DePuy Synthes
THE ORTHOPAEDICS COMPANY OF Johnson & Johnson

Final Year Presentation

locare

Initial Brief

In collaboration with DePuy Synthes

"Design an activity tracker for joint replacement by focusing on removing the barriers to wearing a tracker."

Project Background

01

What are the benefits of tracking patient activity after joint surgery?

Allows healthcare professionals to ensure that the patient is recovering well after the procedure.

02

What is the most important part of the recovery?

Starting to move the new joint soon after the operation and following a home exercise plan provided by a physiotherapist.

03

What are the limits of traditional activity trackers?

Common activity trackers are not catered to the older age group undergoing hip replacement surgeries.

User & Interview

75 - 79

years old is the average patient's age

If you were asked to wear a tracker for 15 days non-stop would you do so?

“**Yes**, as long as it didn't make me suffer. When we offer new technology in France, it has been tested, and **I trust the doctors**. It's no fun going to the rehabilitation centre either, you **need motivation.** My motivation was that I was going to **heal faster**. If the device helps me heal, I will wear it.”

Scenario

01

Patient goes for a check-up a couple days prior to the surgery

02

Doctor introduces tracking device and helps the patient test and calibrate it

03

Patient undergoes surgery

04

Doctor monitors patient activity throughout the rehabilitation period

05

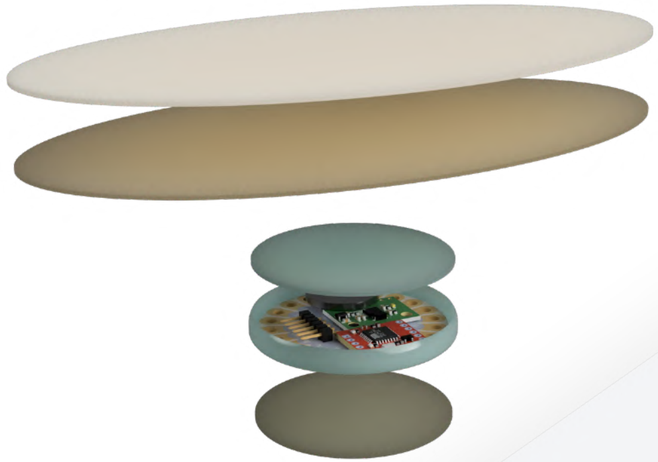
Patient receives feedback from the doctor through relevant exercises

06

Doctor chooses when rehabilitation period stops according to the data (often around 14 days)

