

2016

Thermo-Regulated Device for Extremities Affected by Raynaud's Disease

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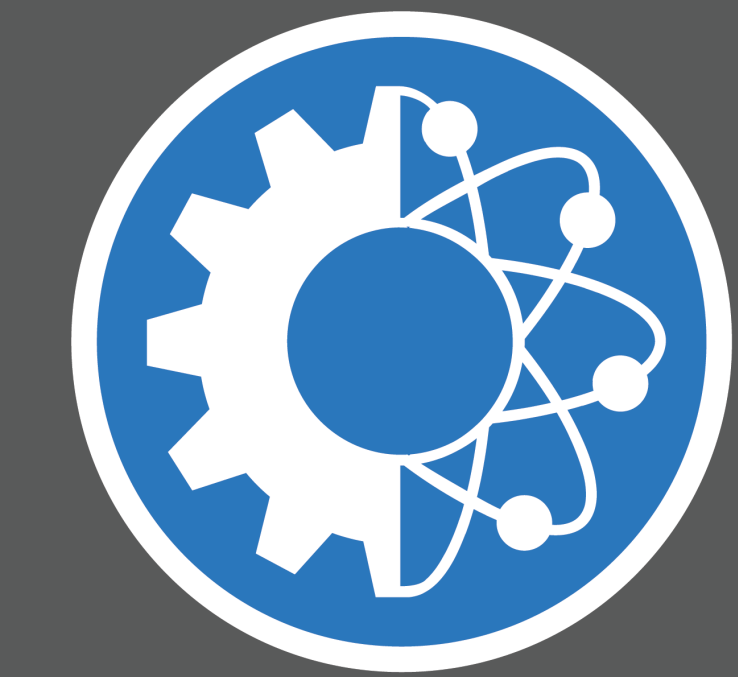
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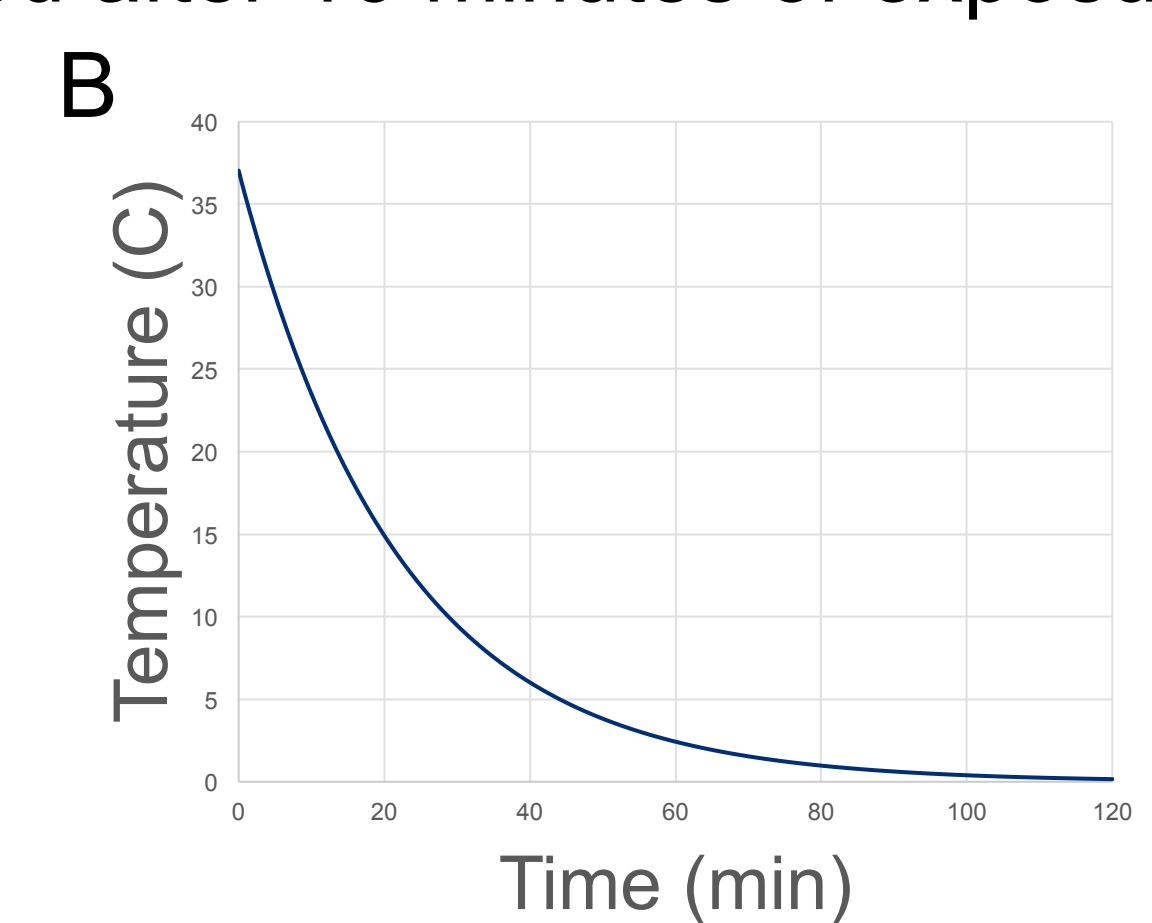
Thermo-Regulated Device for Extremities Affected by Raynaud's Disease

