Design of a Forearm Cumulative-Trauma-Disorder Risk Detector Using EMG Sensor Data Sent through an Arduino to a Mobile Application via Bluetooth

Villafuerte Gonzalez, Dania (School: Colegio Mater Salvatoris)
Cortes-Morales, Larissa (School: Colegio Mater Salvatoris)

The prolonged use of video display terminals while assuming an incorrect posture has led users to develop cumulative trauma disorders (CTDs). The human body generates measurable values that indicate risks of contracting CTDs. These values can be detected through electromyographic sensors. Nonetheless, there are is a lack of research in this area. Although individuals generate different voltage levels, it's possible to empirically determine high tension levels in muscles. Thus, these levels can be associated to an individual's correct and incorrect posture depending on the voltage threshold. This project consisted of developing a reliable and efficient forearm CTD risk detector using an Arduino and a designed mobile application. Said application gathers resting position tension data from the user's forearm muscle in milliVolts and calibrates the system to calculate a threshold for each user. Tension levels are then measured through the completion of a task. In case of a high-tension level detection, the application then notifies the user that the current posture entails high risks to CTDs. The prototype accuracy and reliability were tested through a Two-Factor with Replication ANOVA. The data includes values from 9 experimental subjects that performed 4 one-minute runs at 2 different arm positions that varied in angles. The ANOVA showed that the system was 91.7% efficient and completely reliable. This supports that the prototype represents a useful tool in the design of workstations. Future improvements in the prototype include the development of the same system for other body areas like the back and legs.

Awards Won:
Sigma Xi, The Scientific Research Honor Society: First Life Science Award of $2,000