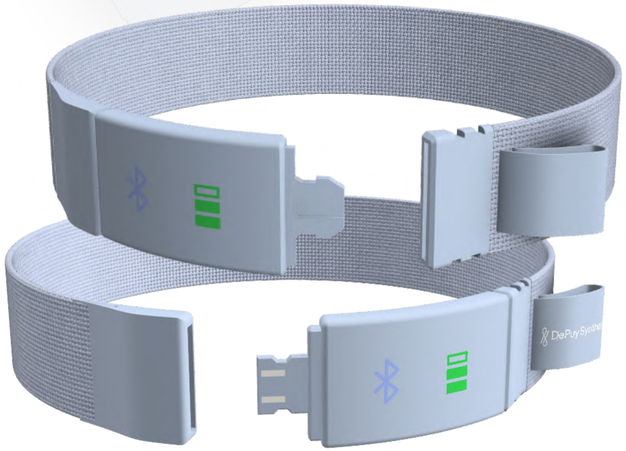
Concept Development

01
Patch



02
Silicon bands

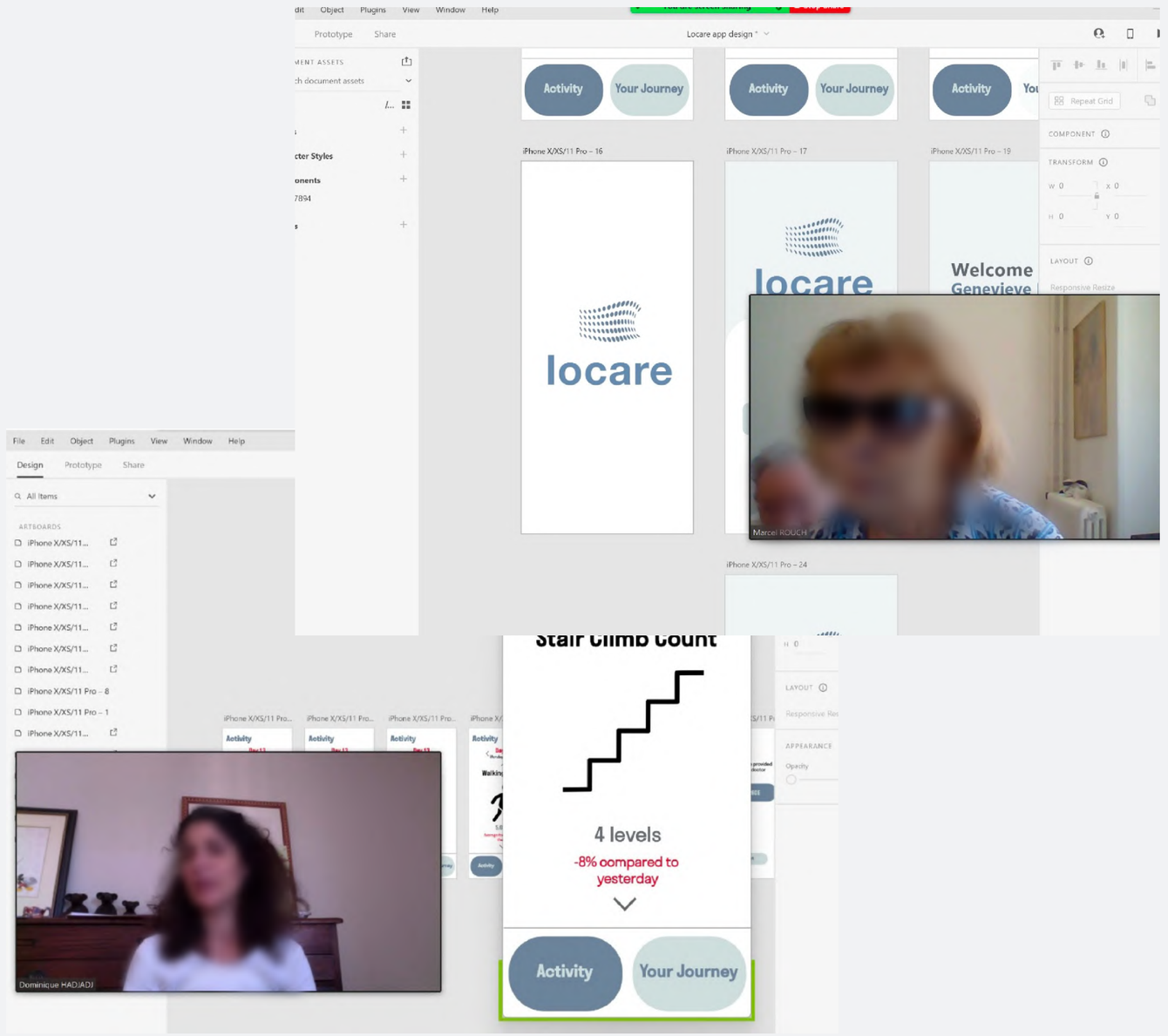
03
Textile Band



Interview & Refined Brief

What will motivate you to wear the device?

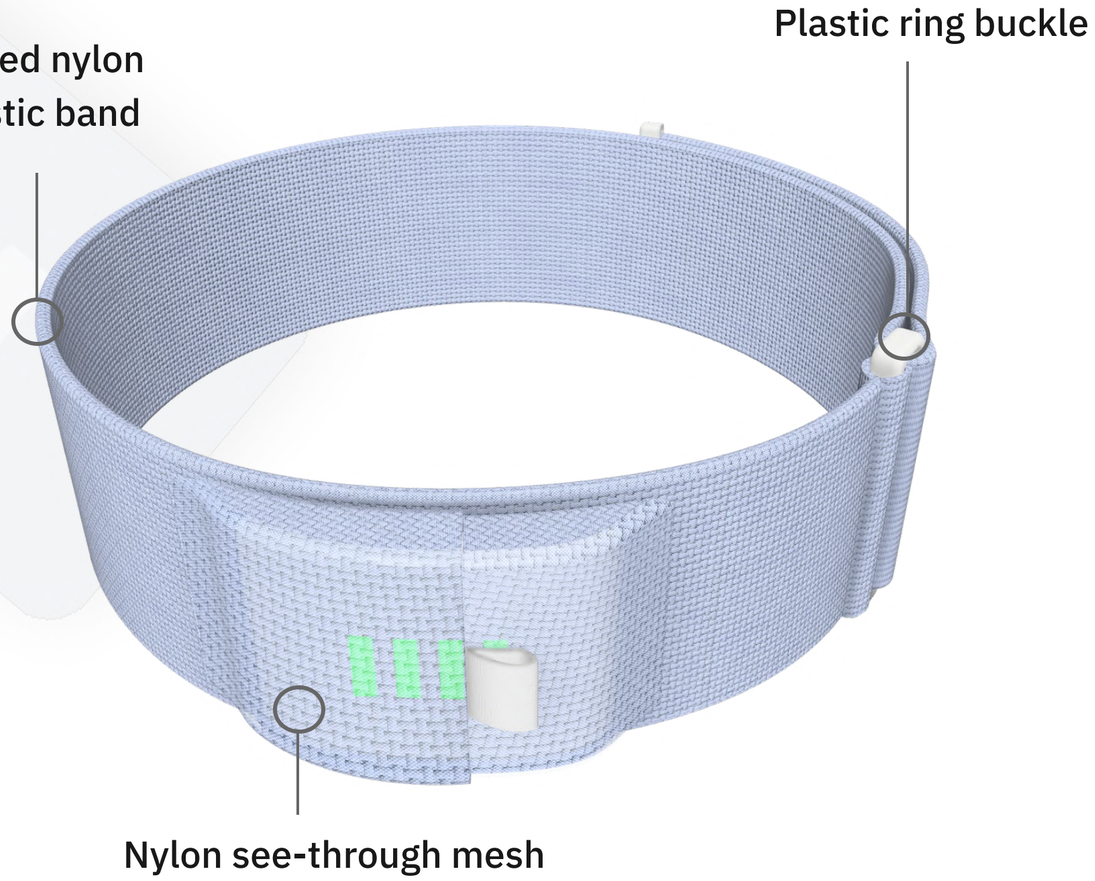
Again, **it will reassure me a lot to know that someone is closely following my rehab**, so I know there is a point to wearing the device. Also if it’s very intuitive to use, for example, if it’s easy to put on and charge