CAPSTONE DESIGN EXPO 2016

Background

Raynaud's Disease

- Blood vessels in hands and feet constrict due to cold environments and stressful stimuli
- Results in extreme discoloration and pain
- Can lead to nerve and tissue damage
- Permanent damage anticipated after 16 minutes of exposure



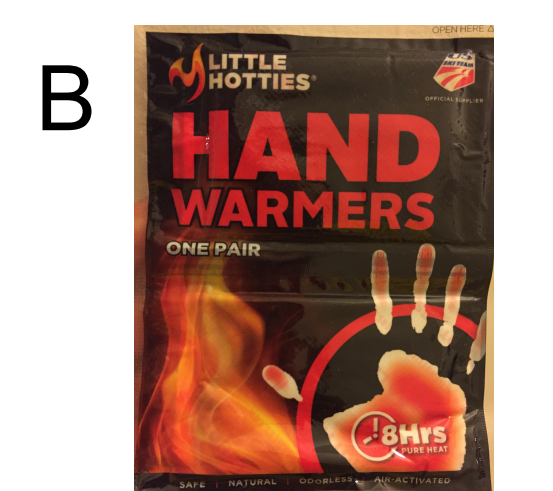
(A) Discoloration in the hands of a Raynaud's patient. (B) The temperature change over time of a patient's hand exposed to 0°C environment.

Objective

This project aims to mediate the negative physiological effects of Raynaud's disease by developing a device to control the temperature of the extremities.

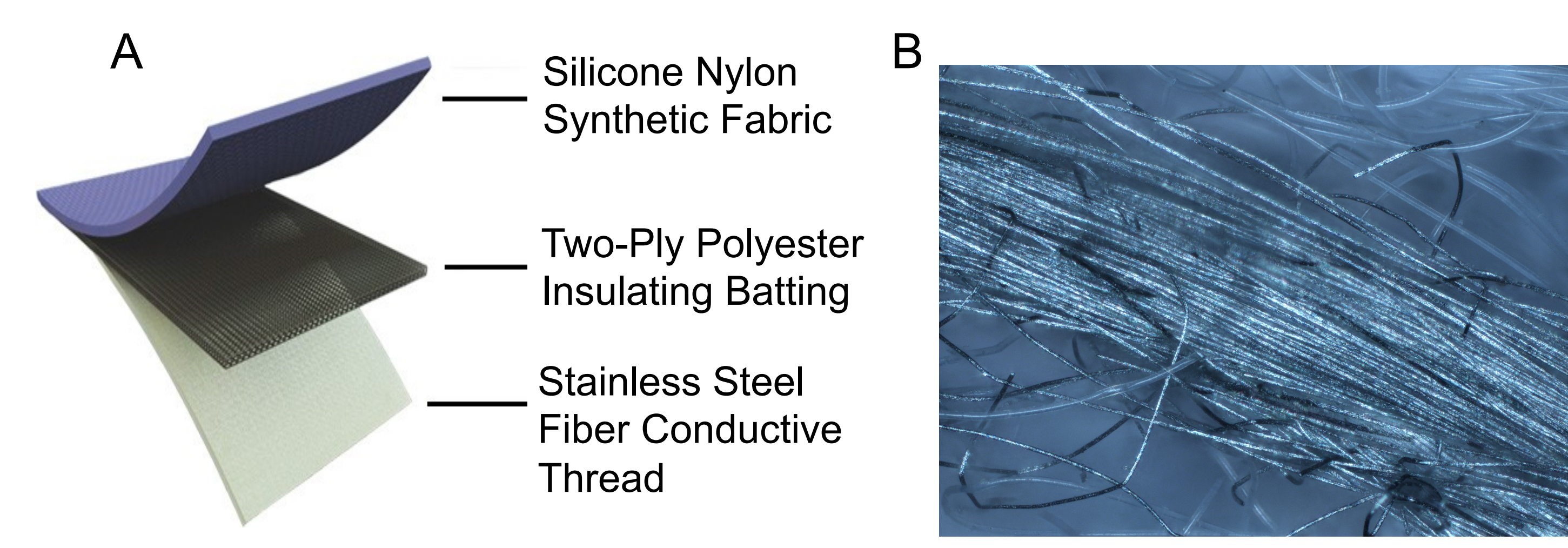
Design

- Heat generating glove
- Heat activated based on temperature of user's hand
- Conserve battery power by using closed control loop



