Effectiveness of Commodity BCI Devices as Means to Control an Immersive Virtual Environment

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ABSTRACT

This poster focuses on research investigating the control of an immersive virtual environment using the Emotiv EPOC, a consumer-grade brain computer interface. The primary emphasis of the work is to determine the feasibility of the Emotiv EPOC at manipulating elements of an interactive virtual environment. We have developed a system utilizing the Emotiv EPOC as the main interface to a custom testing environment comprised of the Blender Game Engine, Python, and a VRPN system. A series of experiments that measure response time, reliability, and accuracy have been developed and the current results are described.

Our poster presents the current state of the project including preliminary efforts in piloting the experiments. These findings provide insight into potential results from experimentation with active subjects and prove to be promising.

Categories and Subject Descriptors

H.5.1 [**Multimedia Information Systems**]: Artificial, augmented, and virtual realities; H.5 [**Miscellaneous**]: Brain Computer Interfaces

Keywords

Brain Computer Interface, Virtual Reality, Immersive Environment

1. INTRODUCTION

With possibilities of virtual reality making a profound entrance into the consumer market in the near future comes a strong need for a natural and more sustainable method of interacting with and controlling the virtual environment. This article presents our initial investigation into the effectiveness of using a consumer-grade BCI device, the Emotiv EPOC, to augment the aforementioned interface and manipulation technologies. The chief goal of our efforts is to understand the effectiveness of the Emotiv EPOC along with its limitations. We believe this information can be used to improve consumer-level BCI devices if they are to be used as either a sole means of interaction or asupplementary means of interaction with a virtual environment.

Research and experimentation in BCI devices for controlling and manipulating spatial information has been investigated within a variety of contexts, from controlling a video game to setting up general frameworks for using BCI devices [1, 2, 3]. However, these efforts focus on using research or medical-grade BCI devices, controlling non-immersive virtual environments, as compared to consumer-grade BCI devices controlling an immersive virtual environment. Also, many of these works use the BCI to control the virtual user, for example to move around the environment, instead of to manipulate exocentric virtual objects or the environment itself [2, 3]. These works have produced many good results, showing that there is potential use of BCI devices in virtual environments. With evidence that BCI devices can be used in these contexts, our efforts focus on determining how well consumer-grade devices, such as the Emotiv EPOC can be used within immersive virtual environments.

Our experiments represent an inital investigation aimed at understanding the questions surrounding effective use and training of consumer-grade BCI devices within virtual environments. The experimental design focuses on testing three attributes: response time, reliability, and accuracy. For the purposes of our experiments we have specified rigirous benchmarks for each of the attributes. If we are able to repeatably achieve these standards, we will conclude that the Emotiv EPOC is capable of being a sole means of control of an immersive virtual environment.

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