Design and Development of a Low Cost Prosthetic Arm Control System Based On sEMG Signal

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Abstract

Many human activities depend on upper-limb motion using the activation levels of the electromyography (EMG) signal of the upper-limb muscles during elbow extension and flexion. Different methods are commonly described in the literature, but there are many problems to deal with online processing of the raw EMG such as the speed requirements of real-time applications and memory requirements. The aim of the presented work is to design and develop a low cost prosthetic arm based on the EMG signal activities of the biceps muscle using rectified envelope EMG signal as a control signal. This paper focuses on the development and validation of the proposed low-cost control system during upper limb activities. This validation is passing through several stages until the generation of the control signal to move the prosthetic arm. The EMG signal is processed, and the relationship between elbow motion and the activity level of the biceps muscle is characterized using relevant extracted features (RMS). The validation of the new low-cost system is compared to the Bioback MP150 specialized system based on the envelope of the EMG signal and the raw EMG signal. The experimental results illustrate that the envelope of the EMG signal has the same features-print as the raw EMG signal, and finally the envelope of the EMG signal can generate the control signal to move the prosthetic arm.

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