Technology to move objects with the mind created by Mexican researcher

May 14 2014

Systems able to process thoughts and translate them into a command to move objects are very useful for people who cannot speak or move, but have the disadvantage of causing mental fatigue. However, a Mexican researcher designed an intelligent interface that is capable of learning up

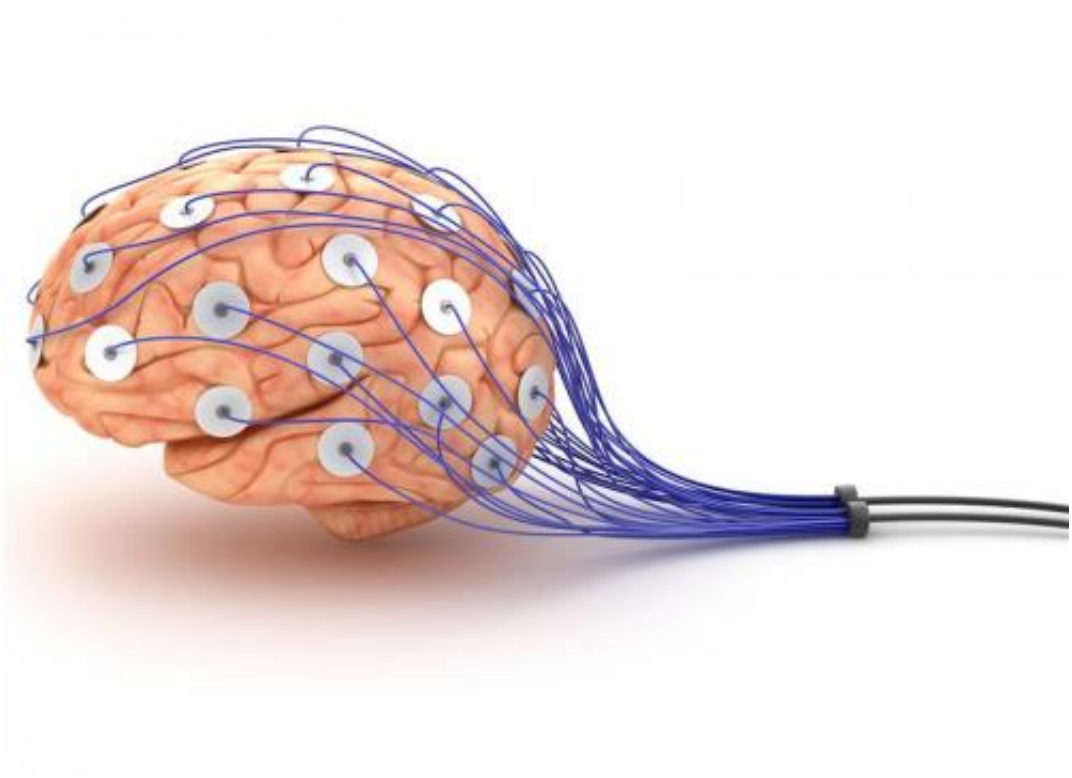
to 90 percent of the user's instructions thus operate autonomously and reduce fatigue.

This project, called "Automating a brain-machine interface system", is in charge of Christian Isaac Peñaloza Sanchez, a PhD candidate for Cognitive Neuroscience Applied to Robotics at the University of Osaka, Japan.

"I have worked for three years in this project, based on brain-machine interfaces, whose function is to measure the activity of neurons in order to obtain a signal generated by a thought, which is processed and converted into an indication for moving, for example, a robotic prosthesis, a computer pointer or house appliances," says the scientist, who is part of the Mexican Talent Network, Chapter Japan.

He explains that the system consists of electrodes placed on the scalp of the person, which measure brain activity in form of EEG signals. These are used to detect patterns generated by various thoughts and the mental state of the user (awaken, drowsy or asleep, etc.) and level of concentration.

It also includes a graphical interface that displays the available devices or objects, which interprets EEG signals to assign user commands and control devices.



In addition, there are wireless sensors distributed in the room in charge of sending environmental information (such as temperature or lighting); mobile hardware actuators which receive signals to turn on and off appliances and an artificial intelligence algorithm.

"The latter collects data from wireless sensors, electrodes and user commands to learn a correlation between the environment of the room, the mental state of the person and its common activities" said Christian Peñaloza.

He adds that in order to prevent users to submit to mental fatigue and frustration because of the high levels of concentration during extended periods required to operate the system, a system capable of becoming

independent was established.

"We give learning capabilities to the system by implementing intelligent algorithms, which gradually learn user preferences. At one point it can take control of the devices without the person having to concentrate much to achieve this goal," said Peñaloza Sanchez.

For example, he details, an individual can use it to control an electric chair and move it to the living room using basic commands (forward, backward, left or right), which are learned by the system. Thus, the next time the user wants to take the same action he or she only need to press a button or think about it for the chair to automatically navigate to the desired destination.

Once the system operates automatically, the user no longer has to exert concentration to control devices. However, the system continues to monitor the EEG data to detect a signal called Error -Related Negativity. Which presents when people become aware of an error committed by themselves or by a machine.

For example, when the temperature in the room is warm the user expects the window to open automatically, but if the system makes a mistake and turns on the TV, this action can be detected by the human brain in a spontaneous way without the user making any effort. This allows the command that caused the error to be corrected and the system re-trained.

"We've had pretty good results in various experiments with multiple people who have participated as volunteers in our in vivo trials. We found that user mental fatigue decreases significantly and the level of learning by the system increases substantially," the researcher says.

Provided by Investigación y Desarrollo