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Wheelchair Neuroprosthesis for Improving Dynamic Trunk Stability

Summer student project for May-August 2018, supervised by Dr. Kei Masani and mentored by Dr. Bastien Moineau and Kramay Patel

Target Student Population(s)

Undergraduate student in Engineering Science, Mechanical Engineering, Electrical Engineering or Computer Engineering in years 1-3. Preference will be given to 3rd year students who are willing to continue with this project into their 4th year undergraduate thesis.

Brief Project Description

Individuals with cervical and/or thoracic spinal cord injuries often lose control over their trunk muscles.. This results in an unstable seated posture, which dramatically reduces the quality of life of these individuals. Functional Electrical Stimulation (FES) is a technology that can be used to artificially contract trunk muscles in an effort to improve trunk stability. We have recently developed a wheelchair based neuroprosthesis which uses FES to artificially contract trunk muscles in a feed-forward manner, to improve dynamic trunk stability. We have tested this neuroprosthesis on able-bodied individuals and the next step is to modify the system and make it suitable for individuals with Spinal Cord Injuries. This will involve upgrading the wheelchair software (using Python) and adding mechanical components to improve the overall safety of the wheelchair.

Expected Learning Outcomes

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

1. Assessing safety of assistive devices and improving it through intelligent and feasible mechanical design and engineering.
2. Controlling Arduino controlled electromechanical devices through Python.
3. Framing a research question.
4. Effectively reading scientific literature to identify the current state of the art.
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

Through this project, you will be contributing to an active research project in our laboratory and will be developing technologies that will be essential for future data collection for this project. Successful completion of the project will result in the student receiving an authorship in a journal publication and possibly in other conference publications as well.

Required technical Skills

- Extensive programming experience (Python/Matlab, etc.)
- Experience with mechanical design and fabrication (Solidworks, AutoCAD, etc.)
- Experience with reading and critiquing scientific literature (optional)
- Basic knowledge in Controller theory

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. Kei Masani (k.masani@utoronto.ca), Dr. Bastien Moineau (Bastien.Moineau@uhn.ca) and to Kramay Patel (kramay.patel@mail.utoronto.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: Wheelchair Neuroprosthesis*".