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# Data Driven thermal comfort profiling insights of Large Population

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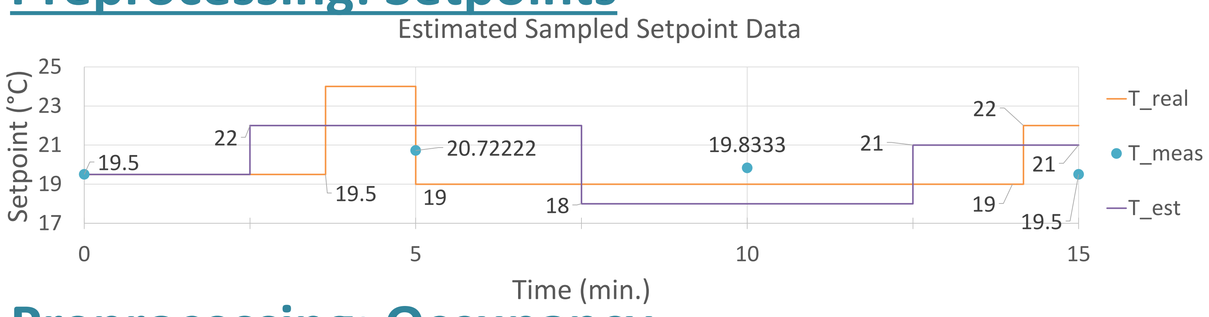
## Opportunity

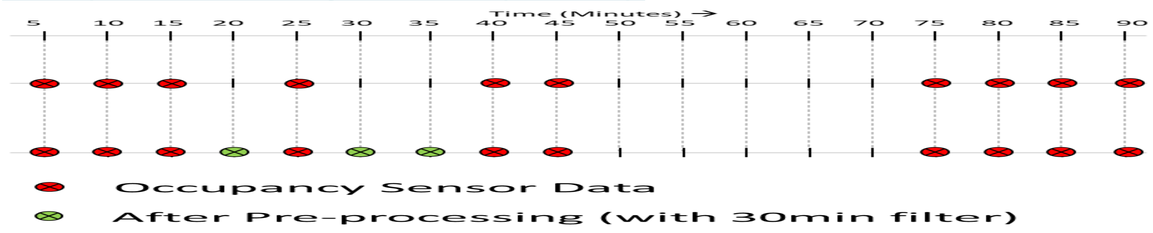
- **Motivation**: Thermal comfort drives ~40% of residential energy use, with the smart thermostats promising to improve comfort, sustainability, and economics.
- **Challenge**: Non-personalized automation leads to user dissatisfaction, frustration, and loss of trust leading to non-optimal behavior and defeated control algorithms.
- **Vision**: Smart thermostats that learn user behaviors, then keep users properly informed and adapt building systems to keep them comfortable and not confused.
- **Goal:** Understand the impact and dynamics of occupant thermal comfort behavior in large populations

## Approach

### Preprocessing: Setpoints




### Preprocessing: Occupancy



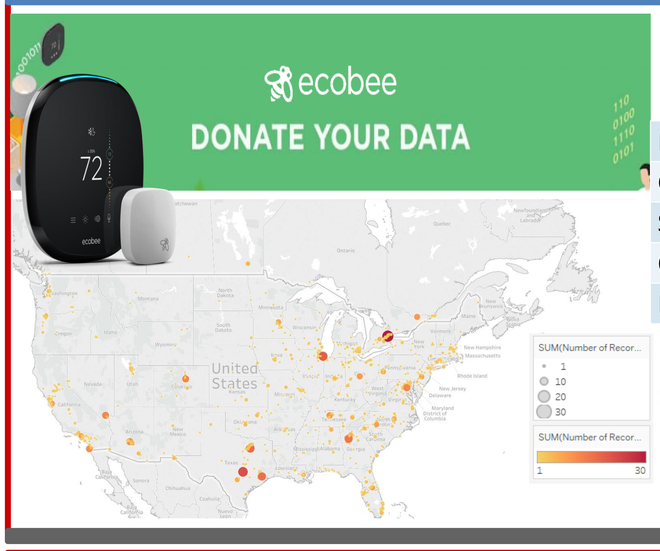

### Data Analysis and Visualization

Manual overrides are the foundation of understanding the discomfort caused by the environment. These overrides allowed us to quantify Degree of discomfort and similarly in association with occupied period, quantify time to discomfort.

## Impact

- **Accurate Predictive of Demand Response (DR):**
  DR programs can understand their community and make appropriate setpoints changes, reducing the cost of renewable energy. Additionally, with better understanding of thermal comfort, thermostats can learn and predict setpoint based of a user's comfort.
- **Increasing Resiliency:**
  These profiles will allow lower energy consumption providing more resiliency to Microgrids. Through these profiles control over demand and supply can be improved. Moreover, with lower energy consumption the need for expensive batteries will be reduced.
- **Increasing user trust:**
  From the insights gained about the user, designers can be informed appropriately to make better products. These profiles can identify mis-informed users and educate them appropriately.

