Unveiling Hand Kinematics: Classification and Mapping through EMG

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Introduction:

Stroke is a condition where blood supply to some part of the brain is obstructed or there is leakage of blood. It leads to disabilities like limb motor function loss, speech impairment, etc. WHO reports 15 million people suffer worldwide; 5 million die and another 5 million are permanently disabled. A wide range of physical therapies are used. Electromyography (EMG) signals are considered most useful as electrophysiological signals in both medical and engineering applications. In the neurorehabilitation techniques like robotic exoskeleton & prosthesis EMG can directly reflect a human movement intention or muscular action of the user and used as an input to a decision making system.

Problem:

The stroke patients need physiotherapy for the limbs to get the reactivation of the dead muscles Basic daily hand motion requirements are vital for stroke patients

Workflow:

Initial data acquisition has been done from 3 healthy subjects (2 male, 1 female) by using Bioamp EXG Pill sensor. The processing of signal is done with bandpass filter (Range of 50Hz-250 Hz) and Notch filter of frequency 50 Hz is used to remove power line interference. The workflow of the entire work is shown in Fig 1.

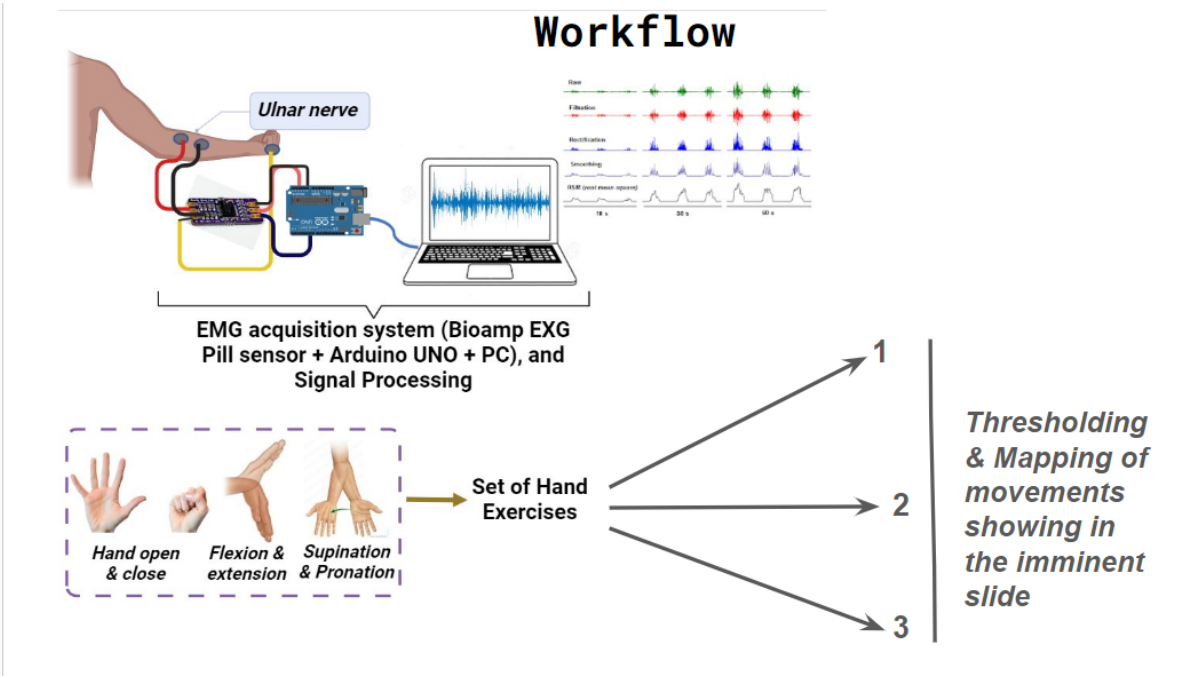

Figure 1: Workflow for the data acquisition to the mapping

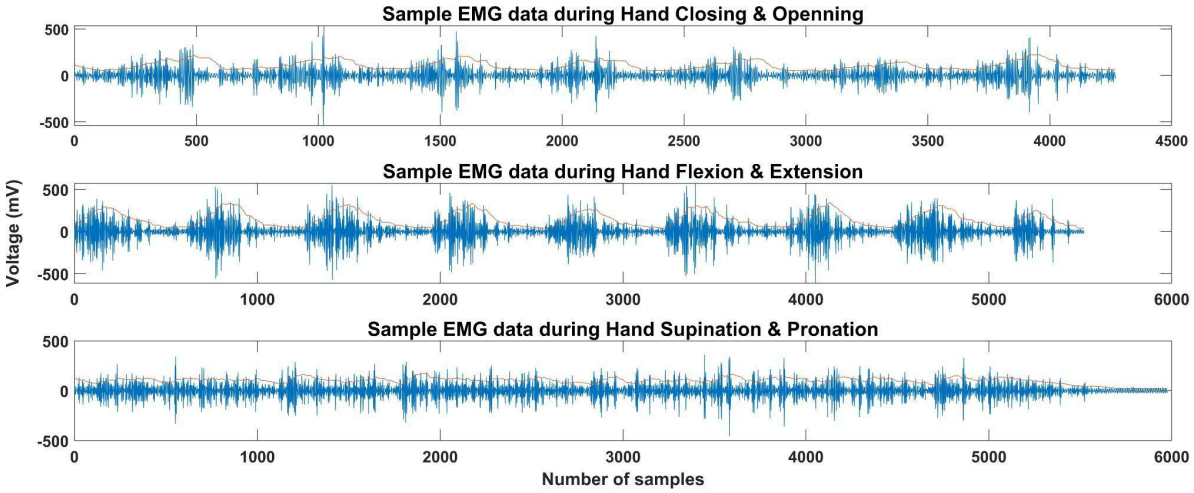

Figure 2: Raw Sample EMG Signal after data acquisition

Simulation :

The human hand has been considered as a three link manipulator forearm, palm, and fingers as one link. The hand size link lengths are considered. The simulation for the expected results is developed in Matlab. The joint movements have to be mapped to the obtained results.

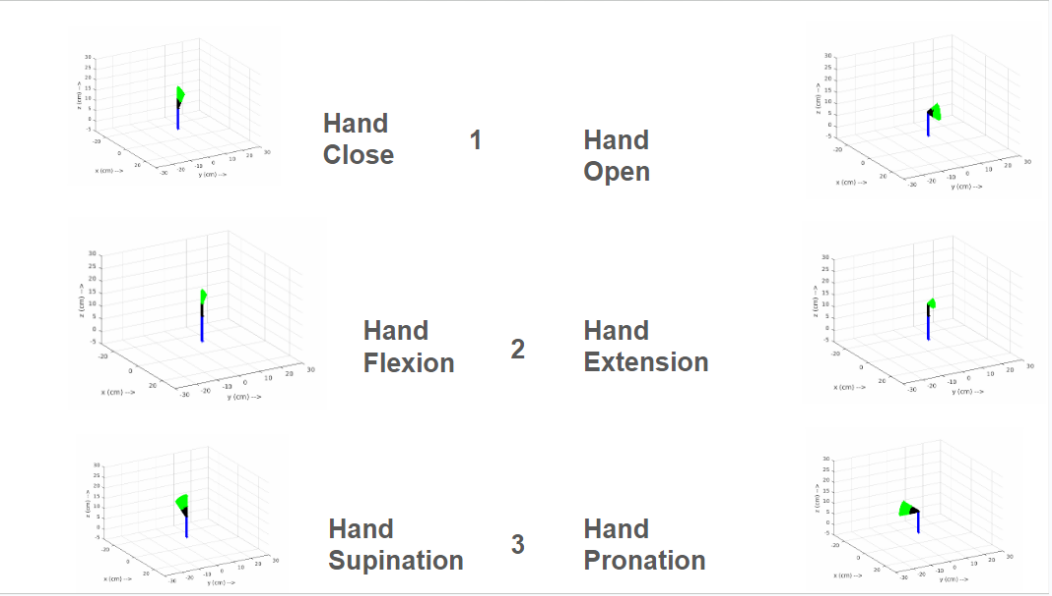

Figure 3. Expected Simulation results in MATLAB

Future Work:

1. To improve the effective recognition of the EMG signal more no. of subjects data need to be collected.
2. Online control of the simulation with EMG signals is yet to work.