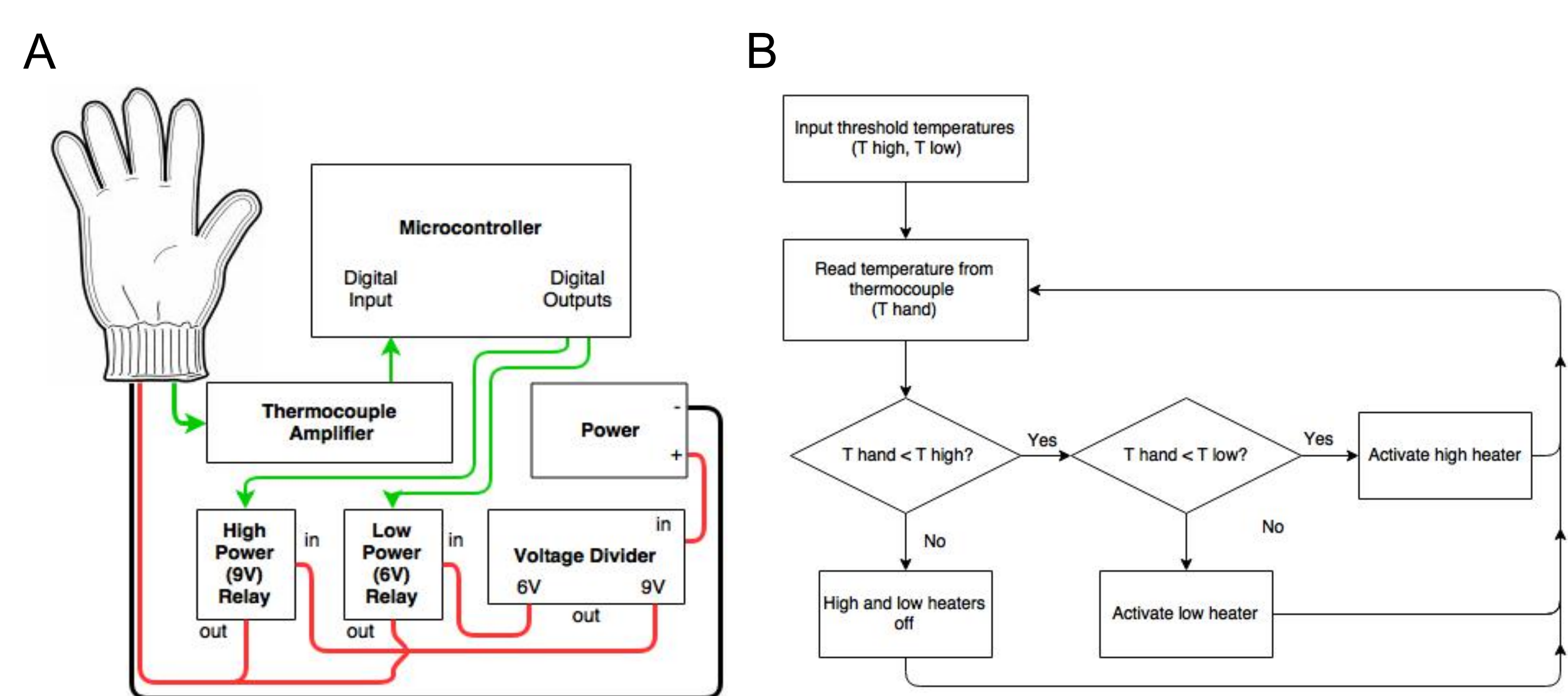
Current technologies on the market include: (A) Outdoor Research Stormtracker™ electrically heated gloves (\$250 per unit); (B) oxygen activated chemical hand warmers (\$6.49 per 10 units).

