Information Visualizations for Household Energy Usage

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***Abstract*— This project will design a way for individuals to visualize household energy use. Our needfinding approaches will include a survey to find out preferences and a review of existing solutions. Our prototypes are evaluated for their effectiveness in fulfilling the needs.**

***Keywords*— Energy use, household energy, visualization, human computer interaction**

I. Introduction

Each month households get bills for the energy they have used that month. The bills may have some information comparing what they have used this month to previous months or years, but the information provided is very general. Many people would like to understand their energy use better to help increase their efficiency and reduce their costs. This project will attempt to design a system to help users with both of those goals.

II. Needfinding

An easy way to comply with the conference paper formatting requirements is to use this document as a template and simply type your text into it.

A. Survey

For our first needfinding plan we will create a survey to help us understand the following data inventory items.

- Who are the users? Would only the person who pays the bills be interested in this product? Or would other people in the household be interesting as well?
- What is the context of the task? When and how often would someone be interested in seeing their energy usage?
- What are their goals? Are their goals simply to save money or are there other things that they would like to know?
- What do they need? What is the best way to show the user the information - would a mobile device be preferred or a more dedicated device?

Among the possible biases for this survey would be observer bias if we don't word the questions in a neutral way. To mitigate against this we have attempted to be neutral in our question design. In addition, wherever it made sense, we have included an "other" answer so that the user can add their own answer if the provided options are not sufficient. The second bias to be aware of is a voluntary response bias. If our survey is too long we will only get people with strong opinions. To mitigate against this we will make our survey only as long as it needs to be to get the answers we need.

Survey questions:

1. What is your age? [Multiple choice range]
2. Are you the person who pays the energy bills in your household? [Yes / No]
3. Would you use a device or app that would be able to give you detailed information about your home energy use? [Yes, No, Maybe]
4. Do you think having more information about what things in your house use energy would

cause you to make changes to high usage items? [Yes,Yes but only if I knew I could save money, No, Other]

5. What is the most important reason for you to reduce the amount of energy that you use? [Environmental reasons (reduce carbon footprint), Save money, I don't care about reducing my energy usage, Other reason not listed]
6. How often do you think you would check on your energy use? [More than once a day, About once a day, a few times per week, a few times per month, once a month, less than once a month]
7. Would you use a feature to be notified once your energy use goes above a specified limit? [Yes, No, Maybe]
8. Please rank the devices where you would prefer to view the household energy use from most preferred to least preferred. 1 being the most preferred [Smartphone, tablet, desktop / laptop computer, dedicated device]
9. Where would you like to use the device? [At home, at work, School, In the car, Other not listed]
10. Are there any additional people in your household that would use the system, if so who and in what way?
11. How important would each item below be for you to see on a power usage dashboard. 1 being the most important.
    - Current overall power usage
    - Current overall power usage cost
    - Power usage/cost over time (by time of day)
    - Power usage/cost over last few months
    - Power usage/cost compared to previous year at the same time
    - Power usage/cost by type of item (lighting, stove, dishwasher, dryer, washer, heating, cooling, etc)
    - Suggestions on how to reduce power usage
    - How you compare to other power users
    - Anything else you can think of

B. Analysis of Existing Interfaces

For our second needfinding plan, we will review existing energy visualization solutions. After doing a search online I found several existing products that help people monitor their energy usage. We plan to evaluate available reviews and information about the following solutions:

- Neurio
- Eyedro
- Smappee
- CURB
- Sense Home Energy

Data Inventory items for this needfinding plan

- What are the users goals?
- What do they need? What can existing products tell us about the needs of the users they are targeting?
- What are their tasks and subtasks? What options are provided to the users of these products?

For this needfinding plan a possible bias is confirmation bias. When evaluating the existing user interfaces some preconceived ideas may bias the results. During the evaluation process we will be thinking about any possible ideas we may have and look for reasons why they may be incorrect.

C. Survey Results

Age Range	18-24	2
	25-34	13
	35-44	2
	45-54	4
	55 and older	4
Are you the person who pays the energy bills in your household?	Yes	18
	No	7

Would you use a device or app that would be able to give you detailed information about your home energy use?	Yes	17
	No	2
	Maybe	6
Do you thinking having more information about what things in your house use energy would cause you to make changes to high usage items?	Yes	12
	Yes, only if I knew I could save money	13
	No	0
What is the most important reason for you to reduce the amount of energy that you use?	Save Money	22
	Environmental reasons	2
	Money, consumption, and efficiency tobe off peak consumption hours	1
	I don't care about reducing my energyusage.	0
How often do you think you would check on your energy use?	More than once a day	1
	About once a day	4
	A few times per week	8
	A few times per month	6
	Once a month	6
	Less than once a month	1
Would you use a feature to be notified once your energy use goes above a specified limit?	Yes	22
	No	0
	Maybe	3
Please rank the devices where you would prefer to view the household energy use from most preferred to least preferred	Smartphone	19
(Most Preferred)	Tablet	2
	Desktop / Laptop Computer	7
	Dedicated device	0
Where would you like to use the device?	At home	18
	Anywhere	~ 7
	At work	0
	At school	0
	In the car	0
Are there any additional people in your household that would use the system, if so who and in what way?	Spouse	7
	Family members	4
	Roomate	1

	No	4
	n/a	2
How important would each item below be for you to see on a power usage dashboard?	Current overall power usage	15
(Most Important)	Current overall power usage Cost	19
	Power usage/cost over time (by time of day)	12
	Power usage/cost over last few months	10
	Power usage/cost compared to previous year at the same time	10
	Power usage/cost by type of item (lighting, stove, dishwasher, dryer, washer, heating, cooling, etc)	16
	Suggestions on how to reduce power usage	11
	How you compare to other power users	6

