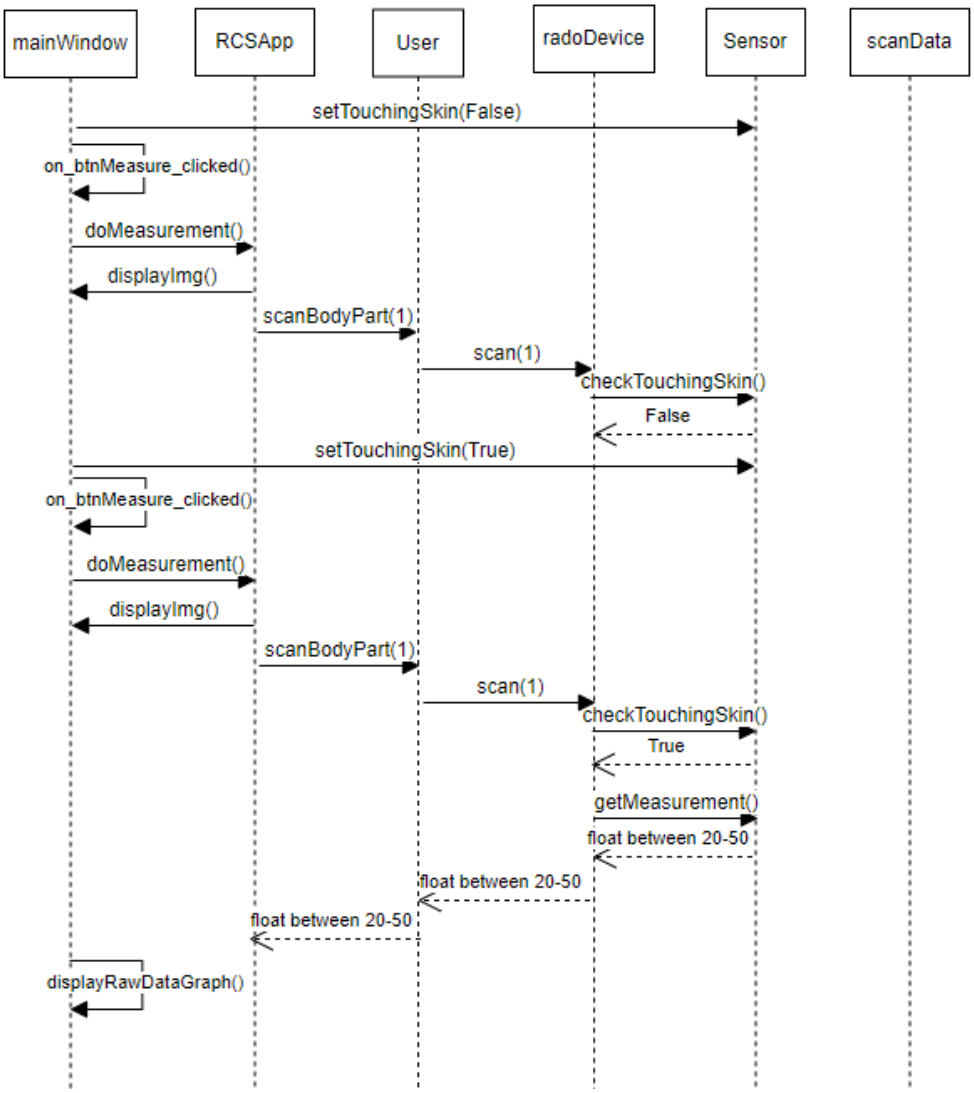


Safety Scenario - battery depleting diagram (give warning to user and gracefully shut down).

When the battery gets low (10%) it will give a warning to the user that the battery is low. When the battery hits 0, the program will make sure all the data is saved within the database then gracefully shuts down.

