

Week 10

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Announcement

Upcoming Important Dates:

- Flyer and poster: submit to Moodle (in ppt), due **Today; (internal review)**
- Final poster: due **Nov. 28** (sent for print);
- Public Presentation: **Dec. 4 at 15h – 20h**;
- Final in-class Technical Presentation: **Dec. 12**;
- Final report submission due on **Dec. 19** by 8h15 (NO LATE SUBMISSION)

Equipment, parts, and tools

- Return on **Dec. 12** (Last in person class)
- Tackle box;
- Any equipment/tools/parts;
- Hand in Prototypes
- **Organize all the files related to the project, upload to the Onedrive**

Grading

Demo Day Grading Scales
Cohesive Scenario (10%)
Clear motivation and communication for the need of the product (10%)
Concept novelty (20%)
Maturity of the prototype (20%)
Application of novel technology (20%)
Poster (content and design) (10%)
Videos and other visual aids to communicate better the concept and working principle (10%)

Final Presentation Grading Scale
<p>Organization (20%) Clear goal Clear engineering approach Clear solution selection Timing</p>
<p>Presentation (30%) Audible and confident presentation Cohesive and coherent slides Visually and content-wise illustrative slides Well-practiced talk</p>
<p>Technical Quality (40%) Clear engineering specifications and approach methods Good solution with clear justification Clear presentation of pros and cons of the suggested solutions Analytical and engineering approach to the solution Present and defend the design options during Q&A</p>
<p>Project Participation (10%) Active weekly TP participation Team effort Quality improvement over the semester</p>

- **Motivation**
 - Why your project matters?
 - What makes your approach novel?
 - Strength?
- **Performance**
 - Actual testing data from prototype, Not expectations;
 - Enhance the readability of the plot/table.
- **Design**
 - Highlight how your design helped improve the performance;
 - Justify the design/selection;
- **Summary**
 - Cons and Pros;
 - Future work;

ME-410: Mechanical Product Design & Development

SynchRower

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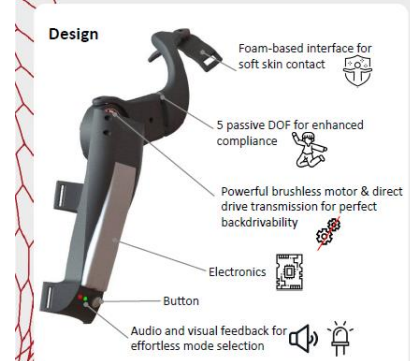


Motivation

For efficient rowing, all crew members need to be perfectly in sync. The usual technique to achieve this is by visually imitating and feeling the movement of the person in front.

Our goal is to improve the synchronisation of the crew by leveraging haptic feedback and muscle memory training, which were shown by previous works [1][2] to have an important impact on learning complex movements.

Additionally, our device will allow each crew member to synchronize with the leader directly instead of with the person in front, thus avoiding delay and loss in performance.



The button allows for calibration with other devices, and activation of the haptic feedback. The thinner segment lies on the calf and its linear position is adjustable by the user. The motor at the interface of the two segments rotates and drives the leg towards the angle setpoint provided by the leader.

State-of-the-art

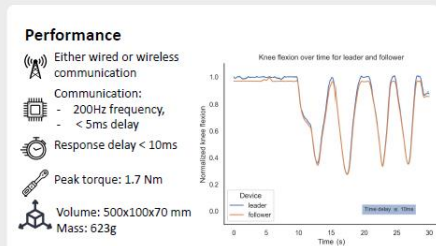
Ortheses

Orthofiga
An actuated knee articulation for walking assistance with a control feedback loop to optimize the gait

Rowing smart equipment

Biorower
A rowing boat simulator that simulates water resistance and boat instability, and allows for pace monitoring.

StrokeCoach
Displays pace, stroke count, time, speed.



Summary and Future Development

Our device enables the rowers to get a fast feedback response to help them row in sync. Indeed, we have shown that the delay is short enough (< 10ms). Nevertheless, it would be relevant to do a more thorough dynamic analysis to assess the full capabilities of our device. It would also be interesting to conduct a study to evaluate how much impact our device has on the training of rowers in real-life conditions.

Achieved	Further improvements
Working proof of concept	Waterproofing
Easy and simple interface	Include battery
Great compliance thanks to the 5 passive DOFs	Synchronize more than 2 rowers

References:

[1] Sigrist, R., Rauter, G., Marchal-Crespo, L. et al. Sonification and haptic feedback in addition to visual feedback enhances complex motor task learning. *Exp Brain Res* 233, 909–925 (2015)

[2] Roland Sigrist roland.sigrist@hest.ethz.ch., Georg Rauter, Robert Riener & Peter Wolf (2013) Terminal Feedback Outperforms Concurrent Visual, Auditory, and Haptic Feedback in Learning a Complex Rowing-Type Task, *Journal of Motor Behavior*, 45:6, 455–472

Next Week

- 2nd Mock demo presentation;
- Poster ready for print;