ABSTRACT

Stroke is a leading cause of disability that affects motor function, particularly walking ability. To support the rehabilitation process of stroke patients, electromyography (EMG)-based technology offers a promising solution due to its capability to detect movement intention in real time. This study aims to develop an EMG-based ankle physiotherapy robot trigger system operating across four phases of the gait cycle. Three major muscles Tibialis Anterior, Soleus, and Gastrocnemius were analyzed to determine their dominant contribution in each phase. The research involved EMG signal acquisition from nine healthy subjects, gait cycle normalization, signal stability evaluation using the Coefficient of Variation (CV), and feature extraction using RMS, MAV, and VAR. Subsequently, muscle activation status was classified as active or non-active based on three threshold levels: 20%, 30%, and 50%. Verification results indicated that the RMS feature with a 30% threshold provided the most consistent classification results, with the Gastrocnemius dominant in phases F1 (Initial Contact), F2 (Foot Flat to Heel Off), and F4 (Swing Phase), while the Soleus was dominant in phase F3 (Heel Off to Toe Off). Validation using different subjects confirmed the system's ability to reliably and timely trigger robotic movement. Although discrepancies were found between the literature and actual activation data, the system demonstrated consistent performance and could adapt to the dynamic nature of muscle activity. While the testing was limited to healthy subjects, these results provide a strong foundation for developing a rehabilitation system that is adaptive, measurable, and aligned with the neuromotor recovery characteristics of stroke patients.

Keywords*: Electromyography, Physiotherapy Robot, Stroke Rehabilitation, Movement Trigger System.*