Power of Touch: Challenges in Designing Haptic Sensing and Feedback for Neural Controlled Bionic/Prosthetic Hand

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The loss of a hand is severely traumatic both emotionally and physically. Prosthetic's are devices that can help restore some of the functionality to the user. However, current prosthetic's can be very expensive and heavy. I looked at the designs of three of the most popular 3D open source robotic/prosthetic hands, the Inmoov, Tact, and HACKberry exiii. All of these have distinct advantages over the current prosthetic's, they are low cost and lightweight. By exploiting the advantages of 3D printing they were able to dramatically decrease the cost and weight. Unfortunately none currently have myoelectric sensor control or touch feedback. I had five steps to integrate touch feedback and myoelectric sensors into an arduino based prosthetic hand. Step one was to download the open source design files to my 3D printer and build each of the three prosthetic's. Step two was to compare the performance of each and look for ways the open source design could be improved. Step three was to assess how my improved design of using long lasting fabric wrist straps compared to commercial brand disposable, gel sensor pads. Step four was to assess how my improved design velostat based force sensing resistors (FSR) compared to commercial FSRs. Step five was to assess the sensitivity of two different haptic feedback designs one using transcutaneous nerve stimulation (TENS) the other vibrating motor disks. The human hand is one of the most complex and beautiful pieces of engineering, replacing this is extremely challenging.

Awards Won:
International Council on Systems Engineering - INCOSE: First Award of $3,000