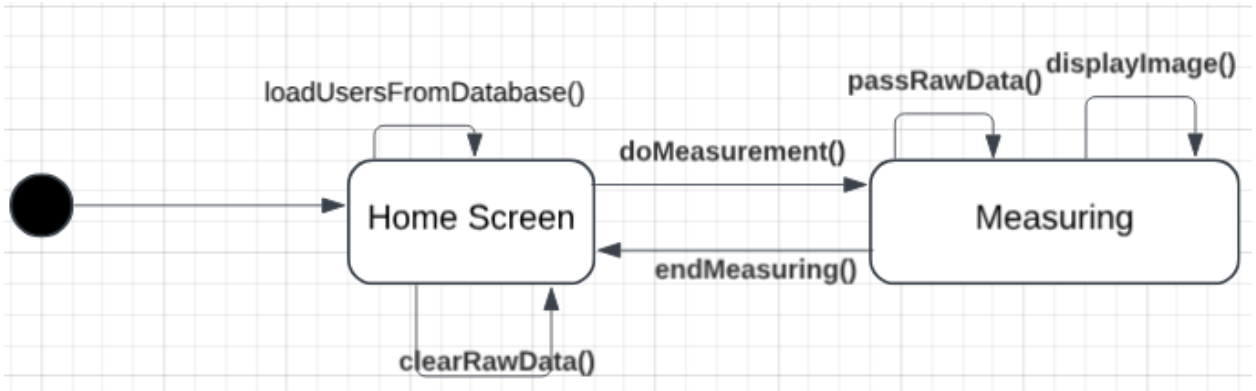


Safety Scenario - Connection loss (on skin or off skin)
The radoDevice is not touching the user's skin so no measurements go off. User has to redo the measurements and make sure his skin is in contact with the device. If done correctly, the radoDevice will return some measurements

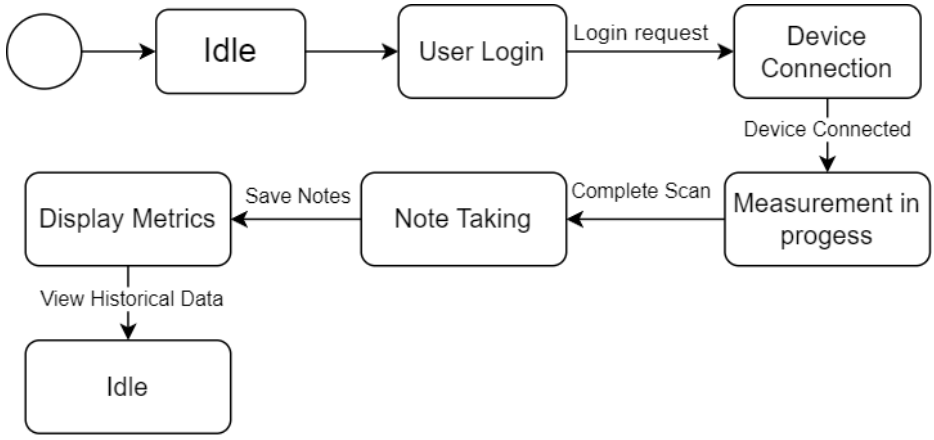


UML State Machine Diagrams:

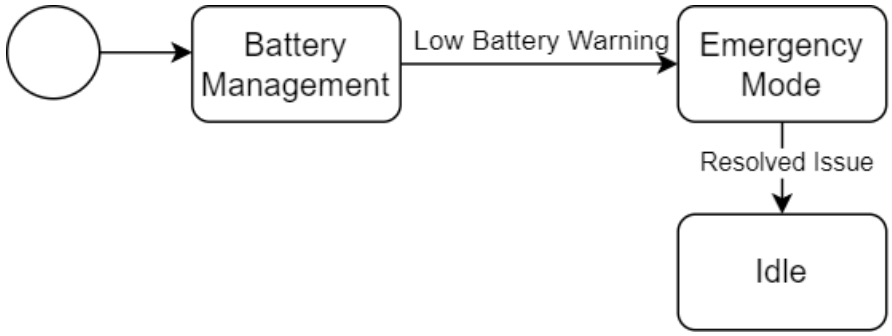
RCSApp State Machine Diagram



RadoTech State Machine Diagram



Battery Failure Case:



Design Decisions:

- After discussion with the professor, we have decided to make the measurements from the scan be randomised into 3 categories: Healthy (5-50), Normal (50-70), Unhealthy (70-180). For example, if the first scan is healthy, then the 23 others will also be healthy.
- The User running the code is assumed to have qtCharts installed as per professor. (To install, type this in your terminal on the vm: “sudo apt install libqt5charts5-dev”)
- For the measuring, after discussing with the professor, we are doing a burst approach where all the scans/measurements of the body parts will happen all at once with no intermediate steps (i.e pressing a button, etc). The simulation will show an image of the body part, get the conductivity of the body part, wait a second, then move onto the next scan.
- We are using a SQL database to store our user information as well as our scan information. The functional dependencies can be found below.
- For the bar graph, instead of displaying 2 bars for the same x-axis (e.g: two bars for the lungs), we decided to take the average of the 2 bars and display them as 1 bar.
- The bar graph is displayed under 12 x-axis depicted by pictures (like in the actual app). The pictures correspond to this list respectively: lungs, Pericardium, Heart, Small intestine, Lymph vessel, Large intestine, Spleen, Liver, Kidney and Adrenal glands, Bladder, Gallbladder, Stomach
- All information is automatically stored in the database once created or measured.
- When battery reaches 10, a warning message appears

- When the battery reaches 0 during a measurement. The program will shutdown and the user will need to restart that measurement from the start. All previous data will be saved.
- The battery only deplets when performing measurement because if you are not measuring then you are not using the device. Therefore the device should not lose battery.