## Data



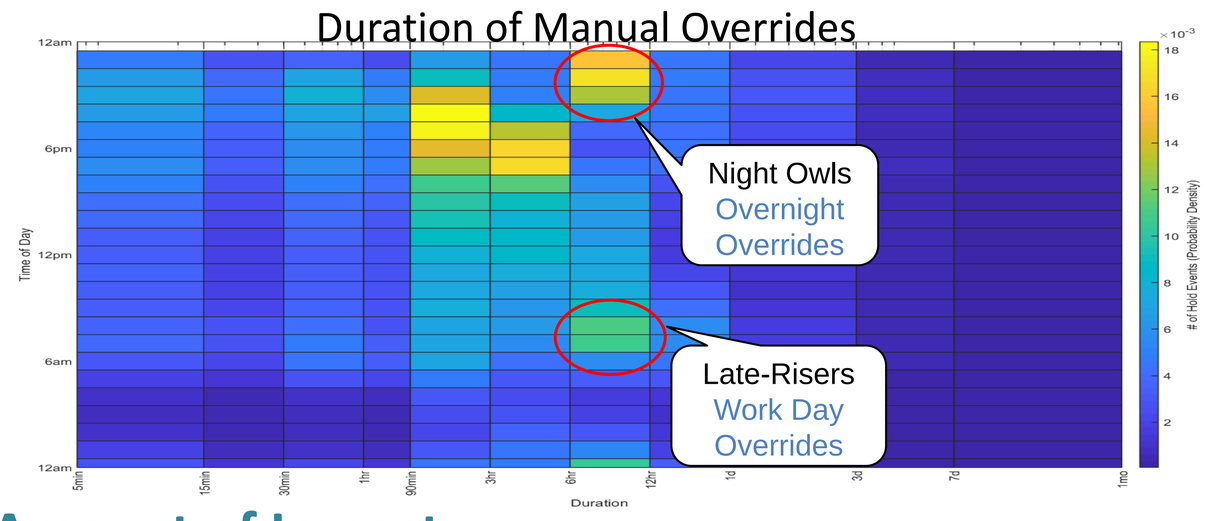

**Based of 2018 DyD platform**
**What's in the Ecobee data**

| | |
|---|---|
| Multiple Room Temps. | Mutl. Room Occupancy |
| Control Temp. | Schedule |
| Setpoints (Heat & Cool) | Events |
| Outdoor Temp. | Equipment Runtime |
| Humidity | ...every 5 minutes |

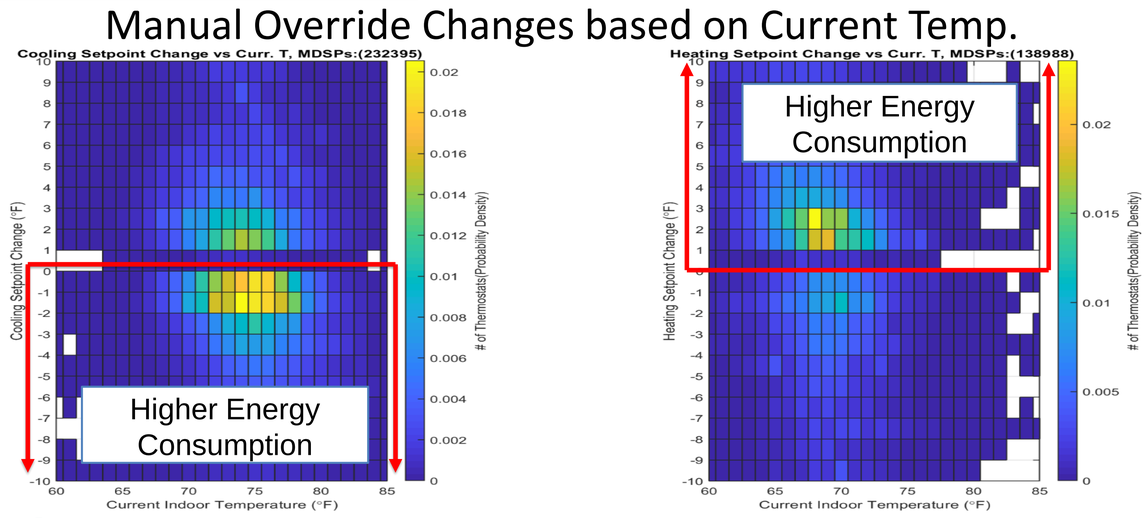
**Single Occupancy** $(n = 1{,}410)$

## Results

### Length of Impact




### Amount of Impact




### Behavior Dynamics