CFC FREE THERMOELECTRIC AIR CONDITIONER

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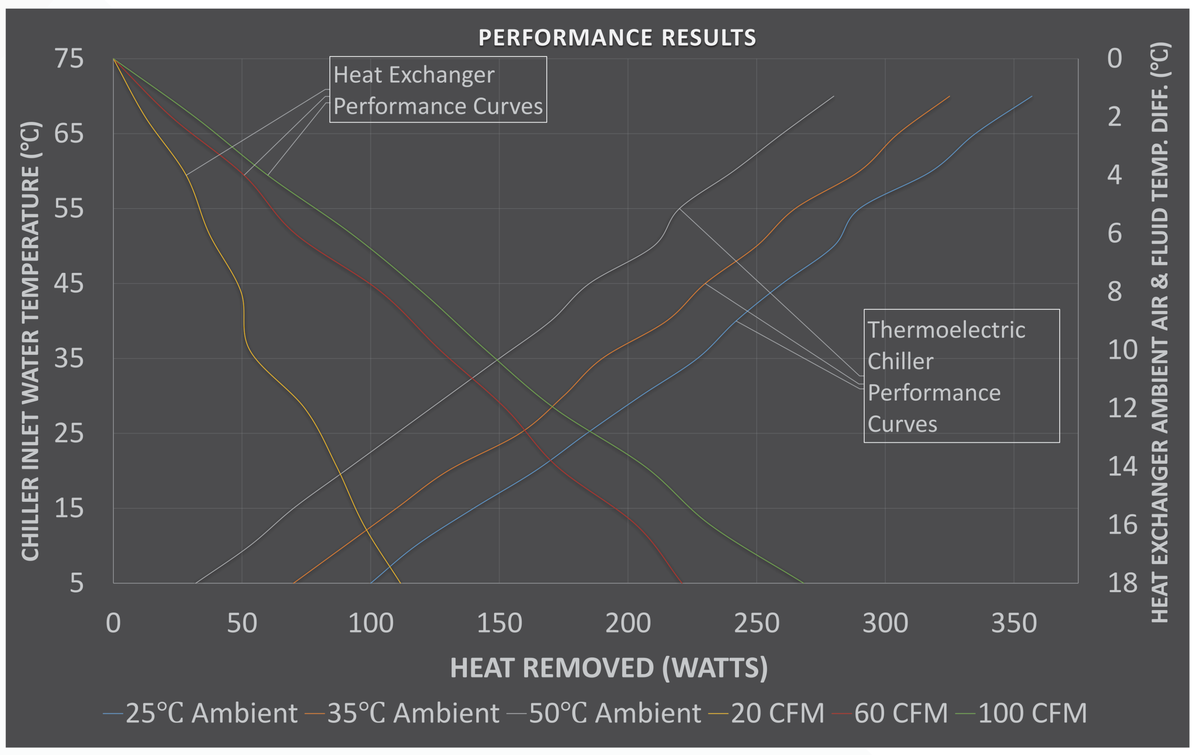
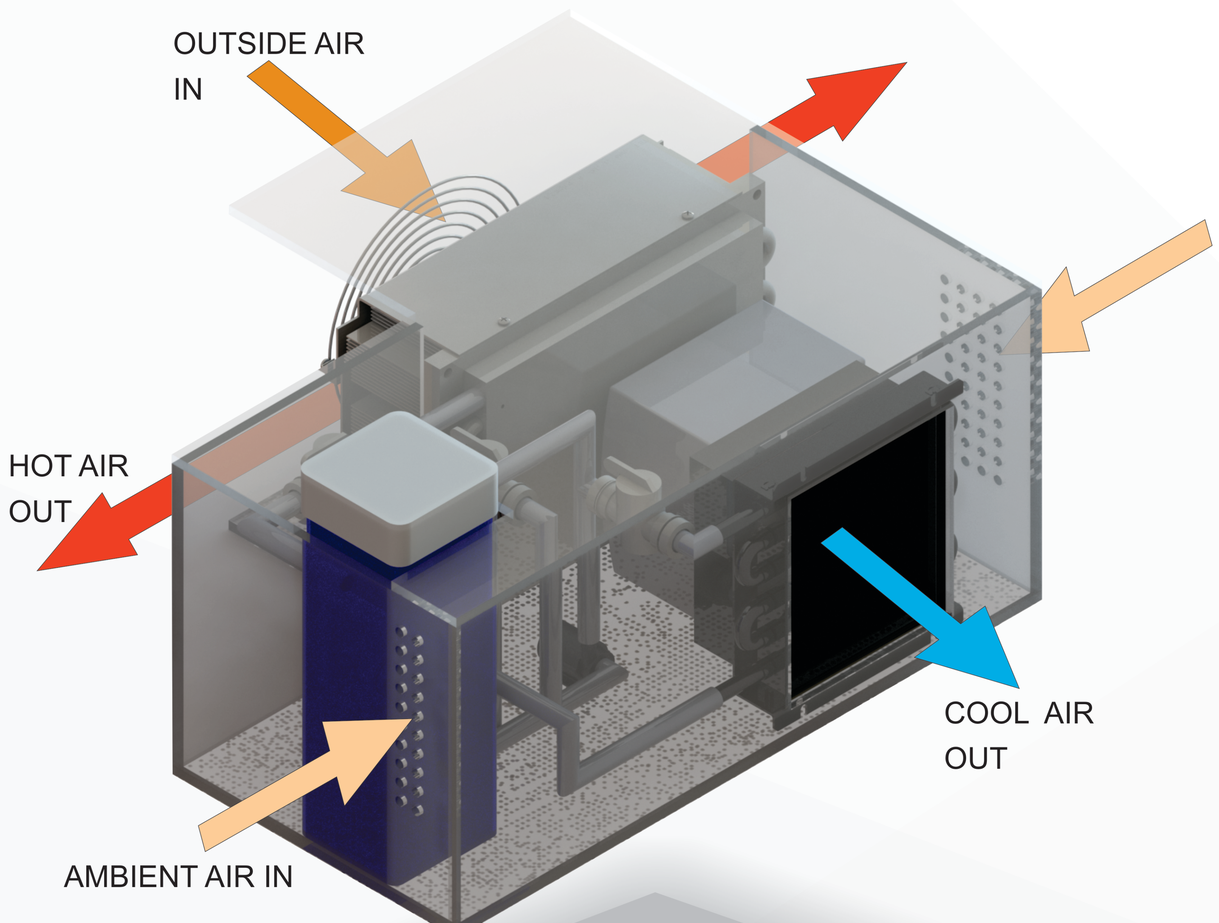
PROBLEM STATEMENT