D. Results of Analysis of Existing Interfaces

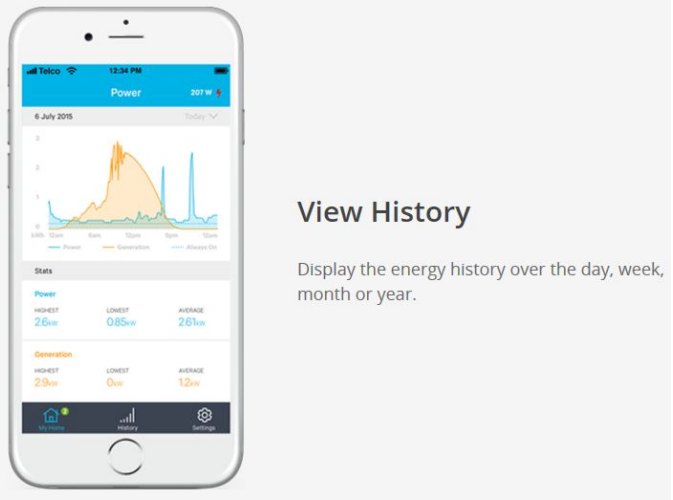
Neurio

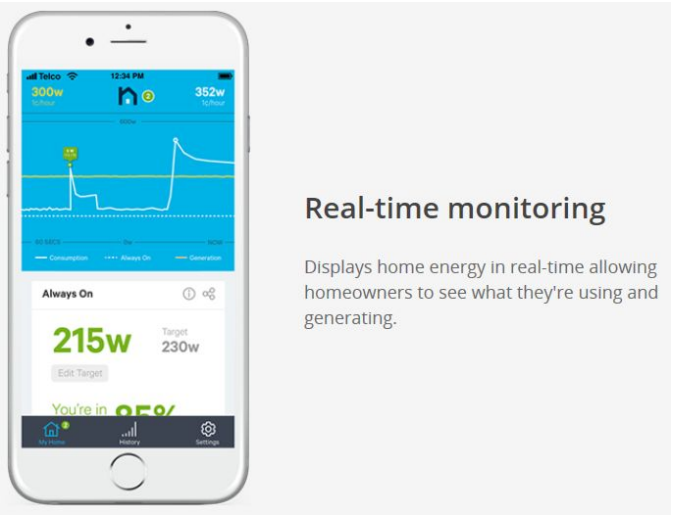
- Cost $219
- Whole house energy tracking
- Track overall usage in real time
- Installation requires intermediate to advanced skill level
- Works on iOS, Android and Web
- Reminds you when you are going to go over your energy budget
- Compares your usage to your neighbors
- Connects to home network to view usage from anywhere

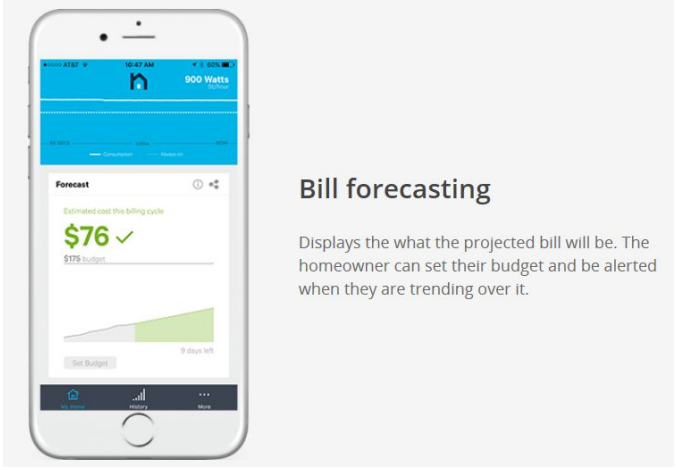
Sources

- https://www.neur.io/home-energy-monitoring/

Images for Neurio:







Eyedro

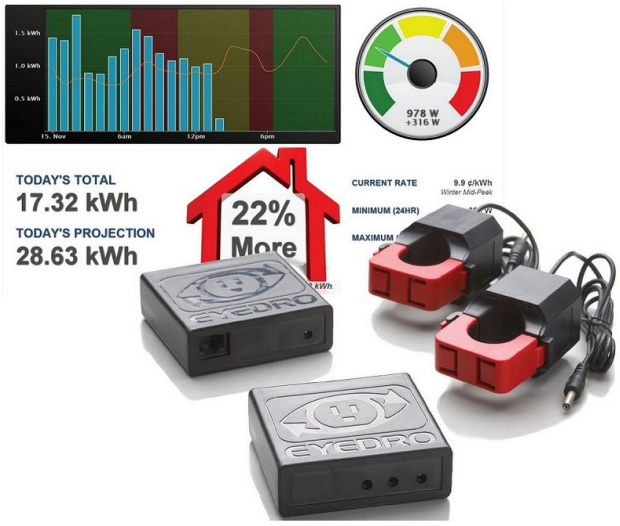
- Cost: $129 (Wired), $199 (Wireless)
- Free Cloud monitoring service
- Notification of power or network failure
- Usage history saved in the cloud
- Usage visible from any web browser

Sources

- http://www.pocketables.com/2017/05/eyedro-wireless-home-electricity-monitor-review.html
- http://eyedro.com/home-electricity-monitors/

Eyedro images:

Marketing image



Smappee

- Cost: $249
- Promotes saving on energy bill
- Mobile app
- Real time information
- Easiest installation out of all compared
- Can see what the energy usage represents in cost
- Also shows estimated yearly cost for a device / appliance
- At first it is only a very broad detection of power
- After starting a device / appliance you give the item a name and then the Smappee can recognize when it turns on by its electric usage
- They have accessory devices that plug into the wall to allow you to shut off the power from the app
    - Also can be programmed to shut off automatically when you are away