Prototyping

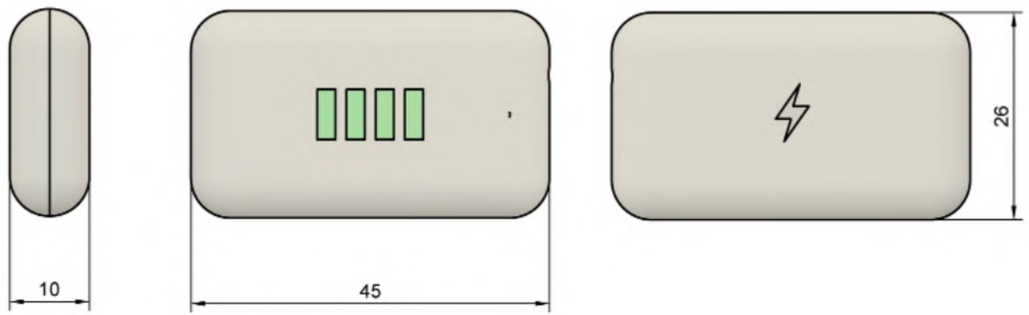
User Testing

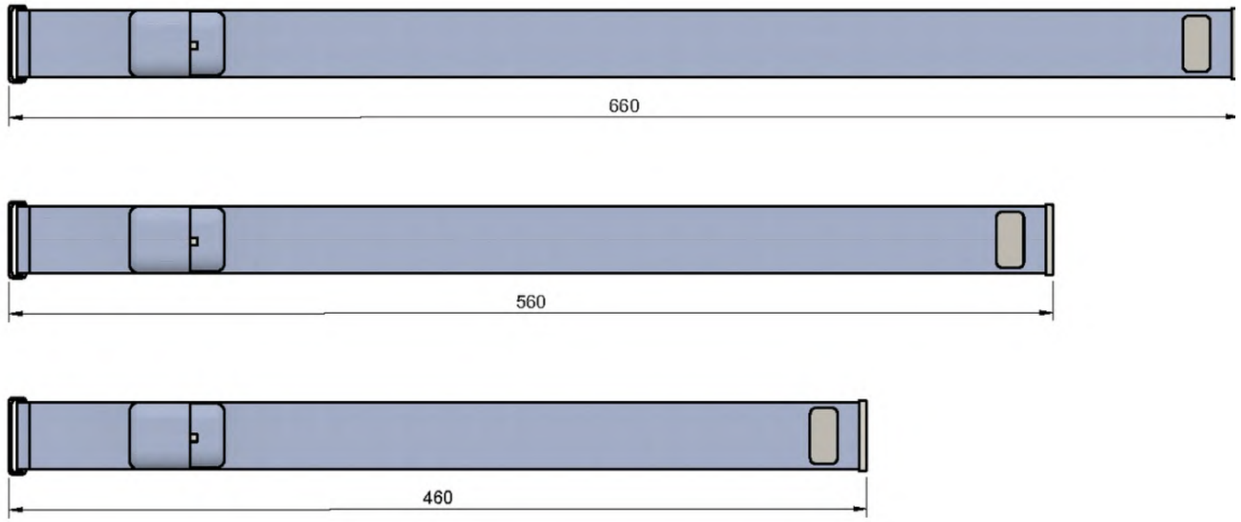
Final Product



Measurement & Sizing

Whilst prototyping it was realised that users have different physiques so providing one size for the elastic band might not be sufficient. This was overcome by providing a range of sizes, including small, medium and large.





All dimensions are in mm

Product Use Cycle

Patient receives device

Patient undergoes surgical procedure

Device is used before and after surgery

Rehabilitation period is finished

Patient returns device

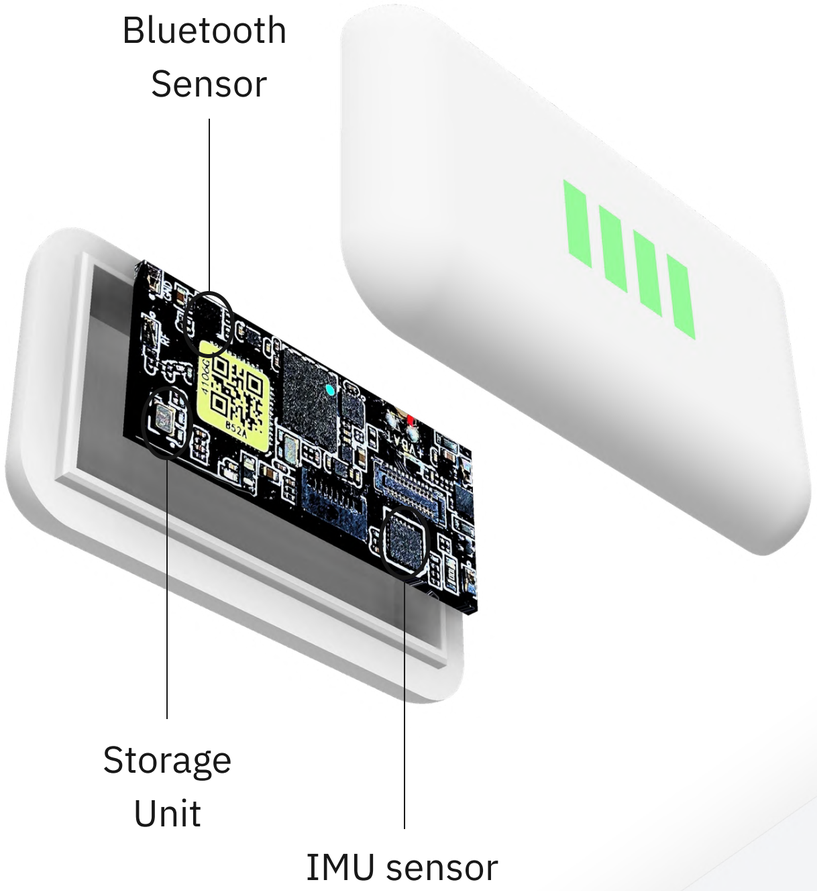
Casing and electronic component sterilised by medical facility

