OctoGrasp: The Design and Construction of a Cephalopod-Inspired Prosthetic Arm

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Purpose The purpose of the OctoGrasp project is to design and build a highly dexterous bio-mimetic prosthetic arm inspired by the biology of cephalopods. Typical prosthetics rely on force at the fingertips to pick up objects using bulky, high-torque motors. Instead of relying entirely on mechanics, the OctoGrasp employs negative pressure pneumatics that can manipulate objects through suction. The measure of success for the OctoGrasp hand is the ability to replicate the 33 commonly-used grips described in the Human Grasping Database. An additional constraint is that the OctoGrasp hand should be light enough not to impair the movement of the user. Finally, a typical prosthetic can cost tens of thousands of dollars and require complex manufacturing techniques. Design Process The design of the OctoGrasp hand involved many iterations across the design of the fingers, palm, thumb, and arm. The fingers are made of Thermoplastic Polyurethane (TPU), a material chosen for its flexible and 3D-printable qualities. A total of seven distinct finger prototypes were designed and created. A total of seven palm prototype designs were made. The arm houses the electronics, pumps, and solenoids. Results The OctoGrasp is able to reach all 33 of the grips in the Human Grasping Database, using a combination of mechanical motion and negative pressure pneumatics. On average, OctoGrasp outperformed its competitors in grasp speed by 3.5x (430 ms vs. 1540 ms). The OctoGrasp costs only $111.57 to assemble, 90x cheaper than its competitors. Conclusions The OctoGrasp project presents a novel, inexpensive, and practical approach to prosthetics. The device takes inspiration from the biology of cephalopods in order to create a more efficient prosthetic.

Awards Won:
Second Award of $2,000