Sources

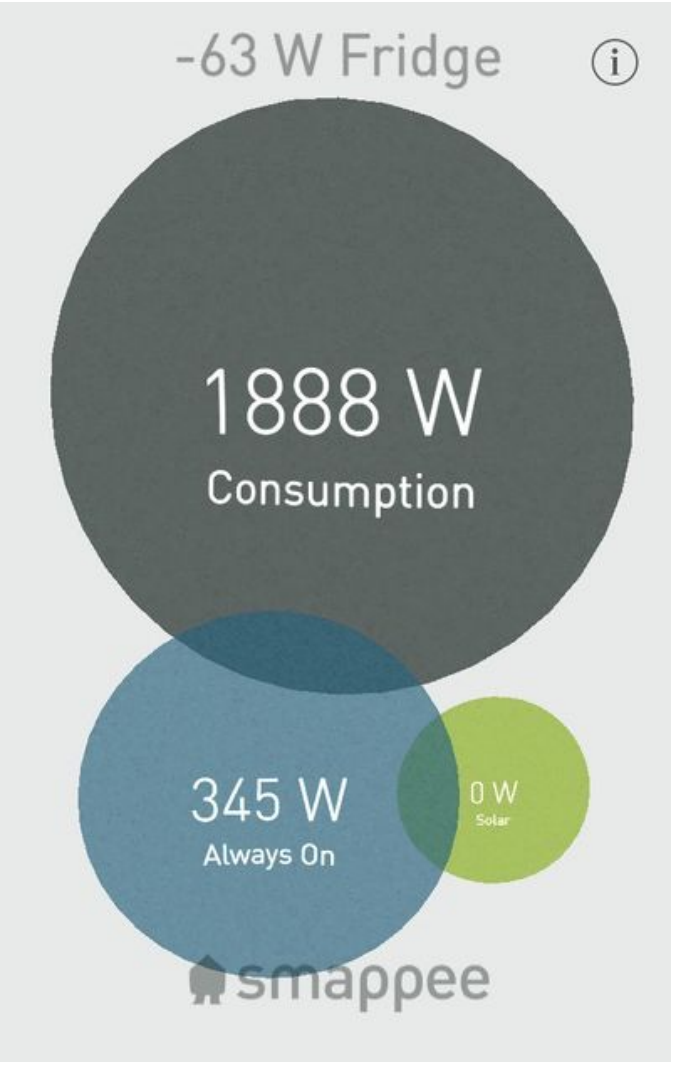
- https://www.smappee.com/us/energy-monitor
- https://www.smappee.com/us/faq/

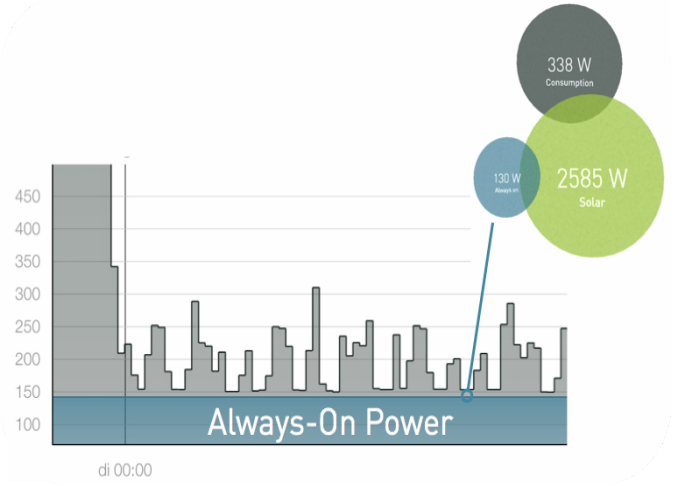
Images for Smappee:

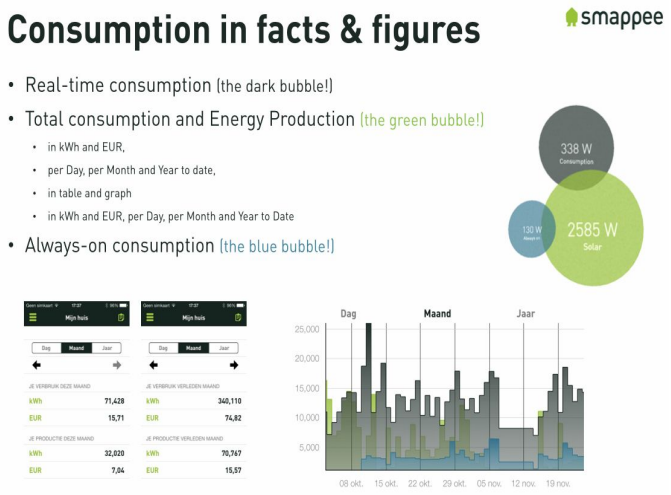
Smappee energy monitor

Comfort Plug™

(to remotely control appliances (433 MHz).)







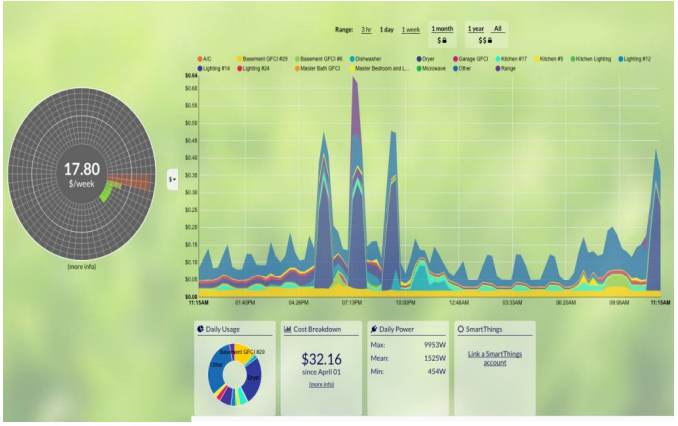
CURB

- Cost $399
- Has ability to send alerts to watch
- Shows live usage by circuit
- Electric bill forecast
- Alert when things are left on
- Works with other smart home devices to power off devices remotely from the app
- Shows solar vs grid usage on app