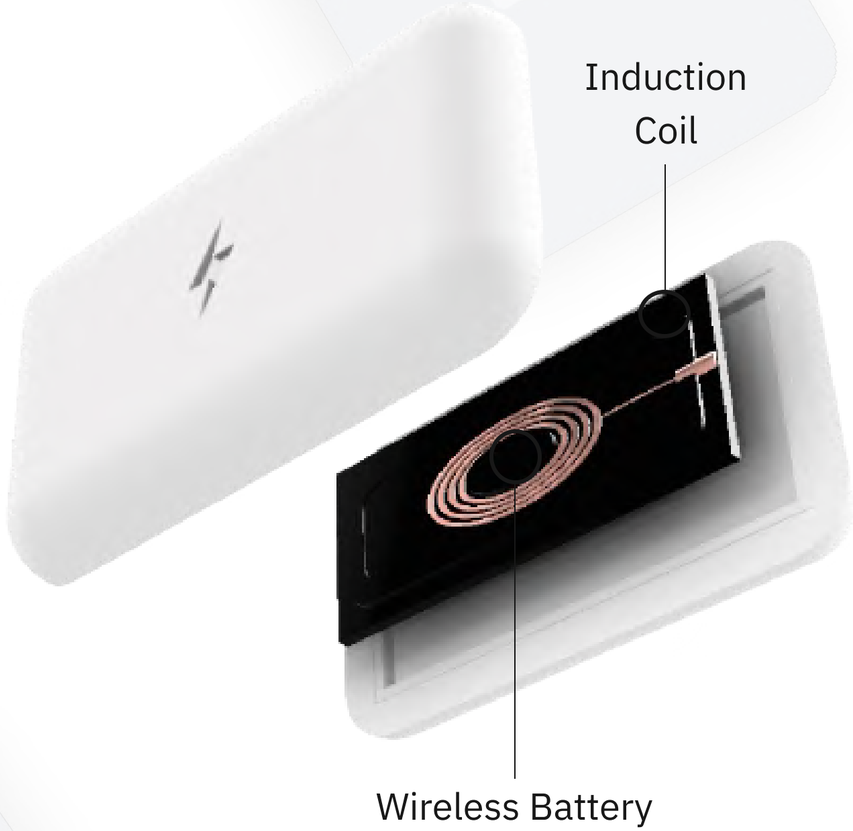
Elastic band is repurposed or recycled

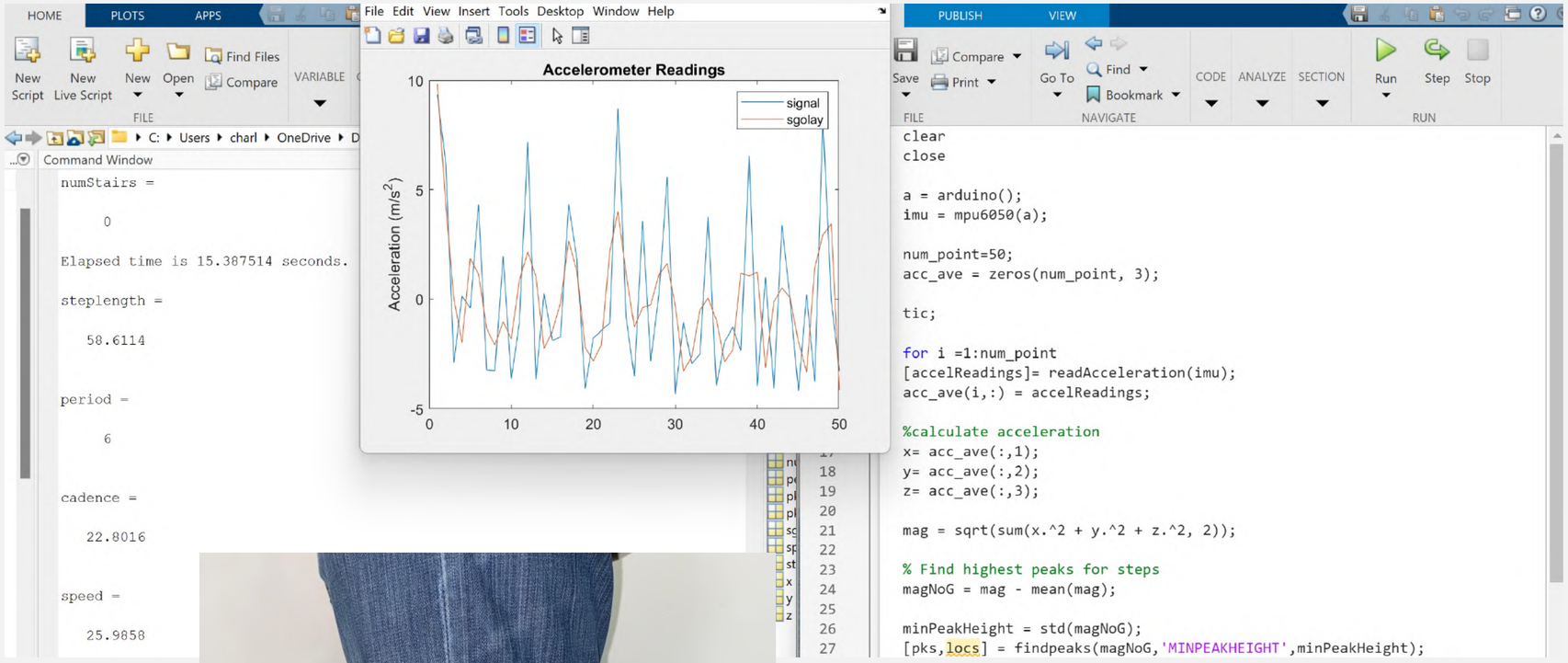
Elastic band condition is examined

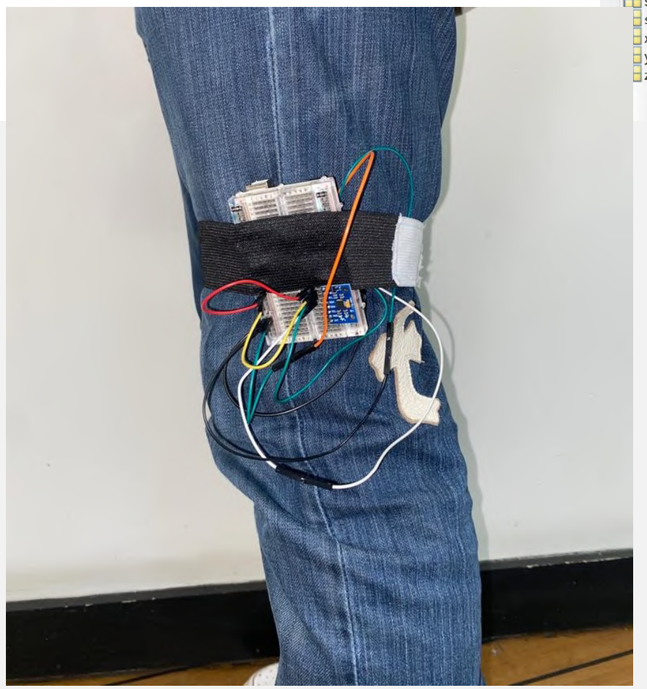
Elastic band is sterilised and reused

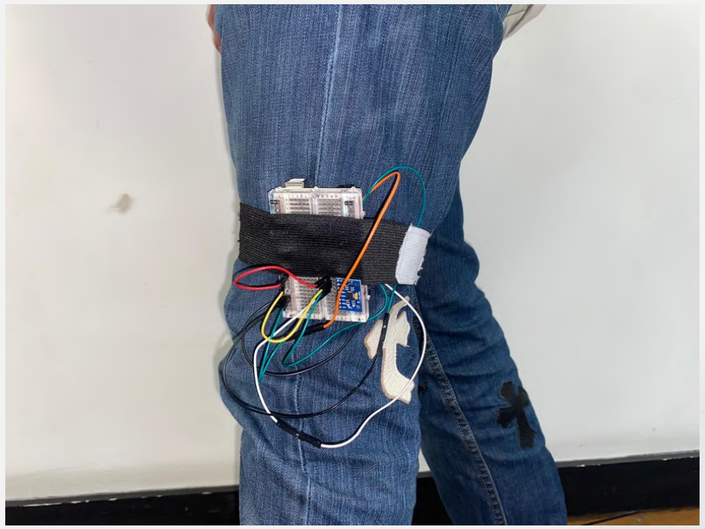
Technology


Bluetooth
Sensor
Storage
Unit
IMU sensor


Induction
Coil
Wireless Battery



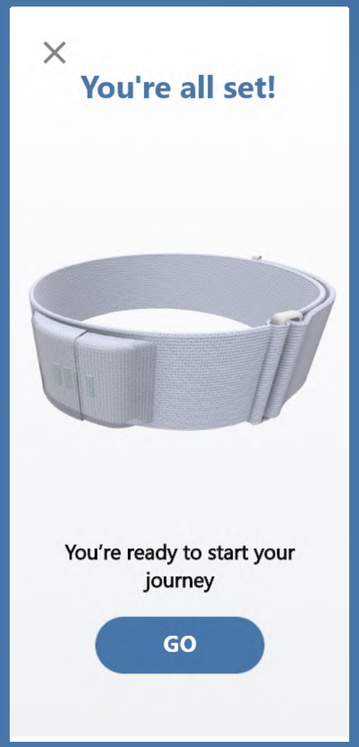


