Evaporative Cooler Controller Design
Troy Boggs, Quincy Bradfield, McKenna Gold, Jordan Tesillo
Department of Electrical Engineering, New Mexico Institute of Mining and Technology

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°F 90% of the time
- ±2°F 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

Objectives not met:
- The 1°F 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
Dr. Wedeward, Capstone Professor
Dr. Teare, Capstone Advisor
Dr. Shao, Bluetooth Connections

Dr. Varela, Thermodynamic Model
Nancy Nangeroni, Project Sponsor

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

Objective Verification

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