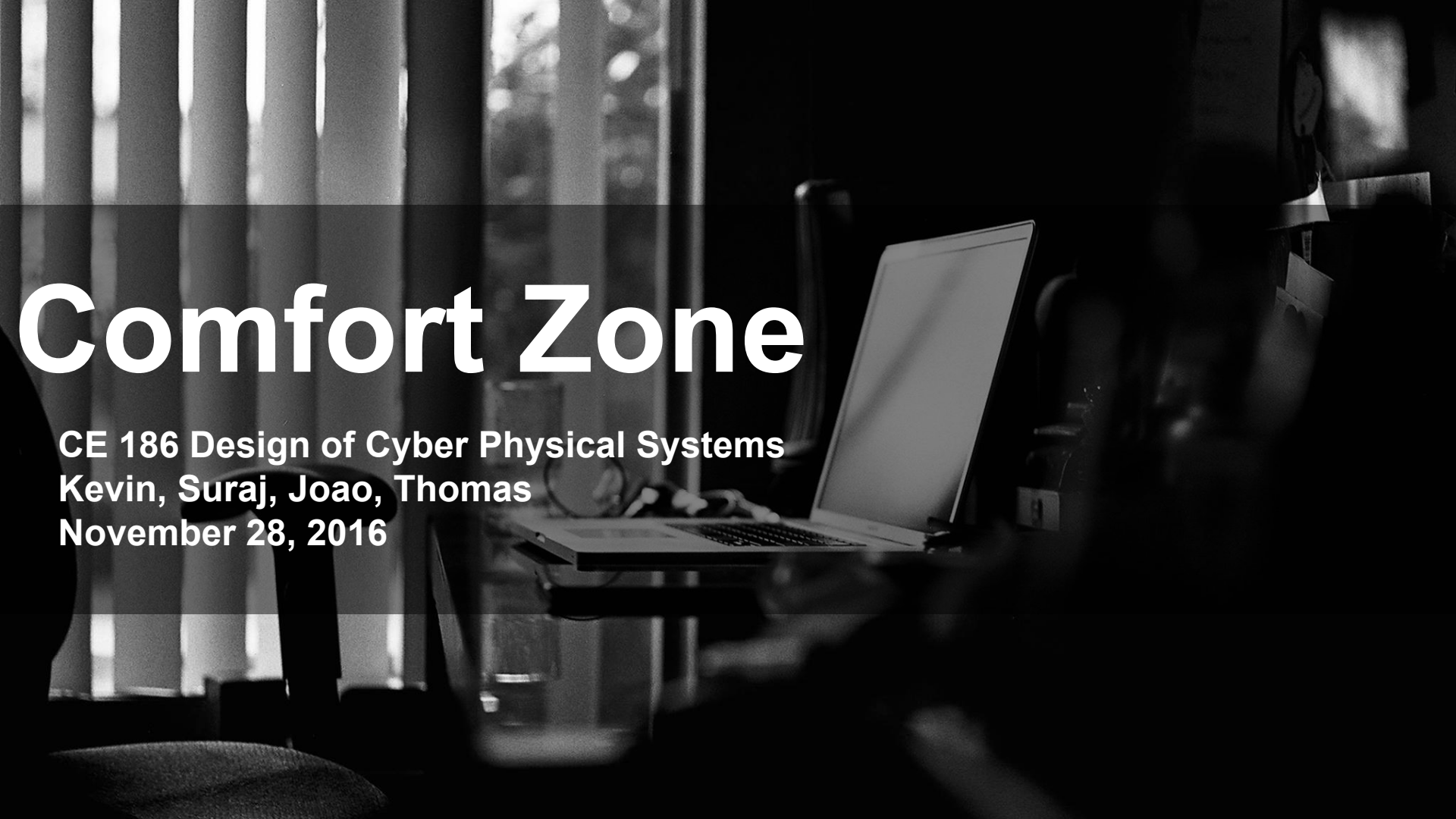


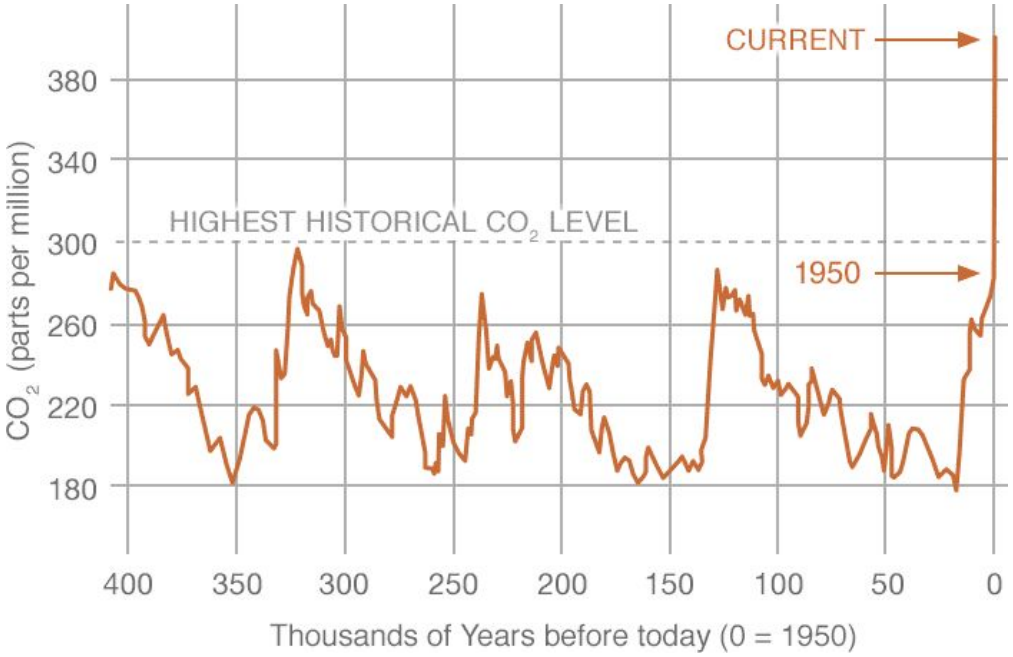
Comfort Zone

CE 186 Design of Cyber Physical Systems
Kevin, Suraj, Joao, Thomas
November 28, 2016

The Future of Chairs

- First fully comprehensive “smart” personal chair
- Monitors, maps, and predicts your thermal comfort settings
- Reduce a building’s energy consumption by up to 30%