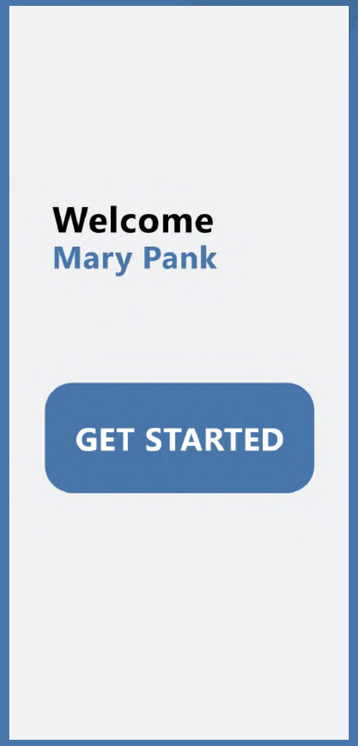


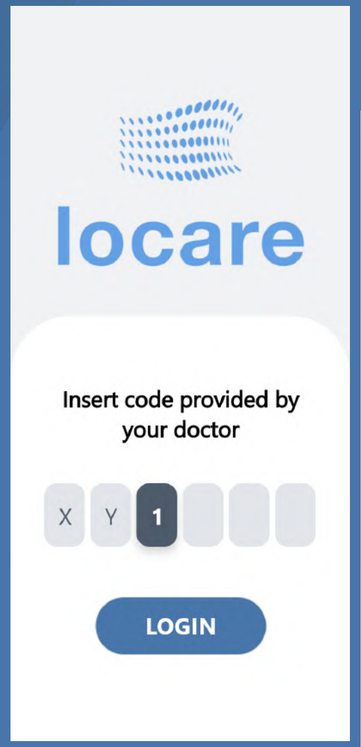
Data collection

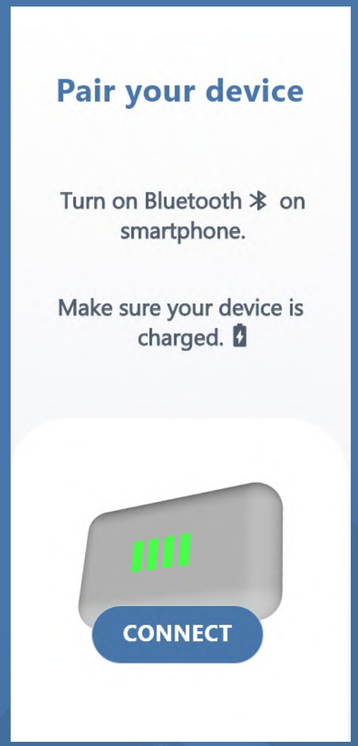
Data collection was tested using an Arduino UNO board connected to MatLab. The acceleration signal is processed, as well as the step count, stair count and cadence. The step length and walking speed was also estimated.

Patient App

