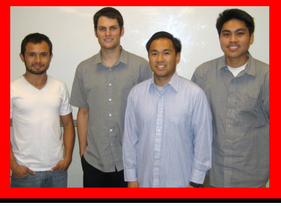
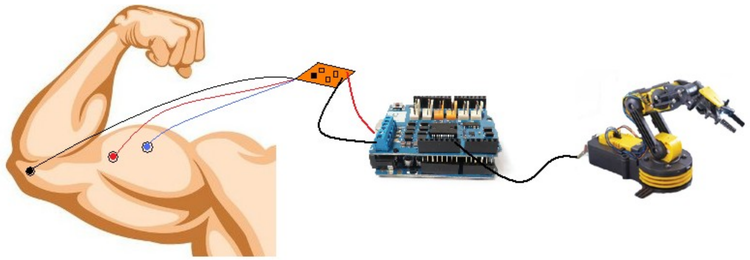
San Diego State University
College of Enginbering

THE LAW



Background

Muscles contract and release through electrical signals from the brain. The theory is to read these signals amplify the electrical signal from the muscle to a voltage to be identified by a microcontroller. The microcontroller will analyze the signal to deliver an appropriate output to control the appropriate robotic arm DC motor.



Results

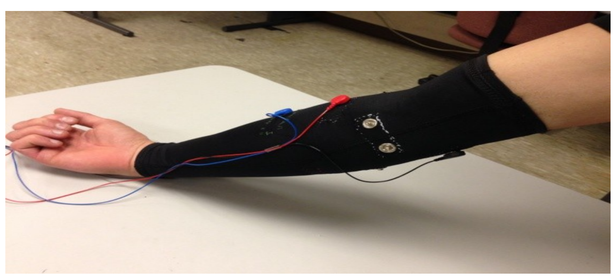
- The conductive fabric fared well against the sticky electrode
- The conductive fabric (wet) yielded the best test results
- Tested four regions of muscles: forearm, bicep, back, and chest
- Overall, each muscle group had distinct contraction and rest values proving to be efficient for operation

	Forearm				Bicep			
	Rest	Contraction	Rest Voltage (V)	Contraction Voltage (V)	Rest	Contraction	Rest Voltage (V)	Contraction Voltage (V)
Conductive Fabric (Dry)	20	200-250	0.0978	0.978	25	350-400	0.122	1.71-1.96
Conductive Fabric (Wet)	30-40	250-400	0.147-0.196	1.22-1.96	25	500-600	0.122	2.44-2.93
Sticky Electrode	24	250-325	0.117	1.22-1.59	25	400-500	0.122	1.96-2.44

	Back				Chest			
	Rest	Contraction	Rest Voltage	Contraction Voltage	Rest	Contraction	Rest Voltage (V)	Contraction Voltage (V)
Conductive Fabric (Dry)	20-22	100-135	0.978-0.108	0.489-0.660	20-22	130-205	0.978-0.108	0.635-1.00
Conductive Fabric (Wet)	28-34	125-195	0.137-0.166	0.611-0.953	25-30	145-225	0.112-0.147	0.709-1.10
Sticky Electrode	22-26	125-190	0.108-0.127	0.611-0.929	23-28	142-220	0.112-0.137	0.694-1.08

Conclusion

- Successfully able to mimic human movements using EMG sensors
- Created reusable form of electrode through the conductive fabric sleeve and shirt



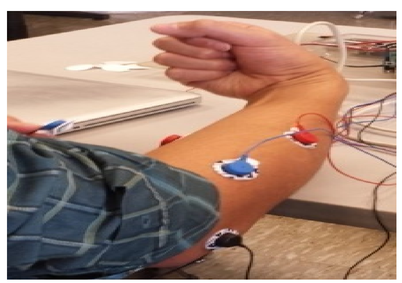
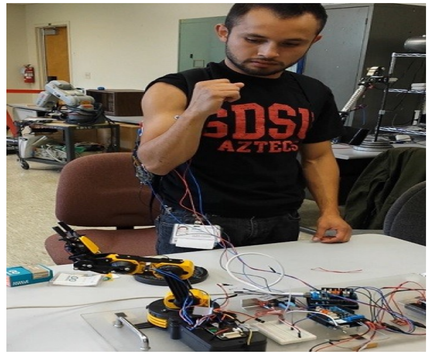


Fig. 4 Conductive Fabric Sleeve vs. Sticky Electrodes

Motivation

- Design a biomimetic system for individuals which controls the motors of a robotic arm utilizing electromyography (EMG) sensors
- Intended to simulate human arm motions for individuals incapable of using “standard” hand held controls



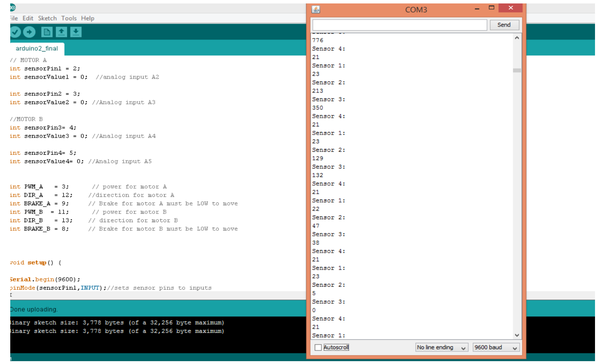
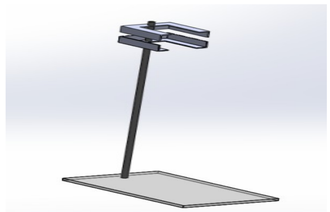


Fig. 1 Muscle Testing & Results

Design



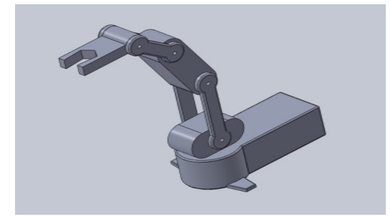
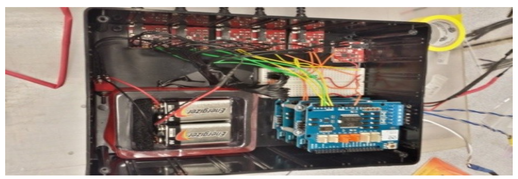


Fig. 2 Robotic Arm Stand simulating human arm



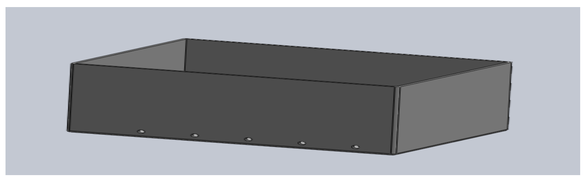
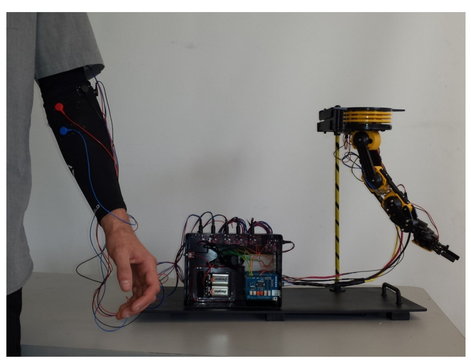


Fig. 3 Electronics Enclosure



Acknowledgements: Dr. Kee Moon | Engineering Research Center