Workshop on new advances in motor-recovery neurotechnology by means of Brain-Computer Interfaces, Functional Electrical Stimulation and Exoskeletons to support the upper limb rehabilitation in stroke patients

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The latest researches in stroke patient's rehabilitation techniques argue that repeated movement of the affected upper limb offer the chance to regain its usefulness. Assisting robotics allows patients to perform repeated movements. Such movements can stimulate the brain to regain the upper limb control and the phenomenon has been termed as neuroplasticity.

Functional electrical stimulation (FES) can be used to artificially induce the muscle contraction of innervated muscles, and in combination with upper limb exoskeletons and glove may contribute to a better rehabilitation process of the stroke patient's upper limbs. Functional Electrical Stimulation (FES) has the potential to restore the body motor functions and it has been recommended as interventional procedure in many countries (i.e. NICE-IPG278, UK). Assisting robotics allows patients to perform repeated movements in a well-controlled manner, while the FES-based activation of the muscles helps the brain to relearn the day life movements.

Brain-computer interface (BCI) is a new technology with a potential to restore, substitute, or augment lost motor behaviors in patients with neurological injuries. Just imagine that a patient may control a neuroprosthesis by his/her own thoughts.

The workshop deals with new proposed systems (EXOSLIM, IHRG) consisting in a mechanical structure of exoskeleton type, anthropometrically dimensioned, aiming to ensure the basic anatomical movements in stroke patient's upper limb and hand, as well as muscle control by means of functional electrical stimulation (FES). Instead of using the traditional surface electrodes some electroconductive yarns which can be easily and effectively integrated into textile structures may provide the electrical stimulation over the muscles (patent request no. A/00673/21.09.2015). Motor Imagery based BCIs can induce neural plasticity and thus serve as an important tool to enhance motor rehabilitation for stroke patients. A new system that integrates BCI and FES techniques aiming to improve motor rehabilitation for stroke patients will be presented too.

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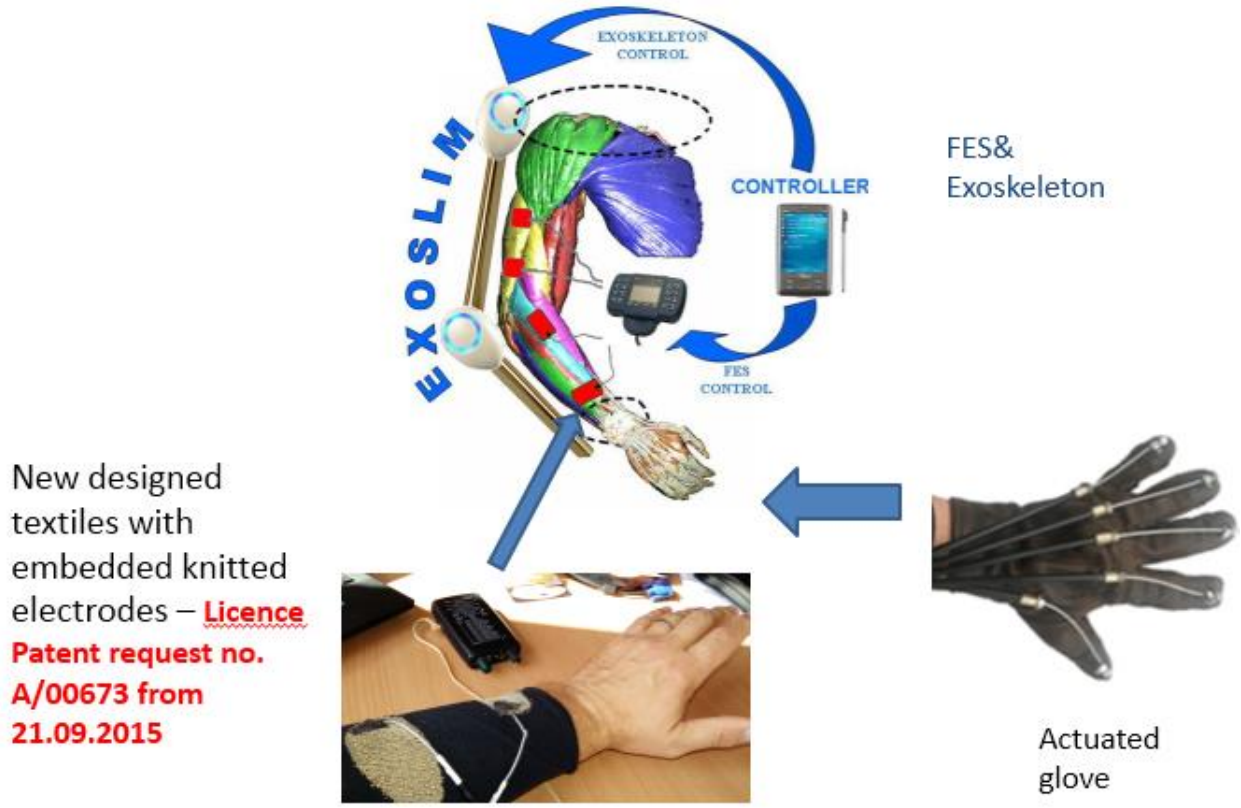

Figure 1 – The hybrid FES&Exoskeleton system to rehabiltate the upper limb in stroke patients

Figure 2 – The BCI&FES upper limb rehabilitation RecoveriX system (Rehabilitation Hospital of Iasi clinical tests)