Database Functional Dependencies:
User Table
USERID -> username, password, fName, lName, gender, weight, height,

Data Table
dataID -> userID, x1, x2, x3, x4, x5, x6 ,x7 ,x8 , x9, x10, x11, x12, x13, x14, x15, x16, x17, x18, x19, x20, x21, x22, x23, x24, body_temp, blood_pressure_right_hand, blood_pressure_left_hand, heart_rate, weight, sleeping_time, face, ranking , notes

Traceability Matrix
The numbers indicated in the “Related Use Case” correspond to the main success step or extension step in our Use Case.

ID	Requirement	Related Use Case	Fulfilled By	Tested by	Description
1	Users can log on to their profile	Using the RadoTech Device (1)	mainWindow, database	Run the code, and log in via the UI by typing username and password.	In the mainWindow GUI, it has text boxes where you can implement your username and password then a login button to confirm. Database will check to see if that user exists.
2	Create, update, and delete user profiles. Each device should support multiple profiles	Using the RadoTech Device (1a.1)	mainWindow, user, database	Run the click and click the create button in the UI. Fill out the information	mainWindow is able to create users and add them to the database along with their necessary information.
3	App has a home screen to access to various information that the app provides	N/A	mainWindow	Run the code and the UI home screen will pop up.	The home screen pops up allowing the user to login, create, measure, check history, etc.
4	The device should be able to connect with the app	Using the RadoTech Device (4a1)	mainWindow, RCSApp, radoDevice	Once a user logs in through the UI, the code will connect the UI with the	When a user logs in it will automatically connect the RadoTech and the measure button will be enabled: showing that the

				RadoTech.	device is connected with the app.
5	User can scan their body with the device and record all 24 data points on the app	Using the RadoTech Device (6)	RCSApp, user, radoDevice, sensor, mainWindow	Press measure button once logged in	When the user presses the measure button, the device will do the 24 scans of the user and save the data to the database.
6	App shows pictures of which body part to scan	Using the RadoTech Device (6)	mainWindow, RCSApp	Press measure button and observe the UI	When the user presses the measure button. The images of the body part
7	Users can take notes after the scan about their current state.	Using the RadoTech Device (7)	mainWindow, RCSApp, database	After the measurements, fill out the form window that pops up.	When the measurements are done, a form will appear where the user has to fill out some information. That information will then get saved into the database.
8	Store and allow users to access historical health data for trend analysis	Using the RadoTech Device (8)	mainWindow, RCSApp, user, scanData database	Click the measure button and wait for it to finish. Data will be saved once form is complete	After the form is filled out, the 24 measurements as long with the form information will be saved to the database.
9	Display health metrics in an easy-to-understand, visual format within the application.	Using the RadoTech Device (8	mainWindow, database	Click the measure button to see the graphs for each scan. Click the “Display Historical Data” to display the bar graph of past scans	Clicking on the measurement button will show a graph for the raw data given by each scan, The “Display Historical Data” will display the past scan data in an easy to understand bar graph.
10	Provide a place-holder for specialists’ recommendation.	Using the RadoTech Device (10)	mainWindow, database	Click on “Display Historical Data”, then “ Recommendation ”	The recommendation button will be enabled once the user has selected a past scan. It will then show the recommendation corresponding to that historical data.
11	Device has a battery life with charge depletion, low power indication, and	N/A	mainWindow, radoDevice	When measuring, observe the battery progress bar in the UI and it will go down.	The device will deplete overtime when measuring. When the battery hits 10, it will give a pop up message indicating low battery.

	graceful shutdown.			Keep measuring until the battery hits 0 to get the graceful shutdown.	When it hits 0, it will shut down and all the information will be saved in a database.
12	Show the device contacting or not contacting the skin.	Using the RadoTech Device (6d1)	mainWindow, Sensor, RCSApp	In the UI, in the ComboBox, select “Touching Skin (ON)” or “Touching Skin (OFF)”	When selecting “Touching Skin (ON)” and then measuring, the measurement will proceed normally but if “Touching Skin (OFF)” then the measurements will not go through.
13	Process raw data to generate health metrics as you understand it based on 1) answers you received from the Product Owner,	N/A	mainWindow, RCSApp, database	Click the measure button and observe the measurement numbers displayed on the UI.	The raw data will be processed with a random number generator. All data points for a measurement will be consistent with each other. So if one data point is healthy, then the rest will be healthy as well.