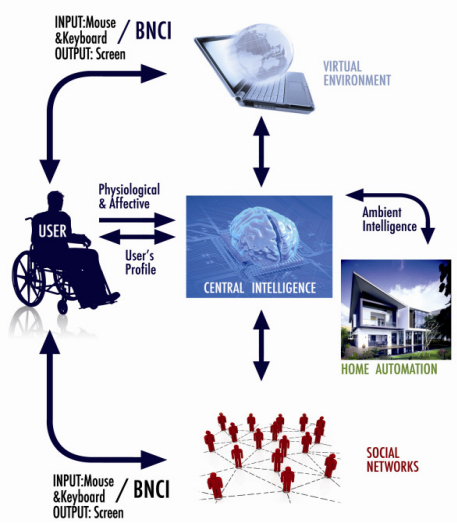
Motor disabilities of people arising from any origin have a dramatic effect on their quality of life. Some examples of neurologic nature include a person suffering from a severe brain injury resulting from a car collision or individuals who have suffered a brain stroke. **For years, the severely disabled have learned to cope with their restricted autonomy, impacting on their daily activities** like moving around or turning on the lights and ability for social interaction.

The *project BrainAble* is about empowering them and pursues to mitigate the limitations of the everyday life to which they are confronted to. Our initiative is to research, design, implement and validate an ***ICT-based HCI (Human Computer Interface) composed of BNCI (Brain Neural Computer Interface) sensors combined with affective computing and virtual environments***.

This combination is expected to *improve the quality of life of the disabled by overcoming the two main shortcomings they suffer - exclusion from home and social activities* - by providing inner functional independence for daily life activities and autonomy (accessible and interoperable home and urban automation) and outer social inclusion (advanced and adapted social networks services).

In terms of HCI, BrainAble improves both direct and indirect interaction between the user and his smart home. Direct control is upgraded by creating tools that allow controlling inner and outer environments using a ***"hybrid" Brain Computer Interface (BNCI) system (BCIs, Electro Oculogram (EOG), Electromyography (EMG), and Heart Rate).*** BNCI also takes into account other sources of information such as measures of boredom, confusion, frustration by means of the so-called physiological and affective sensors.

Furthermore, interaction is **enhanced by means of Ambient Intelligence (AmI) focused on creating a proactive and context-aware environments** by adding intelligence to the user's surroundings. AmI's main purpose is to aid and facilitate the user's living conditions by creating proactive environments to provide assistance.



Human-Computer Interfaces are complemented by an intelligent Virtual Reality-based user interface with avatars and scenarios that will help the disabled move around freely, and interact with any sort of devices. Even more the VR will provide self-expression assets using music, pictures and text, communicate online and offline with other people, play games to counteract cognitive decline, and get trained in new functionalities and tasks.

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The project consortium is committed to create three prototypes, one per year in which the end-users are the key group in the conceptualization stages. The feedback they will provide will be crucial during the projects development stages.

Currently, the project is in its 12th month and the project consortium has finished **the first year's prototype that demonstrates an AmI smart home system controlled via a BNCI interface.** The prototype is aimed at obtaining a proof-of-concept of the BrainAble system which includes a BNCI to interact with: (1) inner environment functionalities such as the controlling a commercial television and lamp (2) a virtual avatar in a virtual model of the user's home; and (3) outer environment giving more participation in today's modern social networks with the access to the micro-blogging service Twitter demonstrated.

Main scientific achievements accomplished are the development of a ***novel interface of BNCI,*** the Hex-O-Spell; Ambient Intelligent techniques such as the ***Context Facilitation for BCI interfaces*** which was presented in international congresses; and incorporation of the ***URC/UCH standard*** that facilitates the integration of new services or devices.

As an outcome, our initiative will produce a commercial product and a set of technologies intended to assist people with severe physical disabilities. The technology has the potential to assist those with special needs such as individuals living with Motor Neurone Disease or locked-in patients. The modular architecture and middleware utilized by BrainAble to connect user-centered bio-interfaces and interactive immersive environments to networks of devices and people, provide attractive assets for the market of *high-tech home automation devices* and intelligent and integrated *smart homes*.

Project title:
Autonomy and social inclusion through mixed reality Brain-Computer Interfaces: Connecting the disabled to their physical and social world

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