Indra-Adecco Foundation Accessible Technologies Chair at University of Lleida

HEADMOUSE AND VIRTUALKEYBOARD REACH 400,000 DOWNLOADS IN 95 COUNTRIES

- **These free, open-access software solutions enable people with mobility problems to control a computer mouse and keyboard using facial and head movements**

- **As part of its Corporate Responsibility programme, Indra is developing accessible technologies with the aim of reducing the digital divide and facilitating the integration of disabled people**

The HeadMouse and VirtualKeyboard solutions, developed within the framework of the Indra-Adecco Foundation Chair at the University of Lleida for research on Accessible Technologies, has reached the figure of 400,000 downloads from 95 countries around the world. Both of these free, open-access solutions enable people with mobility problems to control the computer mouse and keyboard using facial and head movements.

Created as part of Indra's Corporate Responsibility strategy, accessible technologies aim to develop innovative solutions and services to facilitate access to technology and promote the social and occupational integration of disabled people. The company has already completed more than 40 R&D&i projects in this field and has created eight chairs for research on accessible technologies in collaboration with the Adecco Foundation and a number of Spanish universities.

Of the 95 countries on five continents that have downloaded HeadMouse and VirtualKeyboard from the Indra www.tecnologiasaccesibles.com or University of Lleida http://robotica.udl.cat websites, Brazil, Mexico, Argentina and Spain are at the top of the list by number of downloads. The two solutions have also been very well received in Chile, Colombia and the United States. In addition, they have reached countries as diverse as Canada, United Kingdom, Germany, Finland, Saudi Arabia, United Arab Emirates, the Russian Federation, India, China, Korea, Thailand, Japan, Philippines, New Zealand, Morocco, South Africa and Kenya.

This result has been possible thanks to the global conception of both solutions. HeadMouse can be used by anyone because it has no defined application language and has a help system in Spanish and English. VirtualKeyboard comes with three dictionaries that include the most common words in Spanish, English and Portuguese. In addition, it has a machine learning

system that allows expansion of its word base and creation of new dictionaries as it is compatible with the symbols and characters used in over 20 languages.

Combined use of HeadMouse and VirtualKeyboard enables people with reduced mobility to use these devices to operate a computer. Moreover, work is continuing to further enhance this software. As a matter of fact, *HeadMouse 4.2* and *VirtualKeyboard 3.2.* are already available for downloading.

First-person experiences

Beyond the number of downloads, the true success of the two solutions is reflected in the numerous first-person testimonials submitted by the users themselves. For example, Dr Gilson de Lima, a Brazilian expert who heads a programme for disabled young people in schools and slums in Natal, Brazil, is using both solutions with excellent results. An 18-year old youth born with cerebral paralysis that prevents him from speaking and makes him practically unable to move his head, has even managed to start communicating for the first time in his life thanks to this technology. The doctor is currently working to incorporate this software into a motorised wheelchair.

In another case, a Spanish high school teacher related that both tools are enabling one of his students who has a degenerative disease that is increasingly causing mobility problems to keep up with the class.

Associations of disabled people and the governments of countries like Panama, through its First Lady, and Brazil, through its Ministry of Communications, have collaborated to expand the use of these technology solutions through publicity campaigns and training, and by facilitating their downloading from local websites.

Mouse controlled using facial and head movements

HeadMouse is a virtual mouse that enables operation of a computer mouse using a webcam, and facial and head movements. The device works by using a low-cost camera to capture the movement of the user's head in front of the screen. People with motor disabilities are able to control the *mouse* using head movements that represent the full range of "dragging" functions, while their facial movements (opening the mouth or winking) are converted to the different "click" functions.

The system incorporates a number of innovations that provide access to information and communication technologies. Using computer vision algorithms originally developed for mobile robotics, users with motor disabilities are able, without any prior training or knowledge, to operate HeadMouse in an intuitive and natural fashion. Moreover, once the software is installed, the user does not need any type of help to access the configuration and modify system parameters, because the configuration options were designed with the needs of disabled people in mind.

Virtual keyboard that predicts and learns words

VirtualKeyboard enables text entry using any device capable of controlling the cursor on the screen, including a mouse, *joystick* or *touchpad*. Use of the application is totally intuitive and requires no prior training and, moreover, it complements and completes the functionality of HeadMouse.

The solution works by displaying a keyboard on the computer screen that enables text entry by clicking virtual keys that represent letters and symbols. The system incorporates technological innovations that fully facilitate text entry by people with motor disabilities who are unable to use conventional keyboards and therefore must use applications based on a single cursor. Thus, VirtualKeyboard features word prediction algorithms that learn the user's writing style and exponentially improve their match rates. Tests based on entering literary texts of between 15,000 and 20,000 words show savings of up to 50% in the number of keystrokes required to enter them.

Thanks to the machine learning system, its word base can be expanded and new dictionaries created, even in the same language, thereby adapting the system to the writing style of the users and to specific optimised uses: e-mail, technical writing, literary writing, etc.

The enhancements incorporated into HeadMouse and VirtualKeyboard notably include the possibility, since 2012, of using one click to trigger a keystroke sequence (macros) which reduces the effort and time required to perform complex and repetitive tasks.

Indra

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