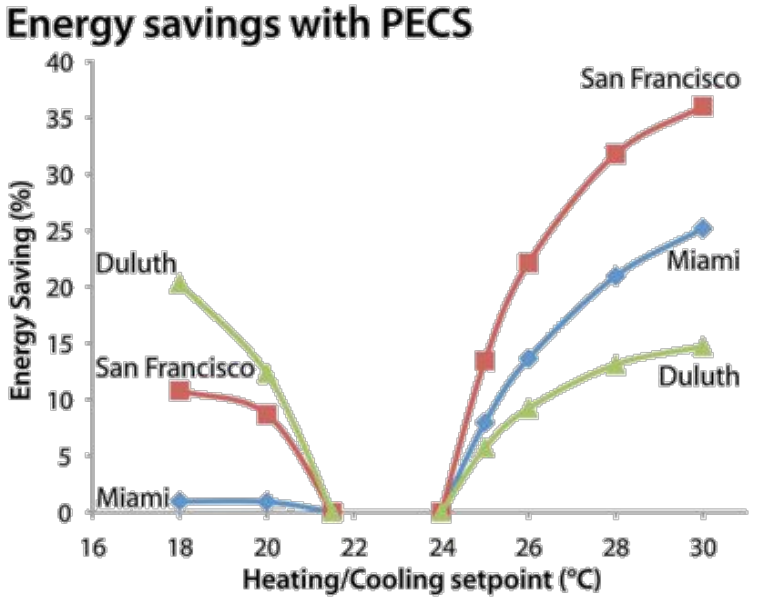
Building Energy Crisis

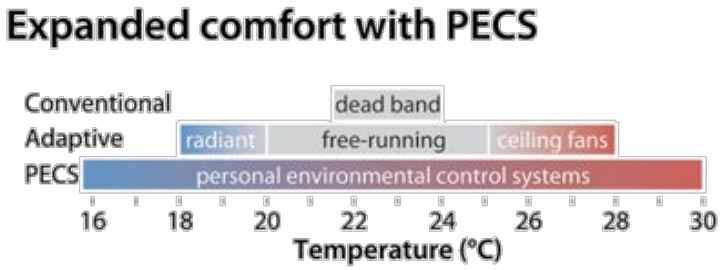


- Commercial buildings constitute 19% of the total US energy consumption.
- Office buildings are the largest sector of commercial (18%)
- Potential to reduce the US energy consumption by 0.5% per year

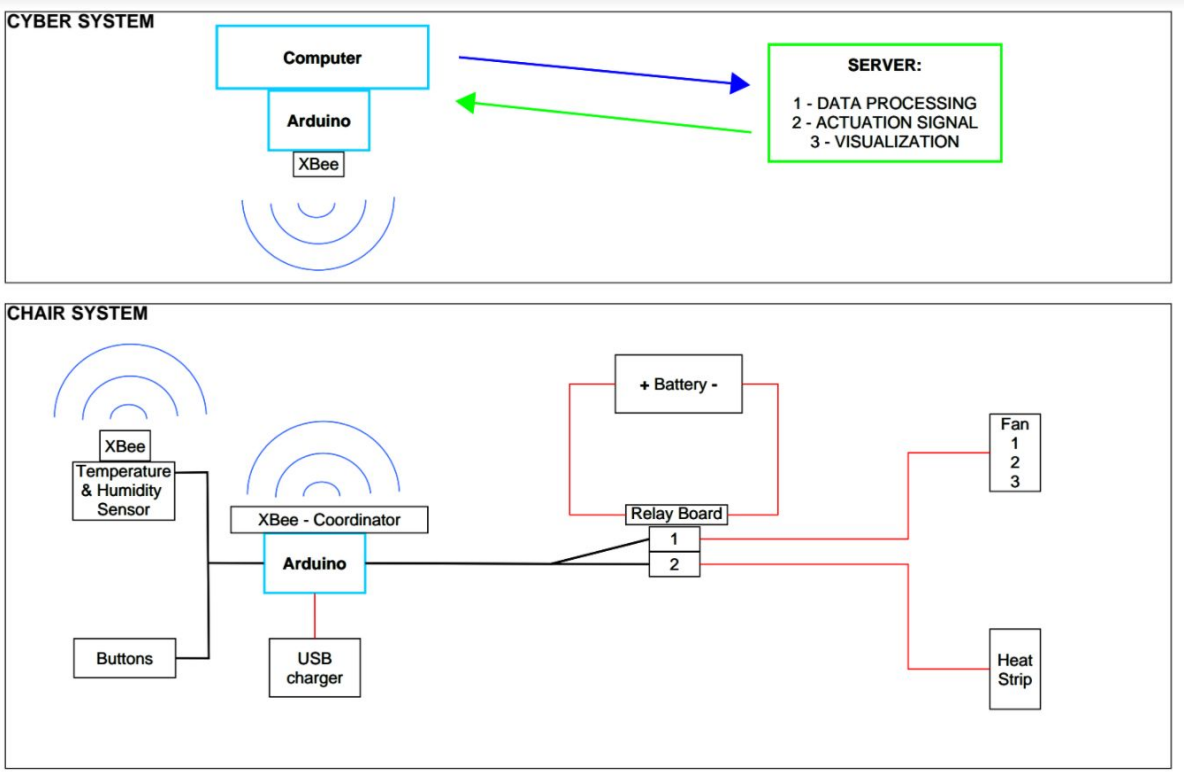
A Proven Solution

- ➔ Localized system to effectively heat and cool your ambient setting
- ➔ Center of Built Environment spent decades researching the benefits of a localized desk environment
- ➔ Minimizes the volume of mechanical heating and cooling