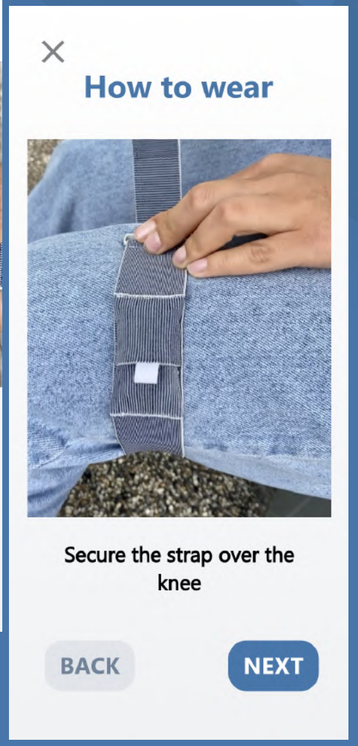

You're all set!
You're ready to start your journey
GO

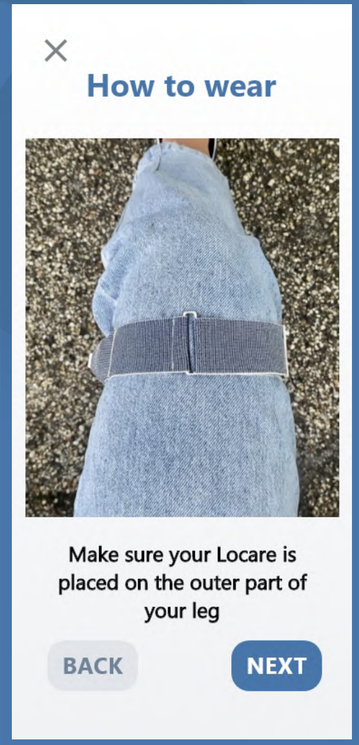

Welcome
Mary Pank
GET STARTED

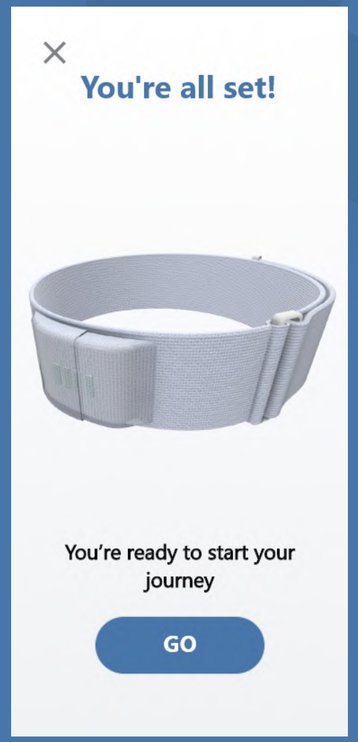

locare
Insert code provided by your doctor
X Y 1
LOGIN

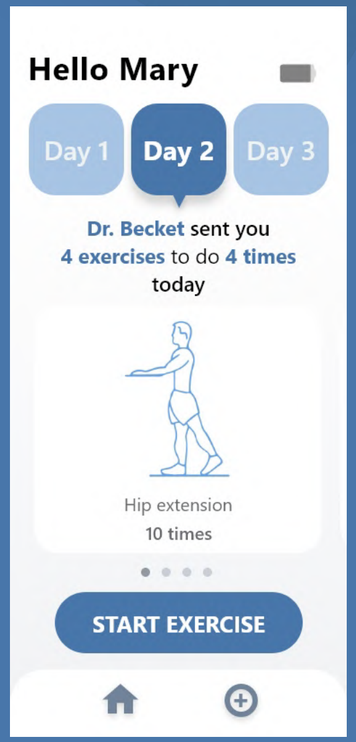

Pair your device
Turn on Bluetooth on smartphone.
Make sure your device is charged.
CONNECT

