



CALIFORNIA STATE SCIENCE FAIR 2014 PROJECT SUMMARY

Name(s) Cade Pretorius	Project Number 34816
Project Title Developing Superpowers by Controlling a Robotic Arm Using EEG Signals	
Objectives/Goals Abstract With the ever increasing influence of technology on our lives and the use of devices to augment our everyday actions, the integration of man and machine has already begun. On the medical front, this means amputees can regain control of their lost limbs with the use of robotic prostheses. In our everyday lives, this could extend to controlling even ordinary devices with our minds. 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 will include smoother movements and better Electroencephalogram (EEG) data. By the third phase, I intend to expand this to other objects and programs that will be able to be integrated into our daily lives. Methods/Materials Following an online blog post, I opened the Mindflex# headset and soldered in two wires to the NeuroSky EEG chip, which I then connected to my Arduino Uno. I did research into controlling multiple servos with an Arduino and found out that the only ways of doing it involved a motor shield or a breadboard and an external power source. I opted to use the Adafruit v2 Motor Shield, which allowed easier use than other options. The servos can be easily plugged into headers on the motor shield and controlled. Results After many changes to my code and hardware, everything worked individually and could be tested as one whole unit. I tested if the motors moved if my attention levels were high enough and if the program iterated between the different motors when I blinked. I calibrated the headset and brought my attention levels up. The first motor started moving. I then blinked and a few readings later, the next motor started moving and the previous motor stopped. I repeated this over and over consistently, proving that everything worked accordingly. Conclusions/Discussion My project uses EEG data and controls four motors on a robotic arm by monitoring a complex combination of signals reported by the NeuroSky EEG chip as Attention, which reflects the level of concentration. The attention level powers the servos and, using theta waves, blink detection is possible and is used to switch between brainwaves. This has been done using materials that cost under \$160 and around 6 months of research and development. In preliminary testing the system has been proven to work with other individuals besides myself in various circumstances.	
Summary Statement I have created a brain-machine interface that uses EEG signals to control the movements of a robotic arm.	
Help Received My dad helped me to understand some of the coding concepts and my mom helped with the display board and write-up. Mrs Alexander and Mr Mays from Santa Rosa Academy helped me with the project preparation.	