Sources

- https://techcrunch.com/2016/04/20/review-curb-energy-monitoring-for-an-entire-home/
- http://energycurb.com/

Images:



Sense Home Energy

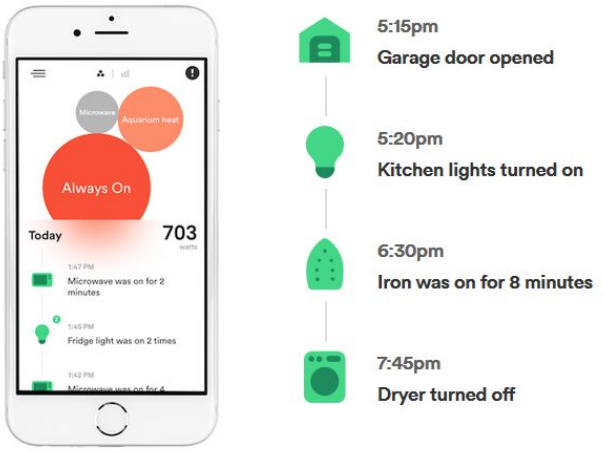
- Cost: $299
- Works with integration service IFTTT
- Ios and Android App
- Automatic device identification
- Shows exactly when energy events happened
- Uses machine learning to distinguish one appliance from another

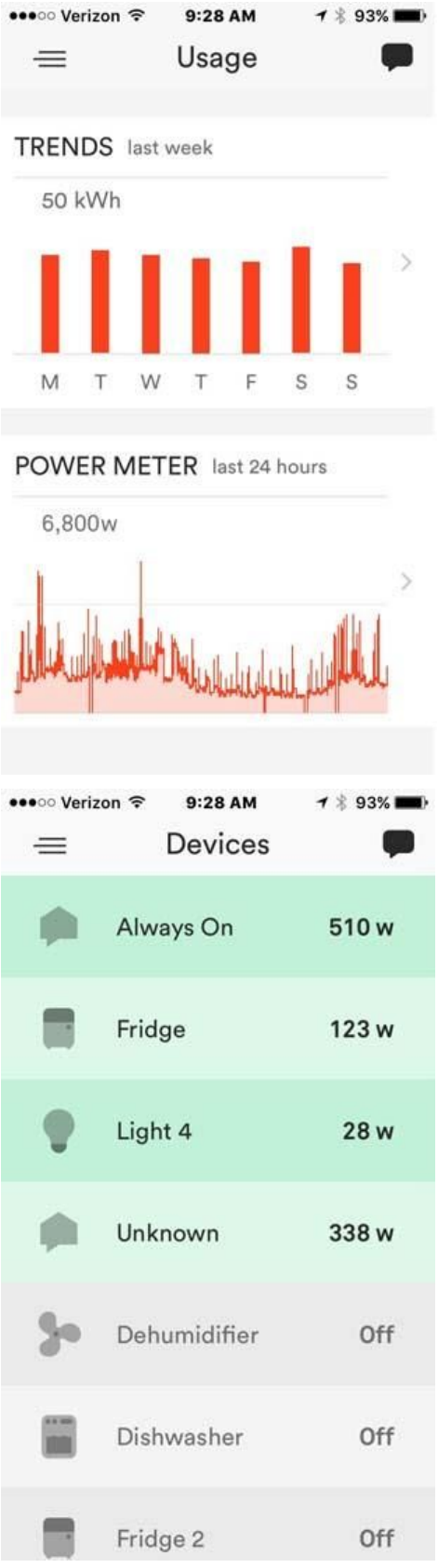
- Shows what is on and off as well as their energy usage
- Daily, weekly, monthly trends are available

Sources

- https://sense.com/product.html
- https://www.pcmag.com/feature/349801/sense-home-energy-monitor

Images:





III. Data Inventory

Who are the users?

Based on the product reviews the users would primarily be homeowners. It is possible that someone renting could take advantage of an energy visualization, but they would need the owner's permission because of the integration needed with the electrical system. The majority of those that responded to the survey were 25-34.

Where are the users?

At the time they would be interacting with the energy visualization interface most people will be at home. Although many of the existing products had a cloud storage or remote access option that would allow someone to access their information from any internet connected location.

What is the context of the task?

The context of the task is people who are (probably) at home and thinking about their energy use. If they have a family there could be any number of distractions and things going on around the user as they interact with the interface.

What are their goals?

The overall goals of the users are to be able to understand their energy use. According to the survey a majority of the users wanted to be able to save money.

What do they need?

They need to be able to see their current energy use as well as a summary of past usage.
Based on the survey results about half would look at their energy use a few times per month or less. Because they will be interacting with the system infrequently, the interface would need to be able to give them enough information in an easy to understand form for them to be able to take action to help lower their electricity costs.

What are their tasks?

Based on the review of the existing products, the most common users tasks would be to view real time electricity usage in their house. Another task would be to view historical usage over time. When usage is higher than expected the user would like to be able to find out what is causing the higher usage. Finally, the user would also like to be able to view how much a particular appliance is using.

What are their subtasks?

Also based on the review of the existing products some sub tasks would include

- Remotely turning off a specific appliance after observing that it is still on.
- Setting an automatic shutdown time for an appliance when the user will not be at home or at night when no one will be using the appliance.

