



**CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY**

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Project Title Teleoperated Anthropomorphic Hand	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The project involved creating a teleoperational robotic hand using servos. The hand includes a Microcontroller board that sends digital signals to the motors and is linked to a user-operational glove. The glove, when manipulated by a user, changes the position of the digits and wrist of the robotic hand. The hypothesis of this project, was to determine whether teleoperation could work through a user and the servo controller, and if the servos that drive the hand would have an increase in response time or delay when supplied voltage decreases and ambient temperature increases.</p> <p>Methods/Materials The hand was first built and all hardware, software, and printed circuit board were designed. The glove which included flex sensors, was built and connected to the hardware. A cardboard box with an attached blow dryer was used as an environmental chamber. The robot's arm that contained the servo motors, was placed in the box. The temperature was monitored using a meter with a thermocouple temperature sensor. Servos were tested over two temperatures: 20C and 60C. A power supply generated 12 voltages in the range 7.25V to 4.50V to simulate battery drainage. For each voltage, there were 5 trials to test the hand's response time. The response time was measured by the delay between the glove's input and robot's movement. There was a total of 120 trials.</p> <p>Results Response time increases as battery voltage drops and when temperature is significantly above room temperature. The response time increased 30% to 40% as temperature increased from 20C to 60C, and when the supply voltage was below 6V.</p> <p>Conclusions/Discussion As servos are used extensively with large loads or they are run in hot ambient temperatures, they heat up and response time increases significantly. This is due to mechanical time constant. Cooling the servos using forced air flow or by using heat sinks would help reduce response time.</p>	
Summary Statement A robotic hand that is remotely controlled by a glove, was built and tested for it's response time to user's hand movements, at two different temperatures and various battery voltages to demonstrate servo motors' performance issues.	
Help Received Father helped clarify some electrical questions.	