CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY

Name(s)
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Project Number
S1017

Project Title
Low Cost Device Utilizing Mathematical Modeling of Heat Loss from the Human Body for Prevention of Hypothermia

Abstract

Objectives/Goals
The goal was to create a low cost heat loss measuring device using Arduino Uno kit that utilizes mathematical modeling of heat loss due to radiation, conduction, and convection in human body. The device assists in prevention of Hypothermia and performs proactive monitoring of lowering of human body temperatures. I was doing research on heat loss in human body and realized that there is no device that exists which can proactively monitor medical emergencies like Hypothermia.

Methods/Materials
Arduino Uno microcontroller, temperature sensor, cables, LED, and buzzer were used to build the device. Device tested on humans of different age groups under different ambient conditions with focus on elderly people. Accuracy tested with thermometer. Tests were done on healthy adults and kids in different environments and with different types of clothes to study the impact of clothing on heat loss.

Results
Multiple tests were performed with different variables to test accuracy. I took measurements of human body heat loss under different conditions. I did the tests on people with different ages with main focus on elderly people. Tests were done in conditions like home water tub, swimming pool, ocean water, and in snow conditions. This was to ensure sensors were giving accurate readings. Test results were validated using a thermometer to validate my test results.

Conclusions/Discussion
The device measured skin temperature as well ambient temperature in different weather conditions and calculated heat loss from human body in those conditions. I also created a threshold limit of 94 °F for skin temperature and the device alerted for anything under this limit. Device also alerted when heat loss from body was high. It met my design goals as it notified before the body temperature dropped to critical level and hence prevented triggering of Hypothermia. The device can be calibrated so that it can alert differently as per requirements.
I plan to extend the capabilities of device in future research work. I would like to make this device work using blue tooth technology so that you do not need any wires and the device works like a waist band. I also plan to build a mobile application that can be integrated with this device. One would get alerts along with other details on mobile application that can be used to prevent fatal events proactively.

Summary Statement
I created a low cost heat loss measuring device that utilizes mathematical modeling of heat loss due to radiation, conduction, and convection in human body that can help in prevention of fatal conditions like Hypothermia.

Help Received
I created and programmed the device myself. I researched on internet by watching videos and joining programming forums. My science teacher reviewed my findings.