IV. Defining Requirements

The design should include the ability to

- View real time electricity usage
- View historical usage over time
- View usage of a specific appliance
- View recommendations from the software on what they can do to be more efficient with their energy usage

V. Design Alternatives

Brainstorming

The plan was to first start with individual brainstorm sessions. The goal of the individual brainstorm sessions was to come up with around 20 ideas in about 30 minutes. These ideas were to be either a few words or a sentence at maximum. The rules for the individual brainstorm were based on some of the key elements from class. We were to keep the core problem visible during the session to help us stay focused on the task at hand. We were allowed to take breaks as necessary, move around, change locations, come up with silly ideas at first, and to think of all the different form factors that might be possible. The main goal was to write down all ideas, not making any judgement calls. The individual brainstorming results are in appendix A.

After the individual brainstorming sessions were complete, we met up on a Slack chat to discuss each of our results. During this session we were to bring up all our ideas without any criticizing, and without the need for justification. The main goals for this session were to make sure everyone spoke up and had a chance to talk, and also to encourage and build off of each other ideas. We tried to watch out for negative group brainstorming behaviors such too much conformity along the same line of thinking, and the tendency where some people in the group might "take over the show" and now allow others to have input, or production blocking.

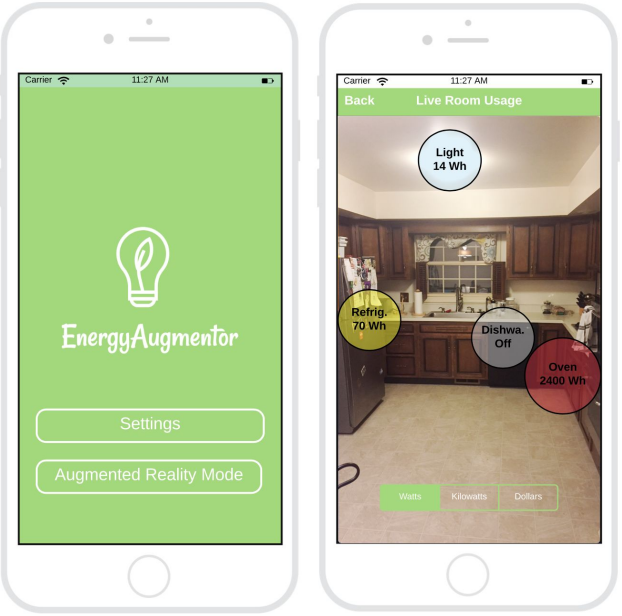
By the end of the group brainstorming session there were a handful of ideas that surfaced towards the top. We made note of these key ideas, and noticed that they fell into two different form factors, one that would most likely be a tablet like interface, and another that would be an augmented reality mobile app. The main decision factors for choosing the top ideas fell to how well they met our requirements set based on our needfinding exercises.

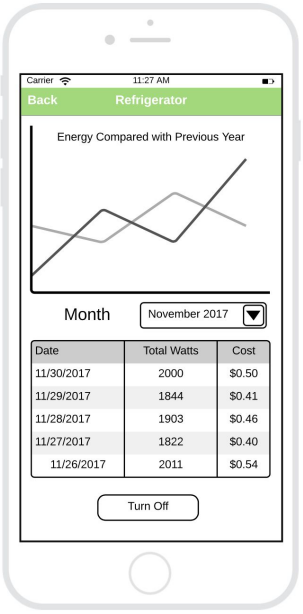
The top ideas selected from the group brainstorming were:

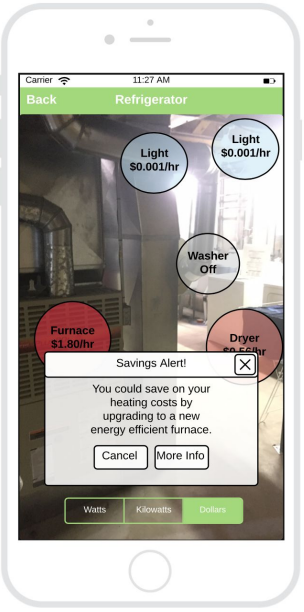
- Augmented reality app that displays energy use above or next to appliances as they become visible on the screen.
- Virtual reality device that shows a virtual walkthrough of the house with energy usage hot spots showing up in red or something similar.
- Integration with electric company so that very detailed usage information for the month could appear on the bill. The exact cost of each appliance could be displayed on the bill.
- The app (on whatever device or display method) could display similar but more efficient products (like a new tankless hot water heater) to the user. It could display how much owning that more efficient appliance could save them.
- Map of the user's home showing a "heatmap" of energy usage
- Pop up suggestions on mobile that suggest something like turning off power to a certain part of your home, for example if it thinks lights have been left on, with the ability to turn it off right here

VI. Prototyping

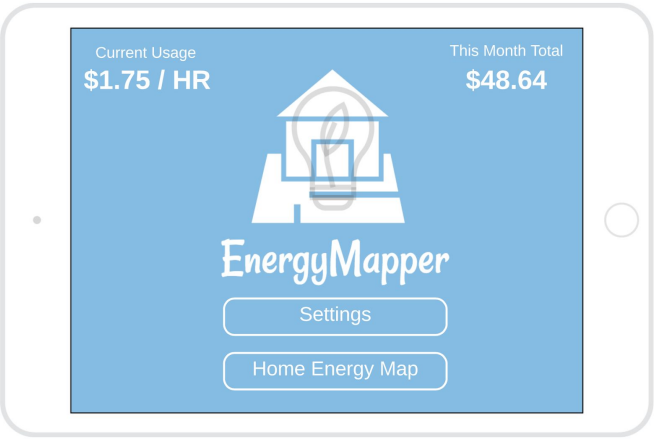
For the prototyping, we've designed two different apps that target two different platforms. The first is an augmented reality mobile based app which we are calling EnergyAugmentor. To use this app, the user could point their phone at a given room and an overlay will show what energy is being used, or the energy cost, by various objects in that room (the objects would need to be registered before hand and have some kind of device that was tracking their energy consumption, however, this part is outside the scope of the design of our interface). If the user taps on a given object in the room they can see more data on that object's energy usage. If the phone detects an object that is old and no longer energy efficient the app can pop up a message encouraging the user to upgrade to a more energy efficient model.

