CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
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Project Number
S0804

Project Title
MindMouse: A Mind-Computer Interface without Pattern Recognition Based on Biofeedback Training

Abstract

Objectives/Goals
The phrase "mind-computer interface" conjures up images of the movie "The Matrix". There have been some different attempts at building commercially viable mind-computer interfaces, and they all took the path of the matrix: the computer actually tries to read your thoughts. This involves complicated pattern-matching techniques that require a lot of processing power. This project explores the feasibility and practicality of non invasive mind-computer interfaces in which the computer does not attempt to figure out one's thoughts.

Methods/Materials
I built an EEG that acquires two signals, one from either side of the forehead, and then translates these signals into mouse movement using a very simple algorithm that does not involve pattern matching. The device can move the cursor on a computer screen in all directions. I wanted to see if it would be easy enough for people to learn how to use. I then wrote Java based software for the device. I was able to attain a fair amount of control over the cursor after spending about an hour with the device. However, it is hard to make people sit down for an hour to help with a scientific study. So I programmed in a set of training modes that first teaches one how to move the mouse in one direction at a time. It timed each attempt to move the cursor across the screen, enabling me to measure the subject's progress. This made the device easier to learn, and now most attain fairly precise control within 40 minutes.

Results
People show excellent learning curves when training with the device. The first time most people try to move the cursor in one direction; it takes about 40 seconds to move it across the screen. After practicing, it only takes about 2 seconds to move it across the screen. The best learners could select 3 objects about the size of a desktop icon in one minute. This shows incredible promise.

Conclusions/Discussion
It is fairly clear that anyone could learn how to use this. The practical applications of this device are enormous. Quadriplegics could use the device to perform tasks that they can't do otherwise. It could also be used to control vehicles. Similar devices would also be useful to people who control complex machinery, allowing them control over their work that they could otherwise only have with more than four limbs.

Summary Statement
I created a device that allows one to control a computer with one's mind, without the computer actually figuring out what one is thinking.

Help Received
Parents helped brainstorm and buy parts for device