Overview of the Comfort Zone



Actuation Algorithms

$$T_i(k) - Actual\ Temperature\ at\ time\ k, day\ i$$

$$T_i^{des}(k) - Desired\ Temperature\ at\ time\ k, day\ i$$

$$s(k) \in \{-1,0,1\} - State\ of\ chair\ elements\ at\ time\ k$$
$$where\ -1 = fan\ on, 0 = nothing\ on, 1 = heat\ on$$

$$\Delta = Acceptable\ temperature\ range$$

$$s(k) = \begin{cases} -1, if\ T(k) \geq T^{des}(k) + \Delta \\ 1, if\ T(k) \leq T^{des}(k) - \Delta \\ 0, if\ T(k) = T^{des}(k) \end{cases}$$

$$Initial\ Condition: s(0) = 0$$

Learning Algorithms

$$T_i^{des}(k) - Desired\ Temperature\ at\ time\ k, day\ i$$

$$b(k) \in \{-1,0,1\} - \ Button\ pressed\ at\ time\ k$$
$$where\ -1 = to\ hot, 0 = nothing\ pressed, 1 = to\ cold$$

Immediate effect:

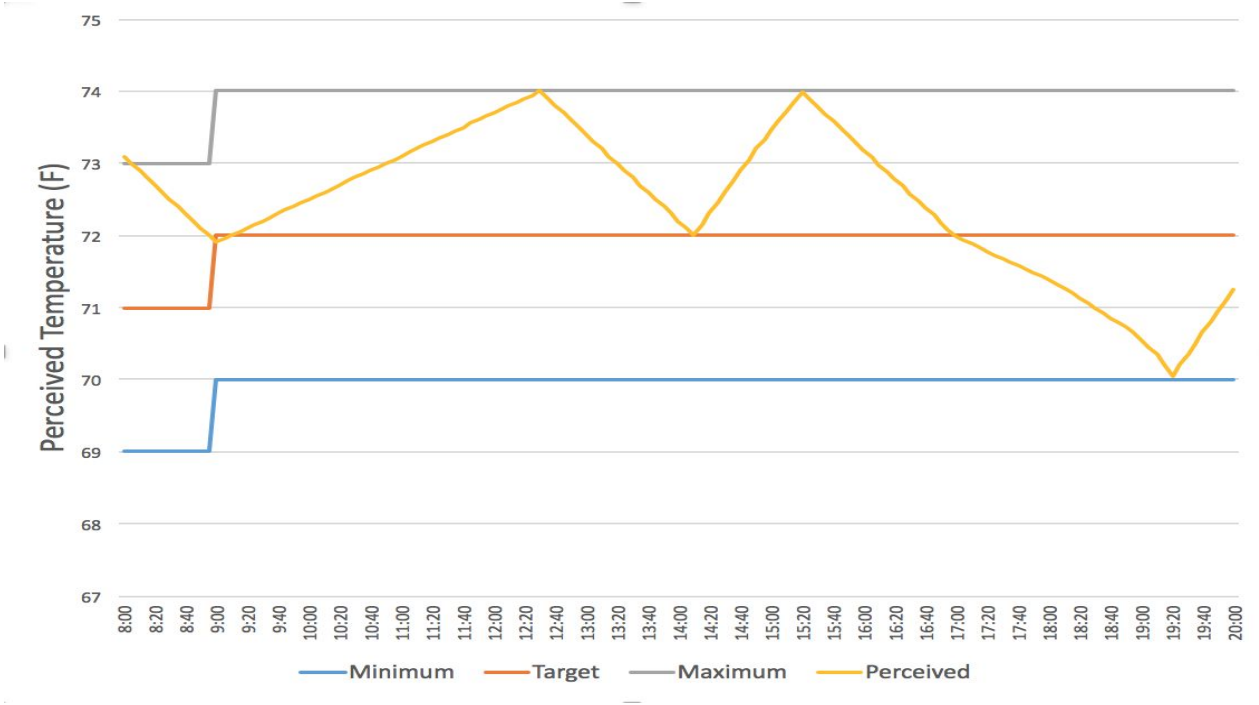
$$T_i^{des}(k) = T_i^{des}(k) + b(k)°\mathrm{F}$$