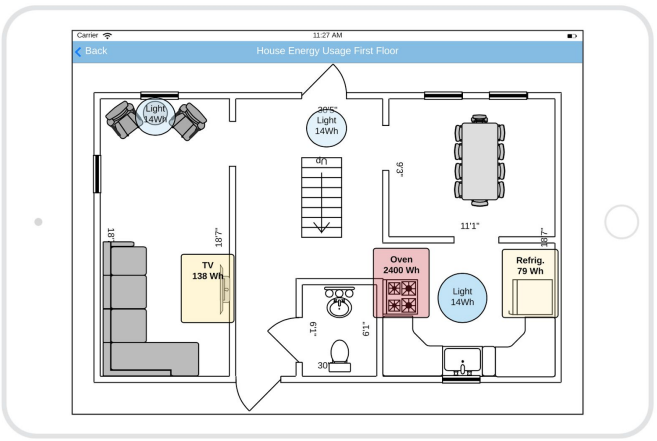


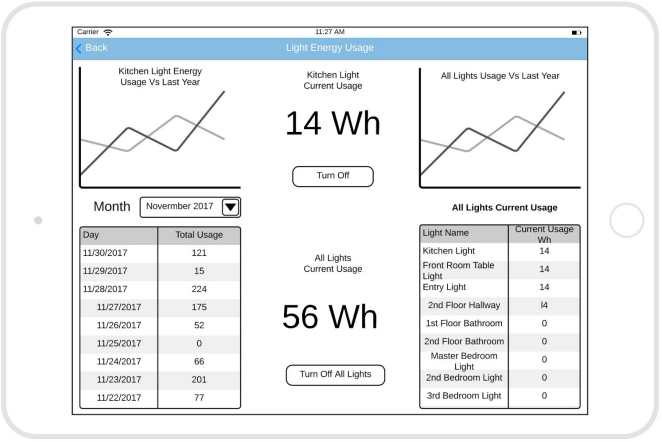


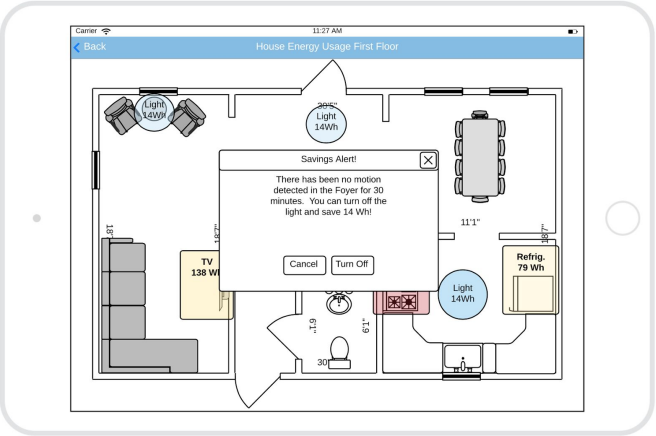


The second prototype is a tablet based application that performs similar functionality as the augmented reality prototype but with a different design using a map of the user's home to show energy usage by object. We are calling this prototype EnergyMapper. This prototype uses a layout of the home and the objects using energy are tappable to obtain information on their usage and comparison to past usage, as well as totals of energy usage of similar objects in the home. There is also the possibility of an alert to warn a user that energy is being used on a light that could be turned off, since no one is in the room.









VII. Evaluation

A. Planning

1. Empirical Evaluation

I will perform empirical evaluation on the two user interface prototypes, the EnergyAugmentor and the EnergyMapper. The EnergyAugmentor serves the purpose of a first-person visualization of the energy consumption in the home while the EnergyMapper delivers an mapview visualization of the household energy usage. Two separate research studies will be performed for the user interface prototypes.

Participants each research study will receive one of two treatments. The controlled treatment is the currently existing utility usage interfaces available to consumers, and the new treatment is the designed prototype (either EnergyAugmentor or EnergyMapper). Users will be tasked with finding the current and past energy usage in their home, as well as associated costs related to usage. Users are timed from when they begin the information gathering process to when they end the process, with the data measuring how long that duration is, how accurate the data gathered is, and whether the new system improves that time and accuracy of data. The existing interface is used as a point of comparison, or baseline, for our empirical evaluation.

The null hypothesis is that both of the newly redesigned energy usage information and visualization interfaces will take the same amount of time or greater amount of time for users to complete the process of acquiring home energy usage information and costs than the existing payment interface and be just as accurate or less accurate than using the existing interface. Conversely, my alternative hypothesis is that both of the newly redesigned interfaces makes the process more efficient and takes less time than the existing system, with the accuracy being better than if using the existing interface.

The experimental method I will use is within-subjects, meaning each participant is exposed to both of the possible treatments. This is because, considering the simplicity of both treatments in terms of physical work and time put in, it is easy to ask users to log into their web interface or pull out a utility bill to view usage, and then have users operate our prototype on a tablet screen on paper wireframe. Random assignment will be utilized to assign subjects to each of the two research studies and order is randomized as well. As part of their condition, participants are asked to find our specific data about their energy usage and cost through the existing system, and through our designed prototype. So as to work backwards, we will be timing the users so the data they generate is the amount of time needed for the completion of the process of gathering the requested information. The data is to be analyzed in terms of averages using a two sample t-test and also in terms of percentages, using a two sample binomial test in order to glean information as to whether or not the new prototype presents an efficiency improvement over the currently existing interface. Some lurking variables that may present itself include the user's background and familiarity with modern technology, or the user's context and whether they are willing or unwilling to participate and simulate the process normally. Though lurking variables may present themselves, we can control what we can by limiting our variables.

