
Investigating the NeuroSky Mindset Brainwave Sensing Headset

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Abstract

The initial parts of an investigation into capturing and recording brainwaves for use in controlling computer applications are described. Attempts at using different "Windows" operating systems and Microsoft development environments for writing interface code in C# for the NeuroSky Mindset Headset are related with some problems highlighted. Successful communication between a software system and the headset has resulted in the ability to record a large amount of data. This opens the way for research to continue in a more meaningful manner.

Keywords

Brainwaves, Data capture, Data Analysis, Data Visualization.

Introduction

This poster illustrates progress, current and potential research on the brain-computer interface. It was sparked toward the end of 2010 as interest in controlling computers with the mind reached journals (Karlin, 2010) and news providers. Research to see what could be achieved started in late February 2011. There were two easily available options one requiring a few hundred dollars to get started and another that required about 10 times the investment. It was decided to see what the less sophisticated, but from its advertising, still eminently practical of the two could achieve.

A NeuroSky headset and associated software was purchased for the investigation (Brook, 2010). The system comes with some demonstration programs and will run in the Windows, or Mac environment and is said to work with Unix. At first sight the Headset looks almost like a normal pair of good quality headphones with microphone attached. It is capable of good sound quality and the demonstration programs suggest it can be used with media player or iTunes.

This poster paper appeared at the 2nd annual conference of Computing and Information Technology Research and Education New Zealand (CITRENZ2011) incorporating the 24th Annual Conference of the National Advisory Committee on Computing Qualifications, Rotorua, New Zealand, July 6-8. Samuel Mann and Michael Verhaart (Eds).

There are three sensors mounted on the material covering the foam surround of the left ear cup that pick up electrical signals from the skin, there is another sensor attached to something that looks like a microphone boom, but which in practice rests on the forehead just above the left eye.

Connection is through a Bluetooth link and software to gather data from the headset treats the link as serial data through a Com port.

Methodology

The aim of this research is to investigate the capabilities, ease of programming and use of the headset as a prior to identifying directions for further study possibly supported by potential final year student projects. This was achieved by writing code to interface, download and inspect the data.

On starting it is important to follow the instructions for installation making sure that you first install the dll, then the supplied driver and finally connect the supplied Bluetooth dongle, otherwise your system may download and use incompatible products. There is the added uncertainty that if you are writing code you do not know where some of the communication errors may be originating from.

This headset has an onboard computer that preprocesses the signals before transmission over the Bluetooth serial connection. Demonstration programs show representations of the brainwaves you are producing and enable control of some "game like" activities. This performs the important role of confirming that the system can and does work.

Software is available to connect the headset through Matlab, however at present the real test comes in writing your own code to interface with the device so that you can develop further applications. There is a fair amount of documentation to help but it didn't prepare me for what was to follow.

Code development was unsuccessfully started on a new "networked" installation of Windows 7 and Microsoft Developers Studio 2010 using C#. Trouble soon appeared in the form of compile time and runtime errors. A simpler stand alone Windows XP platform with MSDS 2008 environment

was then used as a testbed. Sometimes MSDS 2010 produces more and different error messages to 2008 for the same code but effectively less errors were found using 2008 which doesn't mean they weren't there. When success was achieved working code was ported Windows 7 (2010) and refined/reworked where needed.

Findings

The major problem encountered so far has been communicating to the headset through the dll. The dll was written in C with calling structures which C# works with as "unmanaged" code. Changes in the development environment to work with required calling conventions was accompanied by a needed change in the "passed" data types to Ansi rather than the Unicode default. It was then possible to address the COM port properly at compile time and work effectively through the dll at run time.

The system can now communicate and download large blocks of data for inspection. The next step is to analyse and display the data received. A standard set of tasks will be developed and an associated data gathering exercises with different participants will look for similarities and differences in what has been achieved and what the data looks like.

Summary

This research suffered from unforeseen issues related to the marriage of operating systems, development environments and programming languages. Now that the initial hurdles have been passed it is expected that good progress can be made in analysing and interpreting the data retrieved with a view to further research.

References

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