Future effect:

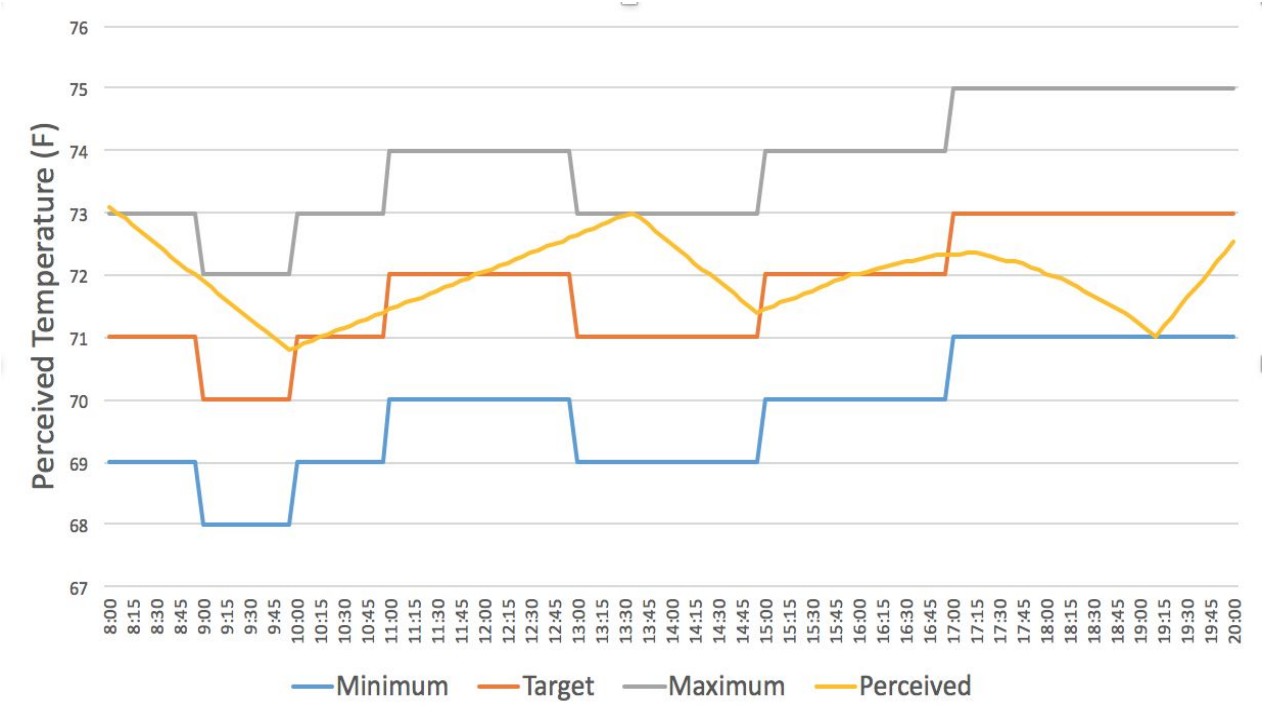
$$T_{i+1}^{des}(k) = T_i^{des}(k) \forall k$$

Perceived Temperature Variation

Perceived Temperature Variation



Perceived Temperature Variation



Data Visualization

Demo!

https://comfortzonexd.herokuapp.com/

Team & Advisors

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