2. Predictive Evaluation

The task analysis to be performed for the predictive evaluation is a cognitive walkthrough. The specific tasks I will be addressing for the cognitive walkthrough consist of learning how to operate the new energy visualization interfaces, viewing consumption data, viewing historical data, and viewing cost data. The user's goal is to gather relevant data regarding their home energy usage. The operator available to the user is

the touch interface. Due to the newness of the redesigned interface to the user, I will be performing evaluation on the user's navigation around the interface to figure out how to accomplish their goal, as users likely will not have used the interface before but have tried to accomplish the goal before, hence the use of cognitive walkthrough. Through the use of cognitive walkthrough, I am able to see the user's thoughts and analyze how they make decisions as they traverse through the tree of options in the new interface.

My cognitive walkthrough procedure is as follows: compile a list of user profiles and perform the walkthrough as each user while noting the cognitive processes that the user would engage in as they are navigating the new interface, trying to accomplish their task of looking up information regarding home energy use. I will capture the evaluation of the cognitive processes through note taking, and analyze the information. The process also requires seeking, to find similarities between the user experiences of users of various differing profiles. Lastly, I will summarize the findings to advise the ongoing design process.

B. Execution

1. Empirical Evaluation

The evaluation as a whole was successful. My surveys were targeted to obtain formative information as I am early in the design process and value qualitative feedback. The empirical evaluation demonstrated promising results in the need for a redesigned home energy usage visualization interface. 14 participants took part in the empirical evaluation and I received greater than 90% completion rate for each prototype treatment. All sessions were the same and no changes were made between participants. Organizationally, I would probably provide an option of a survey as a qualitative evaluation method instead, the reason being it may be a quicker way to get similar information.

The raw results of the empirical evaluation are as follows:

Existing User Interface		Energy Augmenter UI		EnergyMapper User Interface	
Found Data? (Y/N)	Time (sec)	Found Data? (Y/N)	Time (sec)	Found Data? (Y/N)	Time (sec)
Y	15.7	Y	3.4	N	2.5
Y	20.4	Y	6.6	N	3.7
Y	53.6	Y	4.2	N	2.8
Y	48.4	Y	3.7	N	6.6
Y	30.1	Y	2.6	N	4.6
Y	22.0	Y	5.5	N	2.3
N	27.4	Y	4.8	N	7.3
Y	17.3	Y	5.3	N	4.2
Y	38.7	Y	6.2	N	5.8
Y	28.3	Y	8.6	N	6.2
Y	42.7	Y	12.5	N	2.6
N	40.3	Y	4.9	N	1.7
Y	58.2	Y	4.2	N	3.2
N	35.7	Y	8.7	N	2.1

Due to the inadequacy of our existing EnergyMapper prototype to provide cost data, each test resulted in failure to return all the valid data, which includes cost data. This led to an incomplete test which meant the time cannot be used to adequately compare the two prototypes and can only be used as a reference.

On average, a user found the data through the existing interface in about half a minute, 34.2 seconds. Users were able to find the same data on our EnergyAugmentor prototype in on average 5.8 seconds, a sixth of the time. For reference, the average time to

find the information without cost data on the EnergyMapper is 3.97 seconds. Our EnergyAugmentor prototype showed a 83% reduction in time to completion of gathering essential utility usage data and our EnergyMapper showed an 88% reduction in time to completion of gathering essential utility usage date without cost data.

The main takeaways for improving the interface EnergyAugmenter interface was to find a way to allow users to remotely view the data. As for the EnergyMapper, cost information needs to be provided. I was surprised at the disparity in the amount participants who knew how to find their energy usage information in the existing interface and those who were doing it for the first time. From what the feedback actually showed, it seems that users would like the new interfaces implemented. The changes that the feedback would suggest in my prototypes is the fact that the user needs to allow users remote accessibility, and create a way to provide even more detailed information while maintaining the simplicity of the existing designs. Some comments received told us to combine our two prototypes into one application.

2. Predictive Evaluation

The task analysis performed for the predictive evaluation is performing a cognitive walkthrough. I addressed the tasks of how to operate the new energy visualization interfaces, viewing consumption data, viewing historical data, and viewing cost data. As I performed cognitive walkthrough with my predesigned participants of different backgrounds, I emphasized the cognitive aspect of the walkthrough. I delved into the possible thoughts of the users and asked what they were thinking about, or what they had difficulty grasping at each stage of the information gathering process. The affordances such as buttons for settings, AR mode, and other options allowed the user to understand intuitively the different functions of the new system and what actions were available. I performed evaluation on the user profiles as I navigated the interface mock-ups we designed and analyzed how the user profiles were trying to figure out how to accomplish their goals. Through the use of cognitive walkthrough, I saw the user's thoughts and decision making process.

From my compiled list of user profiles and walkthroughs as each user, I noticed that most users with any background with modern touch based interfaces would have a seamless experience when operating the new interface, while users who did not would struggle. Other takeaways from this cognitive walkthrough showed that most user profiles would find the new interface more convenient in terms of added functionality, reduction of user error, and gave users an added sense of direct manipulation over the interface and the objects involved. This is similar to what I expected but what I didn't consider was the backgrounds of the various users in terms of familiarity with modern systems and the learnability of the new interface; users would occasionally think about just avoiding the whole system and just wait for their monthly statement in the mail.

Through the cognitive walkthrough, I realized that our newly redesigned interface could be made more efficient by including some form of in information page with directions instead of solely relying on affordances, as it may not be an interface that is invisible to the user right away seeing as there is such a wide range of user profiles. The instructions could also be presented as an introductory group of slides as they are entering the application, which minimizes how complicated the actual interface would need to be.

