Exoskeleton Legs for Handicap and Elderly Persons

Inside the “AAL CALL 4” the Project “Exoskeleton Legs for Handicap and Elderly Persons (EXOLEGS)”, in which the NEUROCOR Laboratory under direction of Dr. Juan López Coronado from the Universidad Politécnica de Cartagena is one of the partners, has been granted by the European Commission.

EXOLEGS gather three universities and seven companies, from five European countries. The project brings together end-users, industrial companies, and research organizations from an EU dimension to specify the indoor and outdoor mobility needs of elderly persons to enable them to continue living independently for as long as possible. Basic, Standard and Deluxe exoskeleton prototypes (half- and full-models) will be designed, developed, tested and validated in research labs before being validated by elderly users in Sweden, Germany, Spain, Switzerland and the UK. The key concepts of the half- and full-exoskeletons to be developed are presented in the figure below.

Most elderly persons suffer mild to acute degrees of physical and cognitive degeneration. The progressive nature of these impairments often leads to loss of independence affecting quality of life. However, it has been shown that physical mobility and cardiovascular exercise directly improves human cognitive abilities, and can reduce biological and cognitive senescence. Therefore, this proposal will develop a range of active lower-limb exoskeletal assistive solutions (Basic, Standard and Deluxe) for providing indoor and outdoor mobility to help elderly persons maintain and improve levels of physical activity for full, active and independent lives. EXO-LEGS will work to develop commercially viable products for AAL applications which are less technically demanding to design because they provide a modest supplementation capability rather than a full mobility capability (i. e., for spinal cord injured persons) or high physical assistance (i. e., for manual workers).

The exoskeleton requirements for AAL mobility demand specialized “hands-free” locomotion support/assistance to allow elderly persons to perform their normal, wide-ranging daily activities in an independent manner. These requirements include the following:

- Indoor mobility: moving freely within confined spaces giving considerable added value over wheelchairs, be able to perform stand-sit/sit-stand manoeuvres, climb/descend stairs, step over objects, quiet standing, straight walking, turning for centimetric/metric mobility
- Outdoor mobility: walking/turning on uneven/unstructured surfaces/soft ground, avoiding traffic, crossing roads, taking public transport (buses, trains) to go to rural/distant places, opening/closing doors, using escalators for hectometric/kilometric mobility
- Cognitive support: provide information/advice to allow decision making when the elderly person has become lost or confused

Exolegs will introduce innovations on:

- Technology: light-weight biocompatible materials and actuators, which are easy to clean, and powerful batteries for long working life, advanced energy management, open modular components for exoskeletons
- Employment of technology: sophisticated combination of sensors and actuators for stability and usability, use of ergonomics and aesthetics to realise a design which is acceptable to users in everyday situations
- Future ways of working: The deployment of open modular electromechanical components using extensive ICT protocols will allow for more flexible, freelance, collaborative designs to be performed within distributed teams that could be spread in a wide geographical region. This would open for new and more effective ways of working.
The project *EXOSKELETON LEGS FOR ELDERLY PERSONS* (AAL-010000-2012-15) is financed by: