**S7. Features of the orthoses' control system of inserted articles.**

| Author (s) | Nº electrodes used | Control strategy (imagetic, ex.) | Cue type or go signal | Supporting feedback | Control type and action |
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| **Delijorge et al., 2020** | 10, being 8 monopolar electrodes, 1 ground electrode, and 1 reference electrode | The interface controller received the labels, determined which action must carry out the hand-orthosis, and synchronized the state of the GUI to produce visual feedback. If the controller detected a P300 response for one particular option, the flashing sequence was interrupted, providing visual feedback to the user about the selection. Subsequently, the hand-orthosis executed the chosen routine, and the flashing sequence restarted for another selection. | EEG | Visual | Online and continuous |
| **Ren et al., 2019** | 8 sEMG and 9-axis IMU (3-axis GYRO, 3-axis ACC, and 3-axis MAG) | The orthosis mimics the movements of the opposite arm in the elbow and shoulder joints, using four motions (shoulder F/E from 90º to 170º, horizontal abd./add. from 0º to 80º, ext./int. rotation from 30º to 30º, and elbow F/E from 0º to 85º), to get the values of the compensation. | sEMG and IMU | Real-time visual feedback through a monitor | Online control/elbow and shoulder motion |
| **Ha, Kim and Jo, 2018** | 5 | Grasp motion from pressure sensors. | Pressure sensor and leap motion sensor | Not applied | - / Grasping |
| **Wang et al., 2018** | 8 | A subject has been guided to manipulate the handle to rotate his wrist and control the orientation of the bucket via the VR display. After a successful catching, the brick was expected to be moved to one of the three circular spots, and the subject had to hold the bucket for 3 seconds within the circle which would increase the final score by 10 points. | sEMG | Real-time visual feedback through a VR | Online control |
| **Zeng et al., 2018** | 16 | HG, 4 FF, IFE, TIR, TO, KP. For each of the eight muscles, value p (initially, p=0) plus one when the maximum magnitude of sEMG signal is greater than 30% of maximum voluntary contraction in recent twenty signal points, or there is no change to the p-value. Once p is greater than 4, the classification procedure will be carried out to classify gesture and the result will be transferred to linear actuator control, or | sEMG | Not applied | HG, 4 FF, IFE, TIR, TO, KP |

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| | | the program will keep running in this threshold detection loop for another twenty signal points. The actuator control program receives the gesture signal classified and controls the actuators moving the corresponding distance. A zero signal will come out when the actuators reach the target distance. A zero signal will come out when the actuators reach the target distance to control the actuators back. Another threshold detection will be carried out after the actuator control program is finished. | | | |
| **Khan A, Khan F, Han, 2016** | 1 | From DMI, the training trajectories were applied and divided into two groups. The first group was of straight lines of varying directions and speeds and lengths, while the second group was of circle segments with different radii and speeds. | Force | Not applied | Online |
| **Agarwal, Fernandez and Deshpande, 2015** | - | - Learned force-field control was used to assist the subject in F/E motion of the index finger with a coordinated motion at the finger MCP and PIP joints. Its control created a tunnel-like force field around the target path, which guided the limb motion along the desired joint angle trajectory.<br>- Adaptive-assistance-based control was applied to learn a dynamic model of the coupled finger-exoskeleton system and the patient's ability and effort in real-time for a specific subject. | Angle of motion | Feedforward feedback | Continuous |
| **Huang et al., 2015** | - | - Force intensity applied determines the level control has been offered.<br>- Force control is achieved by the closed loop PID controller. Compared with low-level force control, high-level force tracking and prediction is a more complicated task. | Velocity and force signal | Reinforcement feedback based on force intensity | Continuous |
| **Khan et al., 2015** | - | - Passive and active DOFs for the robot were selected based on the joint ranges of motion in the sagittal axis.<br>- Actuated DOFs were shoulder and forearm F/E maximum joint ranges were -30º/135º and 0º/120º respectively. Besides, for the abd/add motion of the shoulder passive joint is used.<br>- All other DOFs were for the user's comfort and kept free. | MCS and load cells | Not applied | On-line control / E/F motion |
| **Ramirez, Alfaro and Chairez, 2015** | 8 | Performing flexion of each finger of the hand. | sEMG and goniometer | Not applied | Continuous |

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| **Kavya et al., 2015** | 4 | From the movements of hands, the positions were established as relaxed, semi-flexed, and flexed at 0º, 45º, and 90º, respectively, with respect to the horizontal plane; and the movements of forearms, the positioned were defined as -90º, 0º, and 90º, respectively. | sEMG | Not applied | F and E of hand and elbow in pronation and supination |
| **Chen and Lau, 2015** | - | - | Not specified, but the kinematic analysis was done | Not applied | F and E of the shoulder, elbow, and wrist |
| **Loconsole et al., 2014** | 5 | The exoskeleton was position controlled (PD control on the reference position derived from the estimated torque) with gravity and viscous friction compensation. The sEMG signals are pre-processed and the MAV features are extracted, respectively. Then, the MAV features to input the TDNNs (third module corresponding to Torque prediction) and the torque values are estimated. | sEMG | Not applied | On-line control/elbow, shoulder, and wrist motion |
| **Tang et al., 2014** | 8 | The subject held a 1-kg load by hand without wearing the exoskeleton; wearing it, but with no actuation; wearing it under direct proportional myoelectric control. | sEMG | Not applied | On-online control/shoulder F and E |
| **Seki et al., 2011** | Electrodes have been placed on the BB. However, their amounts were specified | The subject performed F/E of the elbow while holding a bottle filled with water (mass 550(g)). | sEMG and goniometer | Not applied | On-online control/elbow F and E |
| **Zhang and Nakamura, 2006** | 4 electrodes, being 2 electrodes pasted on the left and right sides, the up and down of the eyes on the face); 1 electrode of the six-axis force sensor is | The first technique is to extract the human intention of eating by analyzing the EOG of the person. If the person gazes at a specific place, the information of human intention about this specific place is reflected in the EOG signals. The second technique is to use a LED. The transmitter is attached to the head of the subject and several receivers corresponding to dishes are installed on a board. The subject can indicate the dish by moving his head in order to send the light to the corresponding receiver. The third technique is that a subject can | EOG | Not applied | Continuous / The route of the MAO was from the initial point to the dish, the mouth, and back to the initial point |

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| | mounted on the center of the end-effector of the MAO | use his body (foot, the lower jaw, etc.) to push some buttons. Each button is corresponding to one dish. |

Abbreviations: BB = Biceps Brachii; DMI = Desired Motion Intention; DOFs: Degrees of Freedom; E = Extension; EEG = electroencephalography; EOG = Electroculogram; F = Flexion; FF = Fingers flexion; GYRO = Gyroscopes; HG = Hand grasp; IFE = index finger extension; IMU = Inertial Measurement Unit; LED = Light Emitting Diode; KP = Key pinch; MAG = Magnetometers; MAO: meal assistance orthosis; MAV = Mean Absolute Value; MCP = Metacarpophalangeal; MCS = Muscle Circumference Sensor; PIP = Proximal Interphalangeal; sEMG = Surface Electromyography; TDNN = Time Delay Neural Network; TIR = Thumb internal rotation; TO = Thumb opposition; VR: Virtual Reality; - = Not informed.