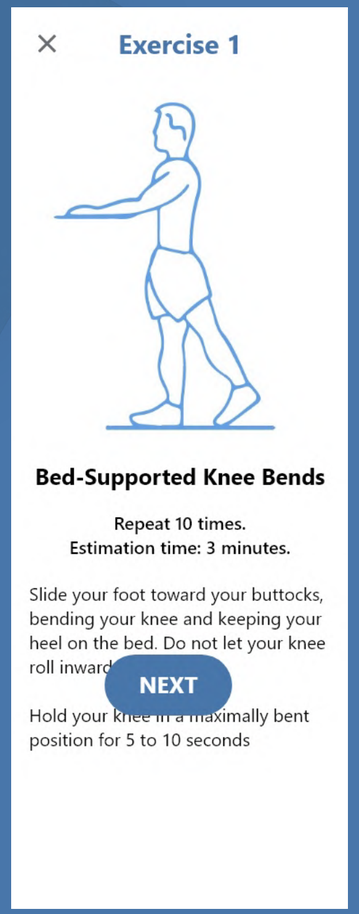

How to wear
Insert Locare into elastic pocket of the band
NEXT

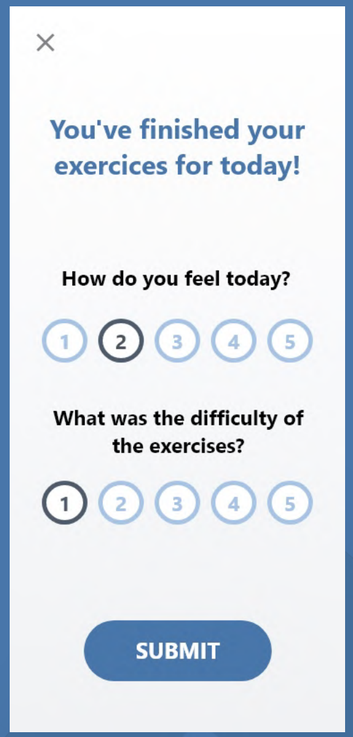

How to wear
Secure the strap over the knee
BACK
NEXT

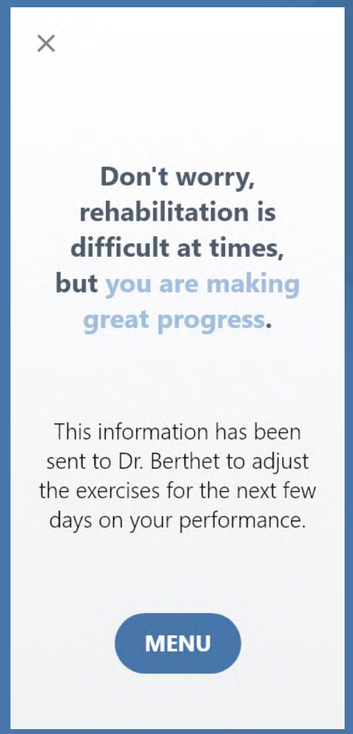

How to wear
Make sure your Locare is placed on the outer part of your leg
BACK
NEXT

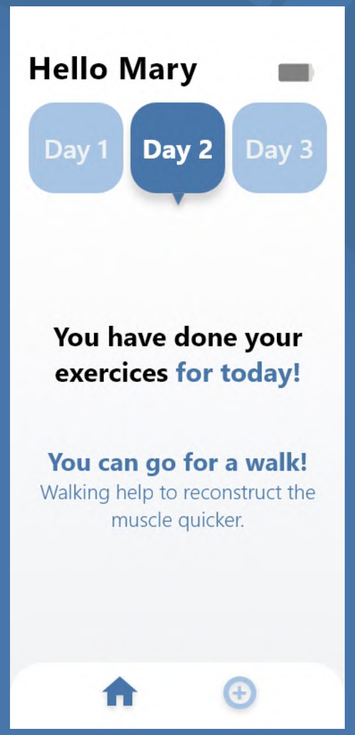

You're all set!
You're ready to start your journey
GO


Hello Mary
Day 1
Day 2
Day 3
Dr. Becket sent you 4 exercises to do 4 times today
Hip extension
10 times
START EXERCISE


Exercise 1
Bed-Supported Knee Bends
Repeat 10 times.
Estimation time: 3 minutes.
Slide your foot toward your buttocks, bending your knee and keeping your heel on the bed. Do not let your knee roll inward
NEXT
Hold your knee in a maximally bent position for 5 to 10 seconds

