Master's Thesis Defense Announcement
Mechanical and Aerospace Engineering Department
University of Texas at Arlington

DEVELOPMENT AND EVALUATION OF A BRAIN-COMPUTER INTERFACE FOR HUMAN-ROBOT INTERACTION IN SIMULATION AND HARDWARE ENVIRONMENTS

By

SHANE WHITAKER

Thesis Advisor: Panos S. Shiakolas

1:00-3:00 PM, Friday, 12/4/2020

Microsoft Teams Link

Abstract

The aim of Brain-Computer Interface (BCI) research is to create a communication system that identifies human intent by processing brain signals with the objective to develop a control signal for an external device, in this case a robotic arm. In this research, a framework to acquire, process, evaluate, and map BCI signals to a specific process is developed and tested in software and hardware. The BCI used is the Emotiv EPOC+, a non-invasive 14-electrode electroencephalogram (EEG) headset, which is also equipped with additional sensors to detect facial expressions and head movement. The development and testing of the interface is primarily performed in Webots, a robot simulation environment. The simulation environment provides a platform to analyze the reproducibility of the EEG or other signals, for a particular action. A pick and place process utilizing mental commands, facial expressions, and head movement was successfully demonstrated in a Webots simulation and seamlessly transferred to the proof of concept robotic hardware. The success of the multiple experiments validates the developed BCI framework and provides a solid foundation for further research into Human Robot Interaction (HRI).

The ultimate goal of researching this BCI is to further enhance the field of HRI, particularly in assistive robotics. BCI devices could provide the means to help those who rely on others for seemingly simple and routine daily tasks, such as picking up a bottle of water or manipulating other objects in their environment.