



**CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY**

Name(s) Cade Pretorius	Project Number J0999
Project Title Brain Controlled Cyborg Arm - Using EEG and EMG Signals to Control a Robotic Arm	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals With technology improving everyday, we are getting closer and closer to true integration with machines that augment our abilities. With this opportunity, we can improve our lives in innumerable ways. The advent of affordable brain reading devices has created a revolution of sorts. These devices can help amputees regain control of their limbs without the cost of multi-thousand dollar prosthetics. My project has three major implementation phases over a six year period, starting with controlling a simple robotic arm, by utilizing concentration levels and eye movements of the user. The second phase includes smoother movements and better Electroencephalogram (EEG) data. By the third phase, I will not only be able to control a simple robotic arm, but other objects and programs that will be able to be integrated into our daily lives. I am currently on the second phase. What I plan on working on next is to further increase ease of use, as well as broadening the applications of my project.</p> <p>Methods/Materials After doing some research, I settled on using the Emotiv EPOC headset, whose sensors are similar to those of a lab EEG machine, containing multiple, wet sensors. My project utilizes thoughts and facial movements to control a robotic arm. When a certain thought/facial movement is triggered, a key is #typed# by the program. The keys are then detected by a program that I wrote that runs on the computer, and sends that information on to an Arduino, which I programmed to interpret the signals and send them on to the robotic arm. This robotic arm is then directly controlled by an Arduino which, as mentioned, receives instructions from a separate program running on a computer.</p> <p>Results To be able to control the headset consistently, some training is required. With practice, I am able to control my thoughts consistently and, therefore control the robotic arm. Because the headset communicates wirelessly, signal interference is a big issue. This causes difficulty when using the device #out in the wild#, but inside a house or other building where interference is low, the project works very well.</p> <p>Conclusions/Discussion I have created an interface between a person and their thoughts and a robotic arm. It uses facial movements to control the motor direction, and thoughts to control which motor is being used. The device can be used accurately by different people, given some time to practice.</p>	
Summary Statement I control a robotic arm using EEG and EMG signals	
Help Received I'd like to thank Cliff Griffin from Griffin Laboratories for being my project advisor. My father helped me to work past one or two spots when I got stuck on programming issues, and my mother helped with the display board.	