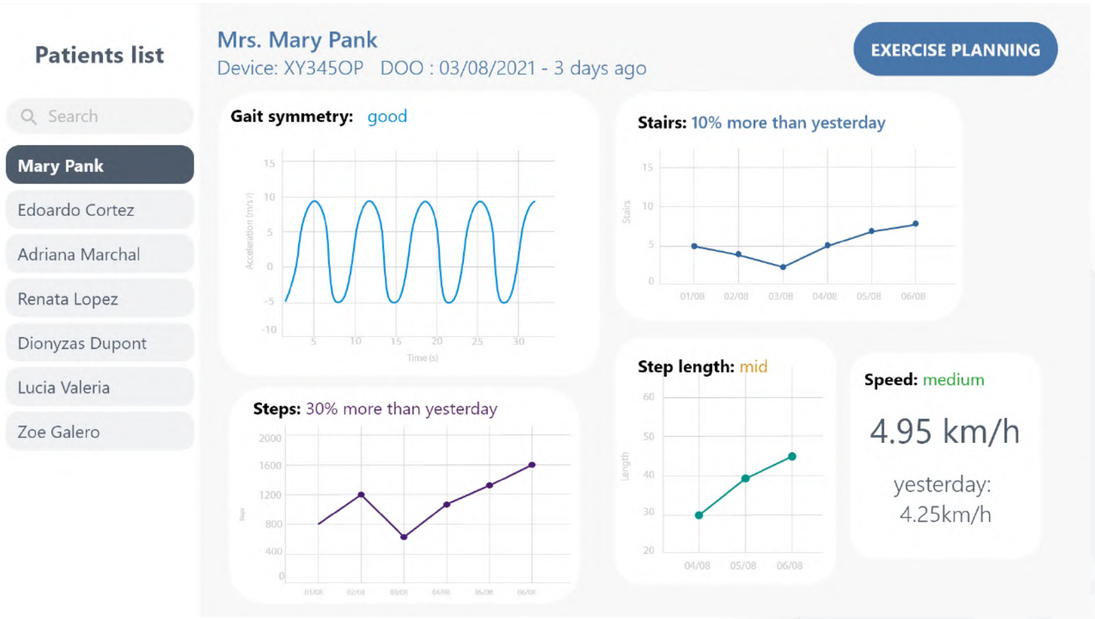

You've finished your exercices for today!
How do you feel today?
1
2
3
4
5
What was the difficulty of the exercises?
1
2
3
4
5
SUBMIT

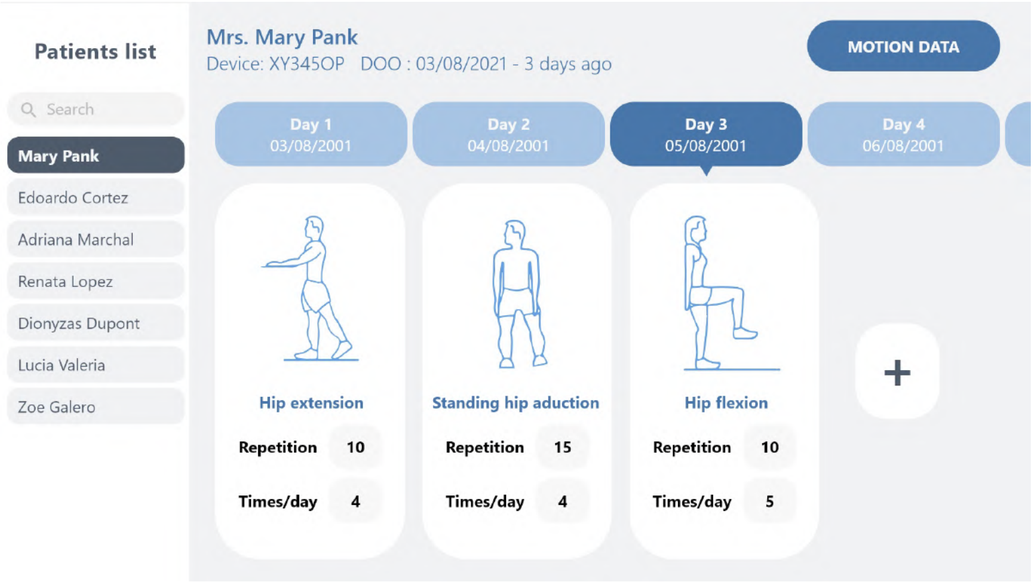

Don't worry, rehabilitation is difficult at times, but you are making great progress.
This information has been sent to Dr. Berthet to adjust the exercises for the next few days on your performance.
MENU

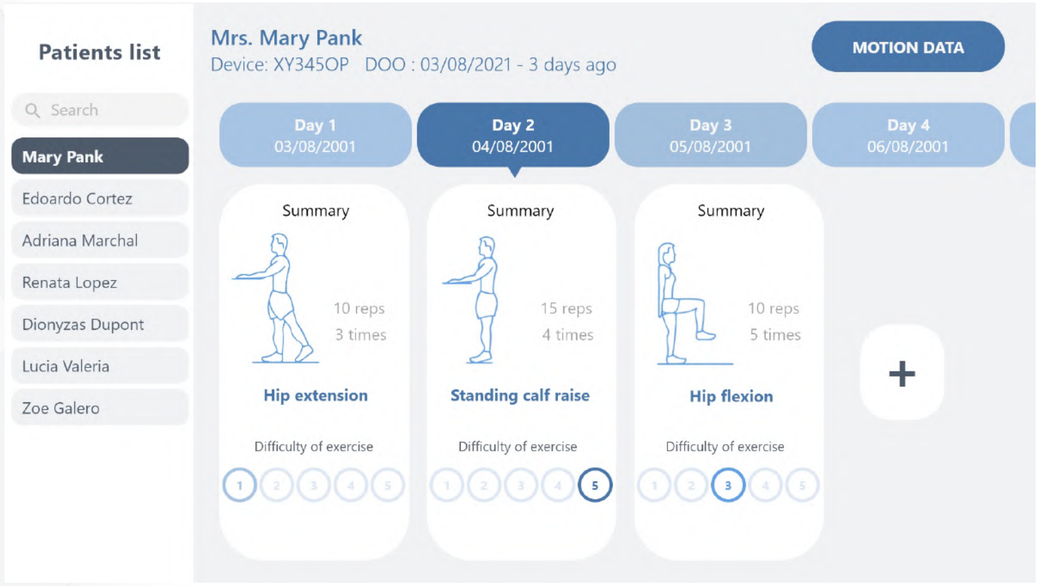

Hello Mary
Day 1
Day 2
Day 3
You have done your exercices for today!
You can go for a walk!
Walking help to reconstruct the muscle quicker.


Your data
Activity Metrics
Steps
4,595
Stairs
10 floors
Active Time
You are 12% more active than yesterday!
4h 24
Progress
Overall, you are making great progress, continue like this!

Doctor Platform







Future Works

The project is still under development.

The accuracy of the data can be improved through the use of more specialised sensors.

Technical aspects of the project can be further developed by experts in that field.

Increasing the usability of the device by providing guiding material for the user (instruction manual/brochure).

Continue to conduct user testing for a more inclusive design.