



Colorado Science and Engineering Fair

2024 Individual Project Abstract Form

Please print 2 copies of the completed form. Sign both copies, keep 1 for your notebook and submit 1 copy to your Regional Fair Director with your other paperwork.

Title of Project: Cool Running: A heat stroke's downfall // Using a Peltier (thermoelectric) module to prevent heat stroke

Finalist's Name: Laurel Amber Kent

School and City: Eagleview Middle School, Colorado Springs, CO

Sponsor's Name: Jenine Winslow

Category: Engineering (ENGR)

Division: Junior (6th - 8th grades)

Abstract (250 words or less):

My project is Cool Running, and its purpose is to help people enjoy time outside by preventing heat stroke.

I designed and engineered a temperature-regulated Peltier (thermoelectric) module to cool down the user's neck to a defined temperature. I chose to use a Peltier module because it is effective, efficient, and easy to carry.

When I went to a concert in Bend, Oregon last summer, it was boiling hot. When I walked around the field, I wished that I had a portable cooler that was easy to carry and that had a personalized option for the temperatures available.

Even though heat-related illnesses and deaths are preventable, 1,680 Americans died last year from heat stroke. The CDC says that "heat-related deaths are one of the deadliest weather-related health outcomes in the United States." Heat stroke particularly impacts three groups of people: hikers, runners, and soldiers.

1. Last summer, 7 hikers died from heat stroke at national parks, including a 14-year old boy and his stepfather who died when it was 119 degrees at Big Bend National Park.
2. Younger, faster runners are at the greatest risk for heat stroke, because the faster they run, the more body heat they create. Runners are 10 times more likely to die from heat stroke than from cardiac events during long races in warm climates.
3. Every year, 2-3 US soldiers die from heat stroke. The number of soldiers hospitalized with heat stroke increased by 705% since 1980, and 40% of US soldiers are stationed at bases that have 100 days at risk of heat stroke.

Cool Running prevents heat stroke as follows:

1. The user sets the temperature by turning the potentiometer (knob).
2. The Raspberry Pi constantly scans to see if the user has turned the potentiometer.
3. When the Raspberry Pi detects that the user has turned the potentiometer, the program takes that signal and turns it into PWM waves (a burst of electricity).
4. The circuit sends the PWM waves to the transistor.
5. The PWM waves turn on the transistor. This provides current to the Peltier module.
6. The duty cycle of the PWM waves controls the temperature of the Peltier module.
7. The Peltier module sits on top of 2 large carotid arteries in the neck. When the Peltier module gets cold, it helps the user cool down quickly. The neck is an optimal cooling site because it is very close to the body's thermoregulation center and large blood vessels are near the surface.

I implemented this project's software in Python using the RPi.GPIO and time modules.

I hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I also attest that the above properly reflects my own work.

Finalist's Signature: *Laurel Amber Kent*

Date: 3/2/24

In addition, all students must complete the ISEF Student Checklist (1A), Research Plan, Approval Form (1B), and Checklist for Adult Sponsor (1), and any other ISEF forms required for this type of project. See the International Rules and Guidelines for form requirements. Return COPIES of all of these forms to your Regional Fair Director with you Finalist Verification/Permission Form. A signed copy of this form must be included in your notebook.