

Real-time tracking of leg position with inertial sensors for closed-loop stimulation

Summer student project for May-August 2018, supervised by Dr Milos Popovic and mentored by Dr. Bastien Moineau, in collaboration with Dr César Marquez-Chin.

Target Student Population(s)

Undergraduate student in Electrical Engineering, Computer Science, or Math, in years 2-4, providing that their training matches with the skills described below.

Brief Project Description

The objective of the project is to prepare the tools necessary to create an assistive device using functional electrical stimulation (artificial muscle contraction) in individuals with neurological paralysis (stroke, spinal cord-injury). Specifically, the student will be asked to design the experimental setting and software based on the material already developed in our lab (conversion of IMU data to angle, stimulator closed-loop controller). The recording device will be inertial measurement units used to measure shank and thigh position (orientation in gravitational referential). These positions will be used to control in real time the electrical stimulation applied on thigh muscles through surface electrodes, which consequently mobilize the knee joint. As per student's progress, other functions might be added to this rehabilitation system.

Expected Learning Outcomes

Through this project, we expect you to learn the following -

1. Effectively reading scientific literature to identify the current state of the art.
2. Framing a research question
3. Collaborate with peers and supervisors to define the best material and methods
4. Understand and take over previous methods to improve and expand them for a different use.
5. Writing scientific reports to report your developments and your findings.
6. Presenting your work to audiences from a diverse set of backgrounds.

Expected Research Outcomes

The expected achievement is to obtain a reliable recording of leg position, as compared to a gold standard assessment, and to feed in real time a closed-loop controller in a way that allows completing the predefined movements.

Required technical Skills

- Extensive programming experience (LabView mostly, MatLab, C++)
- Good understanding of signal processing and sensor fusion theory
- Good knowledge of computer science, VISA function, serial communication, data sheets management
- Experience with reading and critiquing scientific literature (optional)

Funding

Funding for this project may be obtained through competitive scholarship: [NSERC USRA and IBBME Director's Awards](#). It is the student's responsibility to apply in a timely manner, with the approval and assistance of their supervisor.

Application Details

To apply for this project, you must first complete the [IBBME USRP application](#) (Note: only need to do this once). Once you've don't that, please email your updated CV and a statement of intent to Dr. Bastien Moineau (Bastien.Moineau@uhn.ca). Explain briefly why you are interested by the project and its outcomes, and why you would be a good fit for this project. Please also provide your latest transcript (can be unofficial) to help us assess your chances to obtain funding. The subject of your email should be *"Summer Student Application: IMU leg controller"*.