Materials



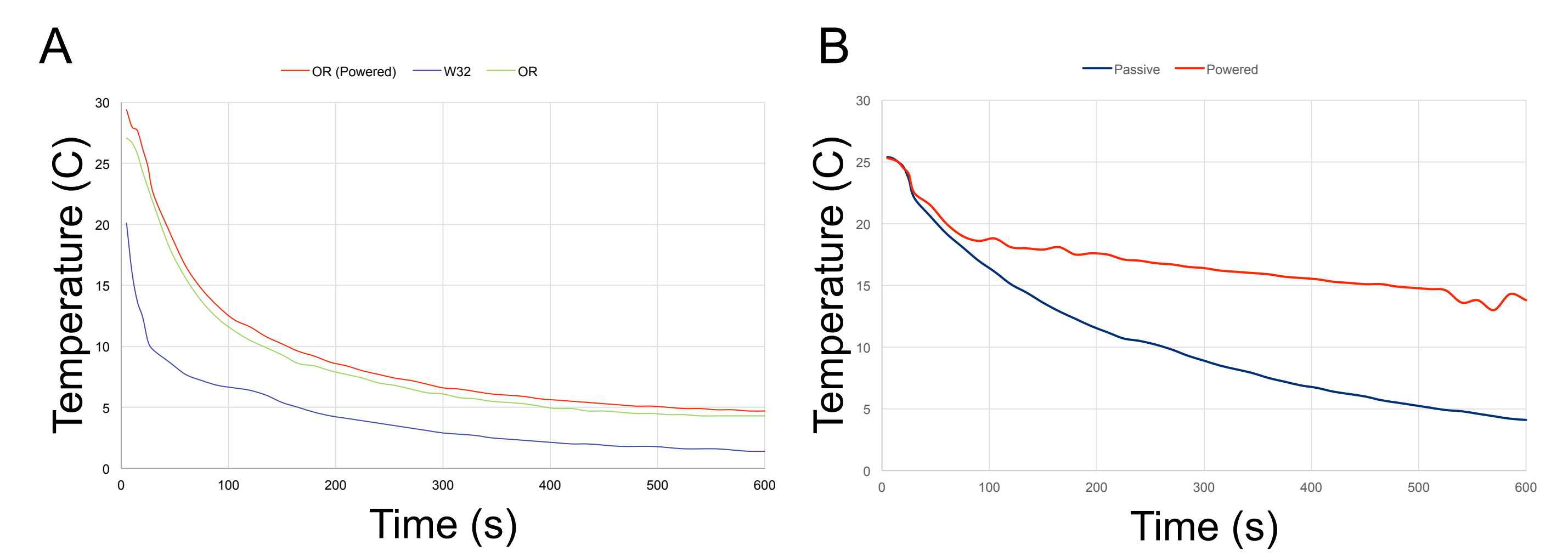
(A) Layers of fabric that make up the prototype. (B) 10x microscope image of stainless steel fiber conductive thread.

Control System

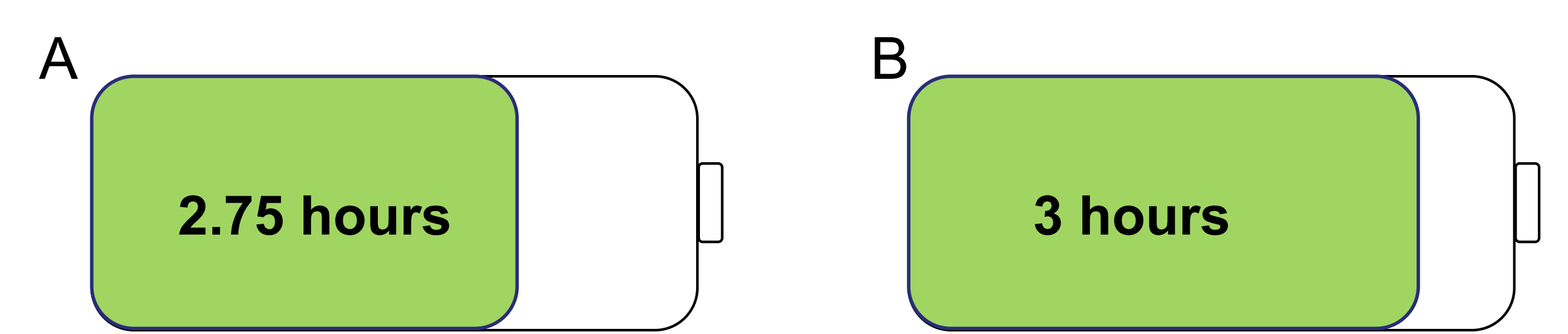


(A) Wiring diagram for prototype. (B) Microcontroller logic flowchart.

Results



Temperature drop over time that user will experience when using: (A) common gloves on market; (B) our prototype gloves in 0°C.



(A) Outdoor Research Stormtracker™ battery life at 100% usage. (B) Prototype battery life at 50% usage (extrapolated).

Conclusions

Our prototype is capable of maintaining a temperature of approximately 10°C higher than that of the current products on the market while extending battery life.

Future studies include:

- Implementing a smaller rechargeable battery
- Allowing user to change threshold temperatures based on personal preferences

Patent Pending