DESIGN OF A LOW-COST PROSTHETIC HAND FOR USE IN DEVELOPING COUNTRIES

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ABSTRACT

The World Health Organization (WHO) estimates that there are 25.5 million people with an amputation in developing countries who are living without any type of prosthesis [1]. Even with a lower incidence of upper limb loss than lower limb, there are likely several million people who could benefit from affordable, accessible upper limb prostheses.

When upper limb prostheses are available, users are typically provided a cosmetic hand or a body powered hook. Although a cosmetic hand provides the natural appearance that is often desired by users in less developed countries, it may not allow users to complete all activities of daily living (ADL). Conversely, a body powered hook is technically functional, but users are often uncomfortable with the appearance of the device. A third type of prosthesis, a body powered hand, is rarely used by people with upper limb deficiencies.

Body powered hands have the potential to provide a functional, aesthetically pleasing, and low-cost option to people in need of upper limb prostheses, but current designs are subjected to the highest rates of rejection of all terminal devices. Users have cited a variety of reasons for rejecting body powered hands [2]. At least two of these reasons, high activation force and low pinch force, can be attributed to mechanical inefficiencies in the device [3]. Existing body powered designs have been unable to decouple the actuation and the posture of the hand, leading to devices that actuate too many fingers and have poor efficiency, or actuate only one finger and have a poor selection of postures.

The authors have developed a body powered hand design which combines a single actuation point (the thumb) with the ability to independently pre-position the fingers and thumb. By only actuating the thumb, the device should require less energy to operate than currently available devices. The device is still capable of producing multiple hand postures, including tripod, lateral, and hook grasps, which should allow users to complete many ADLs. In this talk, the authors will present their design, along with data from mechanical and functional tests that compare performance of the prototype to currently available devices.

REFERENCES

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