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HORIZON 2020 PROJECTS: PORTAL

WHAT PRICE HEALTH

WITH LONGEVITY AND LIFESTYLE CHANGING PUBLIC HEALTH, CAN THE EU KEEP PACE WITH THE COSTS?

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The gift of assistance

Navigating everyday life is something most people take for granted, but there are those who need assistance with basic tasks. The AIDE project works to bring independence to people with disabilities

Around 80 million people in the EU, a sixth of its population, have a disability. They are often hindered from full social and economic participation by various barriers related to physical, psychological and social factors. Moreover, poverty rates amongst people with disabilities are 70% higher than average.¹ Over 30% of people above the age of 75 are impaired to some extent, and over 20% are severely impaired. The percentage of people with disabilities is set to rise as the EU population ages.

According to Article 9 of the United Nations Convention on the Rights of Persons with Disabilities signed by the European Commission in 2010,² 'accessibility' is a basic right for all persons with disabilities. The purpose of accessibility is to enable persons with disabilities to live independently and to participate in all aspects of life.

Nowadays, the recent trends in assistive technology for supporting activities of daily living (ADL), mobility, communication and so on are based on the integration of the capabilities of the user and the assistive technologies.³ The improvement of the interaction and co-operation between user and assistive technologies can be split into three main areas: 1) improvements of the assistive devices, such as mechanical parts, electronic parts, etc.; 2) improvements of the user-technology interface; and 3) improved shared control between the user and assistive technology.

The AIDE project has the ambition to strongly contribute to the improvement of the user-technology interface by developing and



Fig. 1 One of the multiple applications of the AIDE multimodal perception system is a remote control of a robotic device designed for people unable to speak (due to a speech disorder or aphasia) and without functional control of the arm. The multimodal interface will be able to understand the environment and context to automatically recognise the necessary abilities for different activities of daily living. This way, the signals received from the user will be contextualised to interpret the user intentions and execute the desired activity

testing a revolutionary modular and adaptive multimodal interface customisable to the individual needs of people with disabilities. It will, furthermore, focus on the development of a totally new shared control paradigm for assistive devices that integrates information from the identification of residual abilities, behaviours, emotional state and intentions of the user on one hand and analysis of the environment and context factors on the other hand.

Consortium

The AIDE consortium consists of nine groups from four different countries (Italy, Spain, the United Kingdom and Germany):

- Five universities: Universidad Miguel Hernández de Elche, Scuola Superiore Sant'Anna, Università Campus Bio-Medico di Roma, Universitat Politècnica de València, and Eberhard Karls Universität Tübingen;
- One research and development centre: Fraunhofer-Institut für Produktionstechnik und Automatisierung;
- One large industrial partner: ZED Worldwide S.A.;
- One SME: BJ Adaptaciones; and
- One non-profit organisation working with disabled people: The Cedar Foundation.

The AIDE project co-ordinator is Professor Nicolas Garcia-Aracil, who leads the Rehabilitation and Assistive Robotic Unit of the Biomedical Neuroengineering group at the Miguel Hernández University of Elche and has already participated in other Seventh Framework Programme projects.

Concept and approach

The World Health Organization (2002) introduced the International Classification Of Functioning (ICF),⁴ Disability And Health to specify changes in body function and experiences. This classification allows evaluating what potential end users of the AIDE system could achieve in a standard environment (level of capacity), and compares it to what they actually do in their usual environment (level of performance). AIDE shares the ICF concept, focusing on health and functioning rather than on disability, synthesising the key elements and understanding derived from a medical and social model of disability.

The AIDE concept goes beyond the current state-of-the-art in using a novel modular multimodal perception system to customise an adaptive multimodal interface towards disabled people's needs (Fig. 1). The multimodal interface will analyse and extract relevant information from the identification of residual abilities, behaviours, the emotional state and intentions of the user, as well as from analysis of the environment and context



Fig. 2 The AIDE project end product will integrate the NEUROExos system into a support included in a wheelchair structure. Shifting the exoskeleton from an external support with only a weight-compensation system to a portable system will largely improve the applicability of the assistive device and the level of autonomy of the user

factors. Finally, the human-machine co-operative system will be designed in accordance with specific user needs. A series of applications for the AIDE system have been identified across several domains in which disabled people could greatly benefit:

1. **Communication:** The main objective is to improve the communication of severely disabled people for social autonomy. The user will be assisted in communicating with her/his relatives and friends. Communication will be provided by using standard internet services such as email, Skype, WhatsApp and standard social networks (i.e. Facebook and Twitter). The developed system will provide support for web browsing, as well;
2. **Home automation:** The goal is to allow severely disabled people to interact with the devices present in their smart home environments. In short, the user will be supported by an AIDE multimodal interaction system in daily activities, including turning lights, radio and television on/off, answering or initiating telephone calls, locking or unlocking a door, closing or opening curtains, changing environmental settings, and in medical emergency situations;
3. **Wearable robots for assisting in ADL:** The aim here is to adaptively and dynamically modify the level of assistance provided by the intelligent robotic exoskeleton in accordance with specific user needs (Fig. 2); and
4. **Entertainment:** Severely impaired people have reported that participation in normal entertainment activities, e.g. playing a computer game or watching a movie, is an important need. Thus, a main objective is to support the user in playing computer games, expressing his/her feelings, playing music, and/or engaging in painting, and so on.

Impact

The AIDE project wants to spur a breakthrough in multimodal human-machine interaction technologies for empowering people with disabilities to participate in society. For this ambitious task, a multidisciplinary team of experts in multimodal interfaces, robotics, human sciences, computer science and neuroscience has engaged to carry out an in-depth investigation into modular, customisable and adaptive multimodal interfaces as a paradigm of 'assisting as needed'. This way, the multimodal interface will adapt to the residual capabilities of the disabled persons, safeguarding self-perception, movement control and first-hand interaction.

The main aim of AIDE is therefore to preclinically deliver and evaluate a revolutionary modular and adaptive multimodal interface that is customisable so as to enable people with acquired brain injury, multiple sclerosis, and spinal cord injury to fully participate in society.

The disabilities outlined above have significant adverse socioeconomic impact for individuals but also society as a whole. These disabilities place restrictions on an individual's ability to participate in mainstream roles and specifically to engage in gainful work. Disabled people make up a growing percentage (between 12-16%) of the working-age population, but rates of employment remain low. AIDE will support participants to access resources and tools that may also improve their employability options.

Moreover, AIDE has the ambition of strengthening European industrial innovation capacity and competitiveness in the worldwide market of assistive ICT and assistive wearable robotics, developing a novel, adaptive, multimodal interface to break the 'bottleneck' of the seamless and efficient use of highly sophisticated and powerful assistive devices, including the current and future wearable robotic exoskeletons.

- 1 European Commission (2010): People with disabilities have equal rights. The European Disability Strategy 2010-2020. ISBN: 978-92-79-16836-9
- 2 United Nations: Convention on the Rights of Persons with Disabilities and Optional Protocol
- 3 Cowan R E, Fregly B J, Boninger M L, Chan L, Rodgers M M, Reikensmeyer D J (2012): Recent trends in assistive technology for mobility. *Journal of NeuroEngineering and Rehabilitation* 9:20
- 4 World Health Organization (2002): Towards a common language for functioning disability and health. Available at www.who.int/classifications/icf/icfbeginnersguide.pdf?ua=1. Accessed 15 April 2014



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