

Smart Thermostat

Team: Brenden Gough, Caleb Krockover, Henry Bravata, Han Park
Mentor: David Merrick



Customer Background

Chakolas is embarking on an innovative venture to develop a new generation of smart thermostat systems. This initiative seeks to transcend the traditional functionalities of standard thermostats, which typically maintain a user-defined target temperature. Recognizing that human comfort is a multidimensional aspect influenced not just by temperature but also by factors like humidity and airflow, Chakolas is committed to redefining indoor climate control.

Problem Statement / Scope of work

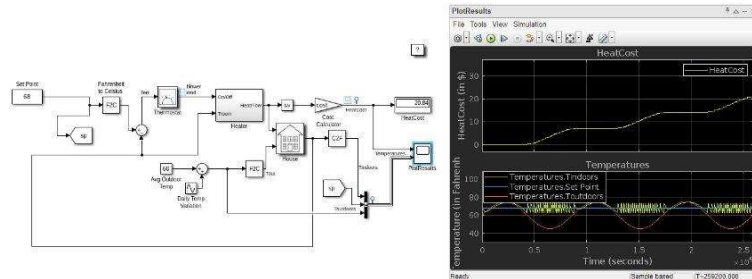
The scope of this project is to create and test an algorithm and subsequent simulation for an HVAC controller and test functionality within a simulated environment. Pending final design and success of the controller algorithm simulation, a final review of its performance will be collected and reviewed against conventional and advanced HVAC systems, with improved cost and energy efficiency being a priority. A further goal includes testing the project within a heating and cooling chamber built by the previous project group.

Requirements Matrix

Req. #	DESIGN REQUIREMENTS	DESIGN TARGETS	VALIDATION
RATIONALE			
1	Temperature control system maintains desired room temperature	Temperature control system maintains room temperature with 3 degrees from user input desired temperature.	Measures correct room temperature. Room temperature adjusts to target temperature.
Essential for maintaining comfort temperature.			
2	Heating system will communicate with temperature control system and will operate accordingly. When turned off by user, heating system turns off.	Heating system raises room temperature until within 3 degrees from user input desired temperature.	Raises room temperature when activated by temperature control system.
Essential for raising room temperature.			
3	Cooling system will communicate with temperature control system and will operate accordingly. When turned off by user, cooling system turns off.	Cooling system lowers room temperature within 3 degrees from user input desired temperature.	Lowers room temperature when activated by temperature control system.
Essential for lowering room temperature.			
4	Fan control system will provide airflow to raise/lower room temperature.	Fan operates on desired setting within 2.5 seconds of being turned on.	Provides airflow to raise/lower room temperature.
Essential for air circulation to increase efficacy of cooling or heating.			
5	ON/OFF switch will turn on/off the HVAC control system	Turns on/off the HVAC control system within 2.5 seconds of being turned on/off	Gives user the ability to turn on/off HVAC system.
Essential to turn on and off HVAC controlling system.			

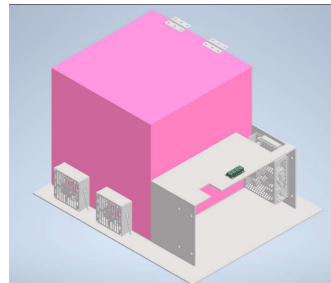
Experimentation / Concept Exploration

Edited the previous group's simulation MATLAB code to implement our intelligent mode.

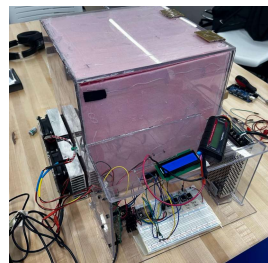


Final Design

CAD Model



Physical Model



Testing Results

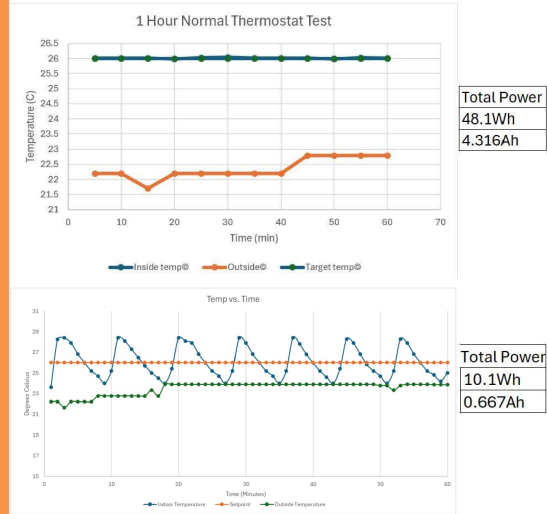
1 Hour Test

- Positives
 - More efficient
 - Stays within the Comfort Zone
- Takeaways
 - Only stays on the lower bound temperature range.

4 Hour Test

- Positives
 - More efficient
 - Stays within the Comfort Zone
 - Goes to the lower and higher bound temperature ranges.

Testing Results 1 Hour



Testing Results 4 Hours

