Team 13: Hydra – 3D Printed Prosthetic Arm

Sponsored by: UConn CSE Department
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Hydra is an affordable elbow-down prosthetic that restores dexterity and muscle control for basic hand functionality. At a far lower cost than alternative high-end prosthetics, it allows for dynamic motion and static hand positions essential for daily tasks. The package provides patients with a 3-D-printed forearm and hand, STL's for printing, supplies and directions for installing an Arduino board, Servo's, and a Bluetooth receiver. An Android phone application will give the user control over movement settings and the various functions. The total price is estimated to be under $300.

The problem we aim to solve is availability and cost of modern prosthetics. The most complicated and expensive part of modern upper body prosthetics is the mechanical control essential for finger movements. Generally, this requires translating the single radial motion of a Servo to a complex jointed bend at the fingertip, which can be done in two ways. The first is purely mechanical finger movement. This has several advantages including exact structured movement for the fingers as well as giving power to flexion and extension equally. However, these designs are complex, heavy, and usually expensive. The second method of finger construction is non-mechanical, where elastics or springs are used in between the joints to return the fingers to an extended position. Flexion of the fingers is achieved by applying a single force pull to the fingertip. This method is lightweight, low cost, and easy to build or fix but is less precise. The strength of the extension is also subject only to the springs in the joints, which must be balanced against the torque of the Servos. Our project aims to find a medium between these two methodologies, allowing the user to specify which type of movement they want at minimal cost. A prosthetic that is capable of emulating multiple gestures would typically require super precise (and expensive) sensors capable of measuring miniscule differences in muscle flexion. By introducing an easy to use phone and smartwatch application, we are able to accurately simulate many common gestures using only two muscle states: flexed and relaxed.

Hydra is scalable, open-source, economically advantageous, and easily reprintable. We want to give the users as much or as little customization as they are comfortable with. Our goal is to merge the various branches of CSE into a unified project that will benefit our education as well as the others in need.