FLORIDA ATLANTIC UNIVERSITY
COLLEGE OF ENGINEERING AND COMPUTER SCIENCE

"Chill" Cool Shirt

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Introduction

The applications of the "Cool Shirt" project are numerous. Areas that could see benefits are military, police, and fire fighters. The use of the cool shirt can extend military operations in hot climates, protect fire fighters from heat stroke, and extend the time a fire fighter combating a fire. This system could also be used as a heating shirt, by using heat packs instead of ice.

Goals

- Human body temperature inputs to control the cooling process
- Light weight, flexible, durable and reliable design
- Low power requirements to allow the use of a small battery pack
- Be able to operate at least two-hour under normal condition
- Affordable
- Easily reusable cooling/heating system

Components

- Basic T-shirt to circulate coolant through
- Ice pack heat / exchanger
- Coolant pump
- Microcontroller to regulate pump, and cooling
- Temperature sensors
- Voltage regulator
- Small battery pack
- Utility belt

Development

T-shirt design and manufacturing

Cool Shirt CS-400 is from Pegasus Auto Racing Supplies.

Heat Exchanger

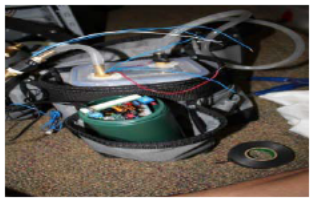
Copper coils encased in a plastic Tupperware insulated with Expanded Polystyrene foam.

Water/coolant pump

Standard CPU SWIFTECH MCP350 water pump was chosen for its small power requirements and the extensive testing that has already been performed.

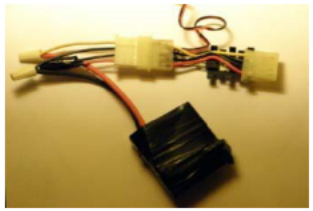
Microcontroller and temperature sensors

A Freescale 32-bit Coldfire JM microcontroller was selected due to prior experience, and the sensors are LM35 sensors.



Power supplies

Three standard cell phone batteries satisfied our power requirements along with one voltage regulator.



Testing

T-shirt/ Water pump

Initial test only included the pump along with the T-shirt hooked up to the power supply of a CPU.

T-shirt/ water pump / heat exchanger

The second test included one heat exchanger filled with ice which cooled for approximate 1 hour at room temperature
(still attached to CPU power supply)

Battery pack capacity

This test concluded that the battery pack would last for 2 hours when running the pump continuously.

Future testing

Microcontroller implementation

With the microcontroller implemented, we will have to determine the life span of the batteries under different conditions using strategically placed temperature sensors to control the circulation of the coolant.

Final testing

There will be a multitude of tests at different temperatures, higher than room temperature to determine the life span of the ice packs. We want to determine how long the system will be able to cool the user under different work loads and at different temperatures.

Conclusion

The project has exceeded all of our design expectations. The remaining work entails data collection and performance analysis. As all the tests prove every component and every aspect of the system to be fully characterized and properly functional, the Cool Shirt system will serve as a finalized product which is completely marketable.