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Husky hand: A low-cost electro-mechanical prosthetic arm for the underprivileged

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PROBLEM STATEMENT

Sufferers of upper limb loss in the Dominican Republic need cheap but effective prosthetic arms. Providing these prostheses will allow them to reestablish a better quality of life, by making it possible to work and accomplish other day-today tasks again. Users require an arm that is both strong and durable to withstand the rigors of manual labor and environmental strain, while appearing aesthetically pleasing, for a low cost.

MATERIALS & METHODS

We decided to improve the overall design of our previous prototype by:

• Integrating the PQ-12 linear actuator for finger actuation

Replacing the servo motor based finger actuation allows for a reduction in size and power requirements.

• Simplifying the user's control

Uses a micro switch operated by mechanical motion of the individuals shoulder.

• Modularity of hand, wrist, and forearm

The cost of servicing will be greatly reduced if smaller, modular, open-source 3d printed parts are used.

We explore the use of several filament materials, namely ASA, TPU, PC, and a carbon fiber infused PC. We use a low cost Arduino Nano Every micro controller to provide future improvements and easy debugging due to the vast amount of online resources.

Figure 1: Rendering of Current Prototype

IMPROVEMENTS

The infographic shows what improvement to be the most important considerations when designing and improving our previous prosthetic prototype.

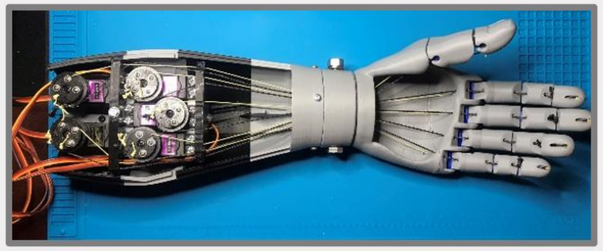

Figure 2: Final Prototype from EGN 301

Figure 3: Various prototype iterations

RESULTS

Our efforts have resulted the implementation of two PQ-12 linear actuators in a wrist module to contract the fingers. One actuator controls the thumb and forefinger, while the other control the other three digits.

A control system consisting of a through forearm Bowden cable attaching to a shoulder harness. As the user extends / or rolls their shoulder the cable pulls on a micro switch triggering the hand to release.

All 3d filament materials has proven to have exceptional physical properties as well as UV, chemical and heat resistances, enough for extended time in harsh environments. Figure 1 shows the current prototype to date. Figure 2 shows our previous prototype from EGN 301. Figure 3 shows the vast amount of iterations of 3d printed components tried and tested during the design process.