Thermocloud: A Smart Collaborative Thermostat

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HVAC operation constitutes 45-55% of house energy, due to inefficient conventional thermostats. The project's goal is creating a cloud-based collaborative learning thermostat that optimizes HVAC operation and maximizes comfort and energy savings using machine learning. A two-tiered learning approach – adaptive clustering to dissect huge problem space, and dynamic collaboration strategy between units rapidly enhances performance. Thermostat uses cost-effective hardware and user-specifiable cost-comfort trade-off with cost-saving features, like user-specified temperature range and comfort-level, blackout-mitigation, and multi-story equalizer. A Raspberry-Pi Zero based hardware module, uses GPIO and sensors to operate HVAC system under guidance of Android application, comprising local and collaborating machine-learning algorithms and automatic access-token based security. Locally, probe creates thermal-profile, sustain maintains interval's temperature, and transit enables transitioning between intervals. Two-tiered learning with automatic clustering enables client consult right cloud server node and dynamic collaboration learning strategy at the node provides best optimization. Grad-learn strategy learns progressively using domain-specific algorithms, neural-strategy optimizes using deep neural-network learning, and hybrid-strategy dynamically uses best optimization strategy. Hybrid-strategy had 34% savings over conventional from day one. Grad-learn excels for identical conditions, neural regresses best with training, but hybrid is most reliable. In the future, two-tiered learning can empower learning for huge problem spaces like smart IoT services and smart space exploration. Thermocloud’s huge energy saving has substantial positive impact on society.

Awards Won:

Oracle Academy: Award of $5,000 for outstanding project in the systems software category.