Smart Home Interface with Environmental Framing for Reducing Energy Use

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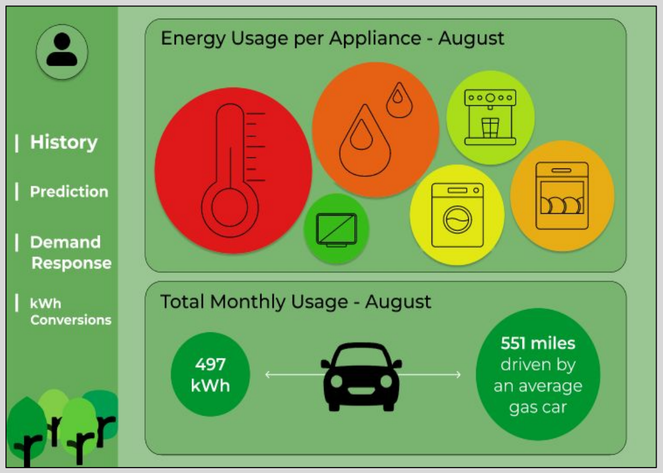
Introduction

- Energy use and how to reduce consumption is very relevant in the modern world, especially with the rise of climate change
- The residential energy use sector produces around 20% of the United State's total greenhouse gas emissions [1]
- Rise of new smart home technologies + automated intelligence in order to give direct feedback on energy use → easier for residents to change their behavior and consume less energy



Interface home page

Objective & Impact of Professor's Research

- **Dr. Bercerik-Gerber**'s research is focused on how human-building interaction can be adaptive and responsive to the needs of humans
- **Zero Emission Affordable Housing Design** focuses on designing a smart home interface for affordable housing that can manage one's energy usage
- The building and the user is able to work together with technology to reduce energy consumption

Methods & Research

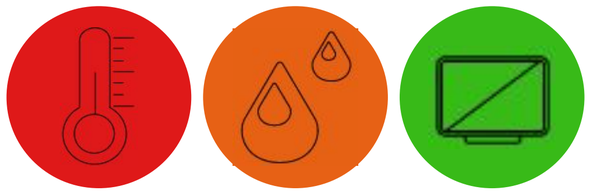
Environmental Framing:

- Environmental framing focus = motivate the user to lower their energy consumption by showing them environmental impacts (i.e. kWh → miles driven or kWh → CO2 emitted)
- In the survey that my mentor carried out, around 75% of the respondents said that they at least somewhat agreed that they feel responsible for reducing energy use to protect the environment
- Another study found that environmental concern has a significant direct positive impact on the purchase intentions of eco-friendly smart home objects [2]

https://tinyurl.com/SHINEinterface

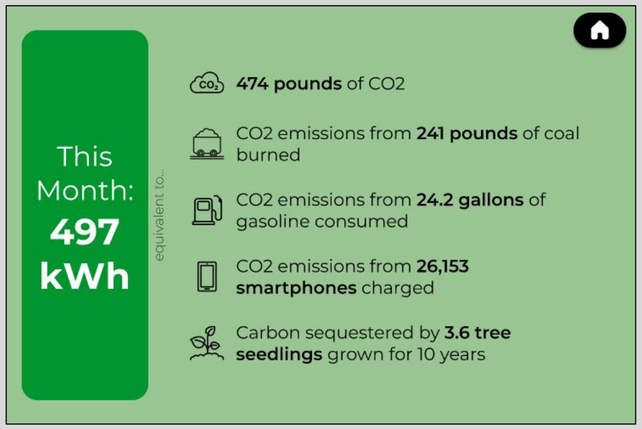
Interface design:

- Disaggregated and area-based graphs as opposed to aggregated and/or time-based linear graphs [3]
- Nature-inspired artistic visuals are effective in showing environmental impact to users, as well as having an emotional effect [5]
- Indicators present in a user's daily life, like the colors corresponding to a traffic light [4]
- The use of icons help bridge the gap between the model and the user's mind [4]



Survey

- **Goal**: test out the effectiveness of my interface on the overall usability, satisfaction, and understanding of the interface for the user:
  - "The disaggregated (separated by appliance) data is helpful in understanding general energy consumption" - rate on a 1-5 scale
- **Results:**
  - Interface was motivating to reduce energy consumption (3-5) as well as meeting energy saving expectations (3 and 5).
  - Some people thought interface was a bit confusing or difficult to navigate



kWh conversions in environmental framing

Take my survey and view my interface

What I Learned + Advice

- **Technical skills:**
  - The field of UI; how interfaces and graphs interact with users
- **Soft skills:**
  - Perseverance and finding different solutions to a challenging problem, like when I wasn't sure how to go about displaying my data
- **For future SHINE students:**
  - Don't get discouraged when faced with an unfamiliar task
  - Be curious and open-minded when researching because you'll never know what study or new data you'll find

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Citations

[1] Goldstein, B. I., et al. (2020). The Carbon Footprint Of Household Energy Use In the United States. Proc. Natl. Acad. Sci. U.S.A., 32(117), 19122-19130. https://doi.org/10.1073/pnas.1922205117
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[3] Melanie R. Herrmann, et al. An empirical investigation of domestic energy data visualizations, International Journal of Human-Computer Studies, Volume 152, 2021, 102660, ISSN 1071-5819, https://doi.org/10.1016/j.ijhcs.2021.102660.
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