CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)

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Project Number

S1899

Project Title

The RC Time Constant: Developing and Optimizing a Three-Dimensional Tracking Interface

Abstract

Objectives/Goals

The purpose of this project was to develop and optimize a three-dimensional tracking device. Our hypothesis was that higher resistances would decrease the RC time constant, therefore increasing the overall speed of the system#s response to movement.

Methods/Materials

Different resistors were hooked up via shielded cables to an X, Y, Z coordinate cube, built of cardboard and aluminum foil. The cables were connected to an Arduino Uno and a computer. Placing a hand inside the apparatus created disturbances in the electrostatic fields of the capacitive sensors. Comparing the movement time to the response time in the software revealed the correlation between resistance and latency.

Results

In the resulting averages, it was observed that the system built with 220K ohm resistors was the most efficient with regards to real-time response.

Conclusions/Discussion

The main hypothesis was that higher resistances would produce a lower RC time constant and thus less latency. The results of this experiment proved our hypothesis to be incorrect. There is a curve in the relationship between resistance and latency, with the tested resistance of 220K ohm performing best overall. Our experiment provides a simple prototype of capacitive sensing, which can be optimized to provide real-time interaction in three dimensions.

Summary Statement

The purpose of this experiment was to determine how resistance changes the latency within a three dimensional tracking interface.

Help Received

Parent helped to finance the project; Mr. Lum taught us the basic concepts behind the physics of the experiment.