RISE RESEARCH INNOVATION SCHOLARSHIP ENTREPRENEURSHIP

#3052
Engineering and Technology
Undergraduate

Northeastern University

Visualizing the Dynamic Fluctuations of Indoor Temperatures

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Opportunity

A household's indoor temperature depends largely on the preference of the homeowner. But despite the irregularity between individuals, all indoor climates exhibit certain behaviors under external conditions such as weather, season and time of day.

- Due to modern society's increasing reliance on energy, conservation is crucial to our economy and environment.
- According to the Department of Energy, 48% of household energy consumption is used for heating and cooling.
- To optimize energy usage, we need to understand how and why indoor temperatures fluctuate throughout the day.

With available smart thermostat data from the Ecobee Donate your Data (DyD) program, MATLAB was used to create animated heat maps juxtaposing the behavior of indoor and outdoor temperatures of 2,162 Midwestern Households.

Data

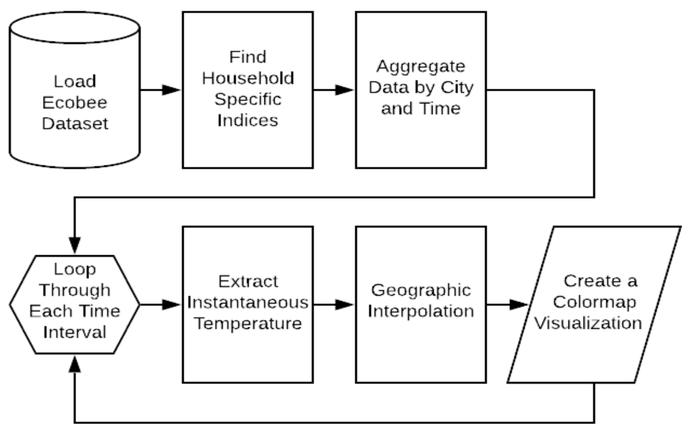
The dataset is a collection of individual household data sourced from Ecobee Smart Thermostat's DyD database. The semi-organized data is stored in a MATLAB cell array with accompanying data label and metadata files. The function also utilizes a file of US Cities and their latitude/longitude.

Timeframe: January 2015 - October 2017
Location: Various cities in Illinois, Indiana, Michigan, Wisconsin
Values: Indoor & Outdoor Temperatures in 5-minute intervals

Approach

Processing:
Averaging temperature data for each city and organizing by datetime.

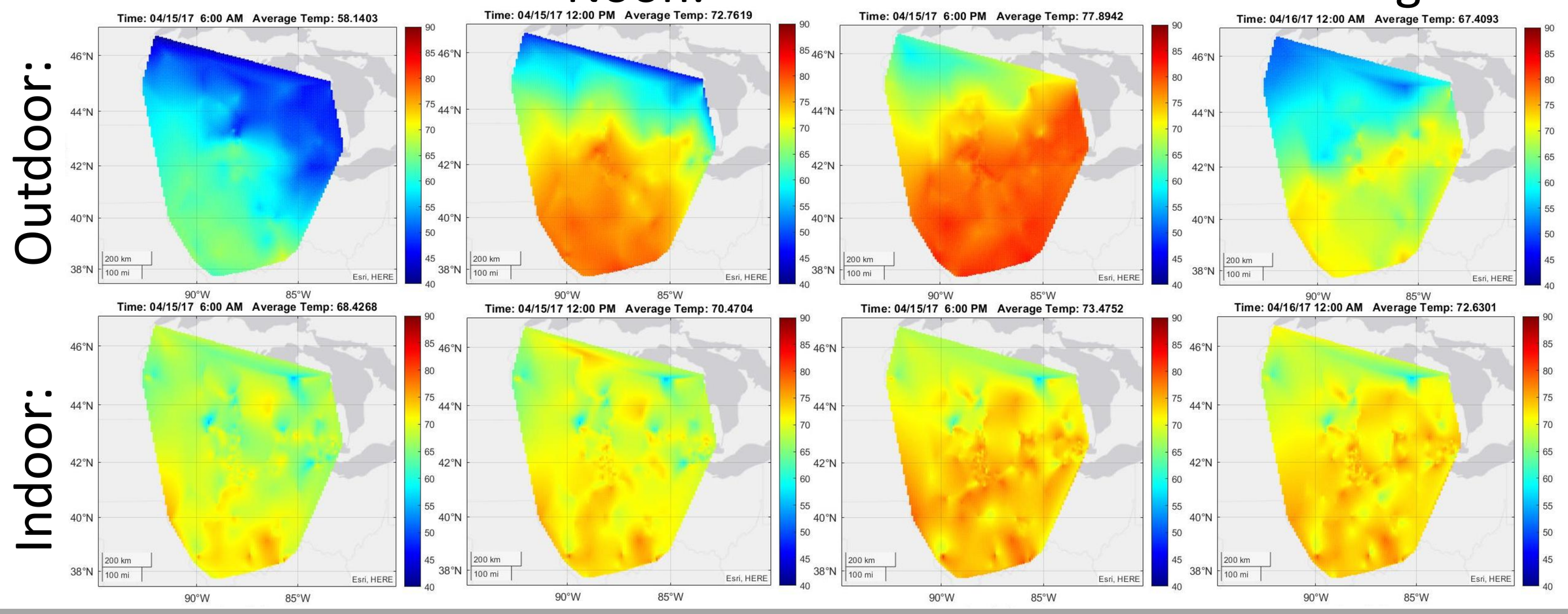
Mapping:
Iterating instantaneous temperature plots to animate a heat map.



Results

Example of Temperature Volatility: Snapshot from April 15th, 2017

Sample heat maps from a warm spring day.



Impact

This project is unique in its versatility; the animations can be understood and acted upon by anybody.

- By analyzing these trends, engineers can identify new methods to optimize consumer energy usage
- Companies like Ecobee can implement predictive algorithms to counteract indoor temperature fluctuations
- Consumers can visualize the patterns in their personal usage and take steps to reduce their energy footprints

In the future, this process will be applied to larger datasets to provide insights on nationwide temperature fluctuations.

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