

Distributed Climate Control (DCC) - Project Summary

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Overview: Welcome to the Distributed Climate Control (DCC) project. Our system will help businesses, homeowners, and other institutions save money on energy spending by dramatically reducing the amount of heating and cooling spent on air space that no one is occupying, as well as contribute to global efforts towards creating affordable, sustainable energy technologies. Our project specifically aims to provide information specifying how many people are in a room, and where they are situated. This information will be used by a HVAC system which can target specific regions of a room. This project is inspired by the ARPA-E's research and funding of advanced energy systems.

Intellectual Merit: This Small Business Innovation Research Phase I project will have to effectively use a variety of sensors to obtain features to train an accurate machine learning model. The device will combine thermal, color, and depth imaging to track where in a room people are, and specifically how many people occupy certain areas so that an HVAC device could heat or cool only regions of the room occupied by people. The sensors used will be a flir lepton thermal camera and a kinect v2 RGB-D camera. Significant challenges of this problem include accurately calibrating the system in the room despite not having a long-range depth sensor, and making the system portable such that it can be placed at a high vantage point and out of the way from any of the activity in the room. Additionally, the device should be able to communicate to a separate, more powerful machine which can help do additional processing including training the headcount and distribution model. Due to the small field-of-view of the thermal camera and the need to combine the images of multiple sensors, the kinect and flir lepton thermal camera will have to pan and tilt to capture a full image of the room, requiring strong and accurate motor control from the controller done in a short enough time to capture a point in time accurately.

Broader/Commercial Impact: This project will demonstrate a new concept on how to save energy in a way that is attractive to businesses and homeowners. The non-intrusive nature of our device combined with the amount of money to be saved by consumers makes a strong argument for the DCC's success on the market, as well as furthering research of sustainable and forward-thinking energy technologies. Additionally, the DCC will explore the ability to create a device with currently obtainable and affordable technology, strengthening the meaningfulness of an effective prototype.