CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
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Project Number
S0311

Project Title
Game, Set, Match: An Electronic Shoe for Playing Tennis

Abstract

Objectives/Goals
My objective was to see if I could create a Peltier tile cooling device that would reduce the temperature within a tennis shoe under simulated heat conditions compared to control.

Methods/Materials
My methods were as follows:
- mathematically calculating the heat load my Peltier system might be expected to cool,
- testing the energy requirements and cooling performance of a Peltier tile,
- integrating into a tennis shoe a Peltier tile and a DC energy source,
- engineering a system for dissipating the heat the Peltier tile generates,
- testing the performance of my experimental model with different batteries against a control, and
- creating a digital model of the thermodynamics within my experimental model.

Results
- The energy requirements of the Peltier tile I planned to use for cooling fit my calculations for heat emanating from the tennis court, but not from the foot itself.
- In all tests with AAA batteries and 9-volt batteries, the experimental shoe cooled down 4°F-5°F while the control shoe cooled down 2°F-3°F
- Despite two design and experimental testing failures, my final cooling system design tested with 9-volt and AAA batteries simulating the heat in a tennis shoe performed modestly better than control so my hypothesis is correct.

Conclusions/Discussion
- In my review of the literature, I did not find that anyone else had ever tried to use a Peltier tile to cool a shoe.
- My experimental testing did conform to my mathematically calculated heat loads with respect to having a modest cooling effect.
- The digital model created will facilitate further experimental testing by better quantifying each phenomenon occurring.
- A Peltier cooling system for shoes should be considered in applications where comfort and safety in hot conditions is necessary such as boots of soldiers in a desert or firefighter boots

Summary Statement
I built a Peltier tile cooling system that functioned to cool a tennis shoe without any moving parts.

Help Received
I wish to thank Matt Ondriezek for assisting with the construction and testing of my experimental and digital models. I wish to thank David Eldon for helping me to research the feasibility of my project. I wish to thank Martin Teachworth for providing suggestions on the direction of this project.