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An In-Depth Conceptual Framework for the Development of Prosthetic Hands: Emphasizing Transradial Prostheses

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Abstract : The human hand is a vital yet intricate organ, essential for tasks ranging from grasping to executing fine motor skills. It serves as the most advanced and natural interface for interaction between humans and their surroundings. Upper-limb deficiencies, caused by conditions such as illness, accidents, or congenital factors, are prevalent worldwide. These deficiencies are categorized into seven types: partial hand, wrist disarticulation, transradial, elbow disarticulation, transhumeral, shoulder disarticulation, and forequarter, with transradial amputations being the most common and often well-suited for prosthetic hands. Advancements in technology and healthcare services have amplified the need for affordable, user-friendly, and functional prosthetic hands capable of restoring essential hand and finger functions. As a critical subset of medical robotics, prosthetic hands have seen notable design and development progress. However, challenges remain in achieving widespread user acceptance and satisfaction, highlighting the need for a holistic approach to their design and implementation. This study aims to consolidate the various factors involved in the development of prosthetic hands, focusing particularly on transradial prosthetics. It considers all types of prosthetic hands, whether actively powered, passively powered, or nonpowered. By presenting a comprehensive concept map, we aim to integrate these factors into a cohesive framework, guiding the development of prosthetic hands that offer enhanced functionality, improved user acceptance, and better alignment with user.

Keywords : prosthetic hands, user-centeren design, human machine interaction design, assistive technologies, meical robotics
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