Design a window air conditioning unit using thermoelectric cooling technology to improve aspects of the system such as convenience, efficiency and environmental impact.

BACKGROUND

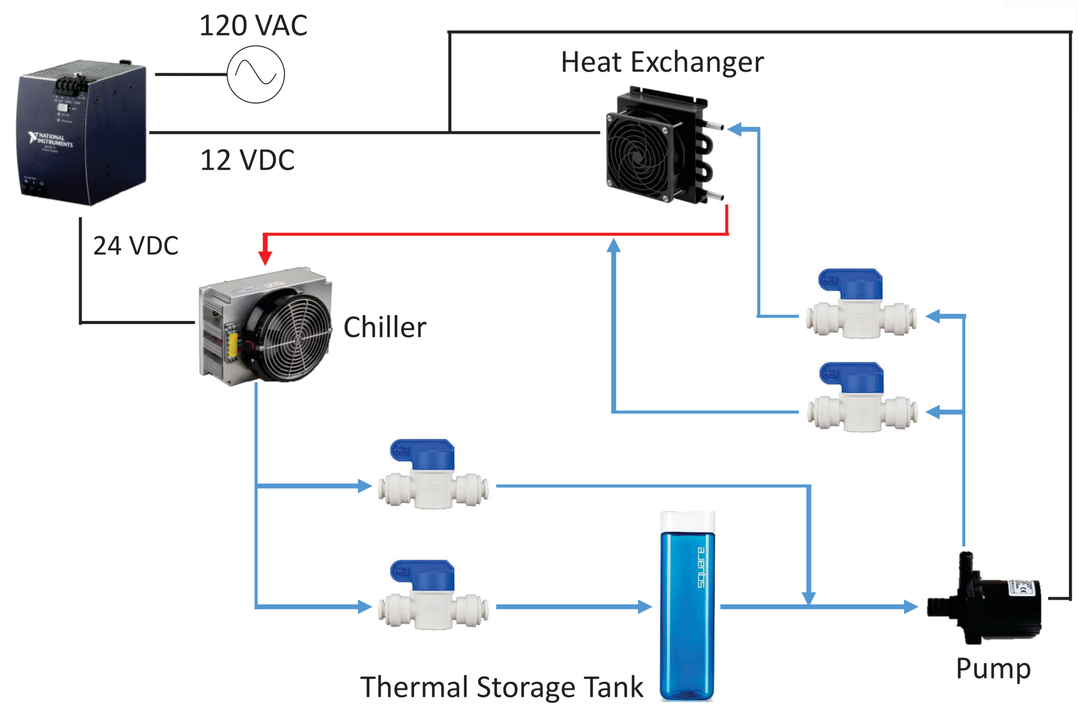
To maintain a consistently air-conditioned room at a temperature set point appropriate for human occupancy, our team designed a thermoelectric air conditioner. The thermoelectric technology has numerous benefits over the conventional refrigerant based air conditioner including the compact size and reduced noise and vibration due to the absence of a compressor.





OBJECTIVES

- Provide maximum cooling effect while minimizing size, power consumption, and cost. The system requirements include:
  - Working fluid must be safe for handling and eco-friendly
  - Working fluid must have low freezing point, high boiling point, and low heat capacity



SYSTEM SPECIFICATIONS

Thermoelectic Chiller	• Maximum heat removal of 184 W • 8-pass liquid loop, 6 TE modules
Heat Exchanger	• Cooling capacity of 381 W • Adjustable speed for variable cooling
DC Pump	• Maximum flow rate of 8.5 L/min • Noise rating less than 40 dB
Thermal Storage Tank	• 1 litre of fluid storage • Cold reserve for improved efficiency
AC Power Supply	• Variable outputs to supply all system components

ENGINEERING THEORY

The system's performance is calculated as follows:

$$COP = \frac{\dot{Q}_L}{\dot{W}_{IN}} \qquad \dot{W}_{IN} = VI \qquad \dot{Q}_L = \dot{m}C_P(T_{out} - Tin)$$

CONCLUSIONS

- Convenience improved through compact geometry
- Modular architecture allows for increased cooling capacity in environments requiring higher heat removal
- Reduced environmental impact through use of Propylene Glycol instead of CFC (refrigerant)

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