VIII. Conclusions

Based on the formative feedback from the empirical evaluation and cognitive walkthrough for our two prototypes, a few changes should be implemented to our design to give more concreteness to some parts of the design. In the first stage of prototyping, our designs were purposely made to be a bit vague to get a sense of how users would feel if certain technologies were implemented and to quickly gauge the usefulness of the redesign of the existing home energy usage interface and see if there was a need to fill. With the intent of improving the interface in mind, the process proceeded with the evaluations. In the next iterations, an implementation of a how to video on the application, as

well as a way to view more detailed data, with remote viewing would be necessary.

The information that needs to be understood more fully through additional needfinding would be the amount of users who would use the interface after its implementation and the amount of users who would prefer the existing method. I would also like to know how users would like for this new interface redesign to be rolled out, for example in the app store by a private creator, or by their local third party energy service provider, or as part of the existing energy service provider's current application. The questions that arose based on the evaluation are, specifically what form of the application do the majority of users prefer, for example, augmented reality or mapview. This needs further investigation and the difficulty lies in finding something that everyone can use.

This experience brought to mind some additional design alternatives that we could explore in the second iteration of the design cycle. By third party api's for our app to gather data, home and vehicle recognition, peer-to-peer information sharing, and advertising, our product could have many use cases and there is a great need to weigh the pros and cons of each one. For example, acting as a peer-to-peer energy consumption network and just presenting data could be a privacy concern, but could provide a information that doesn't rely on the service provider, creating a way to deliver reliable information without a third-party.

At this point, no revisions will be made except for slowly increasing the level of fidelity of future prototypes, in order to slowly zone in on the final product that users are satisfied with. The fidelity level would be raised to software mock-ups and finally to engineering a complete software suite/package, as well as incorporate actual readings to serve as a proof of concept for the end to end functionality. We need to slowly raise the fidelity to account for pivoting the design in the case of critiques in the subsequent rounds of evaluation. More quantitative levels of evaluation needs to be applied as the prototypes become higher fidelity. Only quantitative evaluation is to be applied when the prototypes are ready for it from a few rounds of qualitative, empirical, and predictive evaluation first.

Appendix

A. Individual Brainstorming Results

Brainstorming - Teammate 1

1. Mobile phone application with usage information, alerts, tips on saving money etc...
2. Tablet application
3. Web application
4. Panel that mounts on a wall that shows energy usage
5. 3D hologram like interface that displays usage in the air
6. Augmented reality app that displays energy use above or next to appliances as they become visible on the screen.
7. Integration with home assistant devices like Google home or Amazon Alexa. The assistant could want the user about excess energy usage or tell the user the current usage on demand.
8. A small device with some sort of display could be mounted on each appliance that shows their current usage. Either numerically or with a color code (red for high usage, green for low etc…)
9. Some newer refrigerators have monitors built into them. Energy usage could be displayed on that monitor for convenient access while the user is in the kitchen.
10. Virtual reality device that shows a virtual walkthrough of the house with energy usage hot spots showing up in red or something similar.
11. Apple watch or similar device could show alerts or other information about energy use.
12. Average energy use could be emailed to the person every day so the user would notice if it is trending up or down.
13. There could be a device in each room that shows a light with a color indicating how much energy that room is using. It could be helpful to keep people conscious of energy use while they are in that room.
14. Google Glasses (or similar) application, similar to the augmented reality app.
15. Integration with electric company so that very detailed usage information for the month could

appear on the bill. The exact cost of each appliance could be displayed on the bill.
16. Integration with other IOT devices like plug-ins for automatically turning off appliances not in use.
17. Integration with IFTTT (If this then that) service for alerts or other info that could be viewed on almost anything.
18. The app (on whatever device or display method) could display similar but more efficient products (like a new tankless hot water heater) to the user. It could display how much owning that more efficient appliance could save them.
19. Car interface - Some car stereos have a screen that could be used as an interface for alerts or to remotely control appliances.
20. Infrared add-on for phone or tablet that lets you see / detect heat escaping next to Windows / doors. This information could be integrated into the app for energy efficiency tips.

Brainstorming - Teammate 2

1. Watch app (ios or android), or custom watch that shows live info of energy usage
    a. Alerts on the watch of energy usage
2. Alexa app, alerts via voice when energy levels are reached
3. Map of the user's home showing a "heatmap" of energy usage
4. Max watt usage for plugs, which shutdown after total watts used in a given time period
5. Alerts of rooms using energy that haven't had recent motion (coupled with motion detection)
6. Icons with the different types of products (lightbulbs, dryer, heater, refrigerator) and how much power they are consuming.
    a. Comparisons to the average and to high energy efficient versions, and how much the user could save
7. Energy comparison based on the temperature outside
8. Energy usage comparisons between rooms in the house
9. Text alerts of power usage details when power usage high
10. Point system/Gamification of competing with other people of similar homes in similar climates see who can reduce the amount of energy usage with prizes
11. Pop up suggestions on mobile that suggest something like turning off power to a certain part of your home, for example if it thinks lights have been left on, with the ability to turn it off right here
12. Graphs comparing your home power usage to other similar homes
13. Graphs showing how much time you spend in your home compared to how much energy you use, by member of the family (with motion or keyfob usage)
14. Video pop ups that explain how to perform maintenance on areas of your home that might provide reduction in energy usage
15. Congrats messages on screen when usage is low to encourage
16. Energy usage goals and little characters or emoji like images to show how you are progressing towards your goal
17. Website with customizable graphs (by type of device, room, total house)
18. Graphs with year over year total energy usage by customizable date range
19. Venn diagram of time spent in house and energy usage
20. Live Speedometer/gauge type chart of current power usage in home
21. Heatmap of days and times of week and power usage