Electromyographic Control for a Telerobotic Human Computer Interface

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Remotely operating electromechanical systems has many applications including robotics, hazardous environment inspection, and telemedicine. Traditional methods for teleoperating electromechanical systems allow for real-time input. These controls, such as joysticks, levers, buttons, or touch computer screens, allow the operator to access different parameters through bodily kinetic action. In some cases, the speed of communication between human and computer controller is vital to the function of the system. The delay between mentally selecting a desired function and the behavior to physically input that function to the controller can be the difference between success and failure. This conversion increases in intricacy with the complexity of the system. In order to handle this issue, training with such controls is required in typical applications until a functional level of skill in communicating the correct control signals has matured. Alternatively, a more intuitive controller involving behaviors more natural to humans would significantly decrease the delay. A more natural control would require less artificial mechanics of conversation to be learned and mastered. This project aims to design a control system utilizing muscle activation; a more natural feature of the human body. Utilizing electromyography (EMG) signals as an input, machine learning techniques will be used to interpret the data signals and extract patterns in order to map the control signals for a simple robotic arm movement. This system will have EMG surface electrodes for the bicep, tricep, anterior deltoid, and posterior deltoid muscles. The EMG signals will be analyzed to determine the motion and position of the elbow and shoulder, each about their axis of rotation. In the prototype different digital signal processing techniques are being applied to the EMG data, and

machine learning algorithms are being developed. Various machine learning techniques will be tested to identify an effective method. After an algorithm has been selected, the system will be further developed to utilize the algorithm for better characterization of the EMG signals for control of the remote robotic system. If a promising output response is achieved, further testing will be done involving an even more complex motion.