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Evaporative Cooler Controller Design

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Goal

Goal: Develop a system that can control an evaporative cooler and maintain within +/-1 degree of set temperature 90% of the time, and within +/- 2 degrees 95% of the time, when outside temperature is higher than inside temperature

Background

Advantages of Evaporative Coolers:

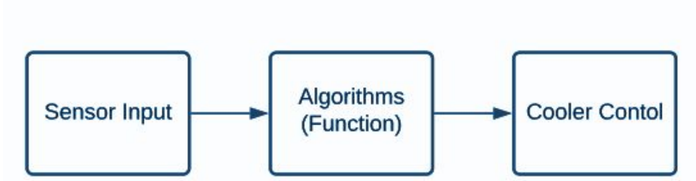
- More Environmentally Friendly than AC
- Lower cost
- Easier to install and maintain

In developing a low cost control system for most evaporative coolers, consumers will be able to buy something less expensive that will also keep their house cool.

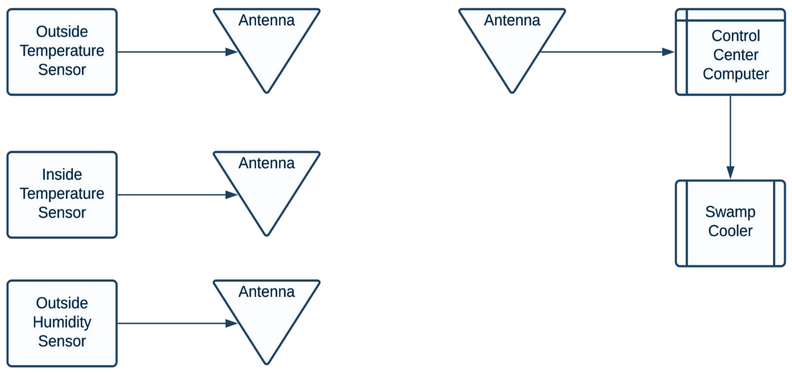
Objectives

- ±1℉ 90% of the time
- ±2℉ 95% of the time
- Rechargeable / Recyclable Batteries
- Minimal Sensors
- Low Cost
- Able to add Flash Storage
- Able to replace existing thermostat
- No larger than client provided hardware
- Bluetooth Low Energy (BLE) Compatibility
- Wifi compatibility
- Updatability

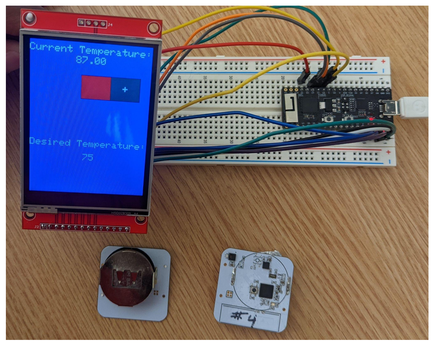
Algorithm Design

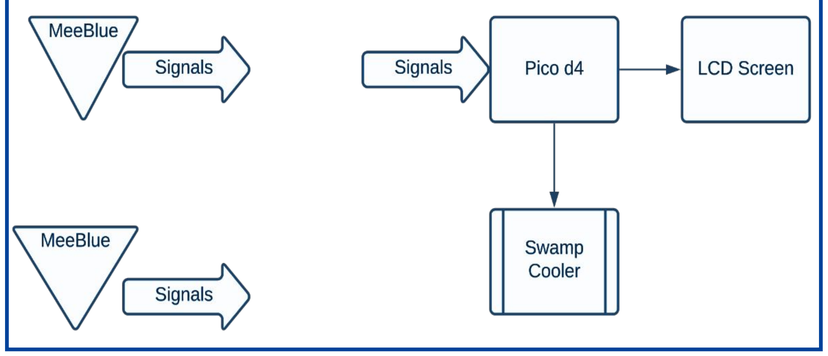


Hardware Design



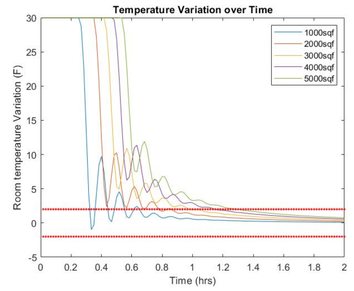
Technical Design





Status

Description	Price
ESP32-PICO-D4 Wifi/Bluetooth	$4.95
Meeblue beacon M52-SA (x2)	$14.00
ESP32-PICO-KIT	$10.00
HiLetgo ILI9341 2.8" SPI TFT LCD Display Touch Panel	$17.59
Power Relay SLA-12VDC-SL-A (x2)	$23.99
Total Production Cost	$70.53



Objective Verification

Objective	Test Results	Objective Met
±1℉ 90% of the time ±2℉ 95% of the time	The model plot shows that the 2℉ target is hit, but not the 1℉	No Yes
Rechargeable/recyclable batteries	Batteries are recyclable	Yes
Minimal sensors	2 sensors are required for an accurate algorithm to function	Yes
Low cost	The production cost is $70.53	Yes
Able to add flash storage	Additional flash storage not possible	No
Replace Existing Thermostat	Uses the same wires as conventional evaporative cooler thermostat	Yes
No larger than client provided hardware	This is client provided hardware	Yes
Bluetooth Low Energy	Connects to Bluestooth Sensor	Yes
Wifi	Wifi was not implemented	No
Updatability	Pico D4 updatable through micro USB port	Yes

Conclusion

Successes:

- Made model of Evaporative Cooler
- Converted this model to an algorithm

Challenges:

- Had to change to client hardware
- Unable to test the algorithm
- Couldn't connect second sensor

Objectives not met:

- The 1℉ was not achieved for houses above 2000 sq. ft. due to oscillations
- Wifi took a backseat to BLE
- Unable to add flash storage because we used client hardware

What we would do differently:

- Use Arduino sensors
- Manage time more efficiently

Acknowledgements

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