
NRGY

16st November 2016

TEAM

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PROBLEM AND SOLUTION OVERVIEW

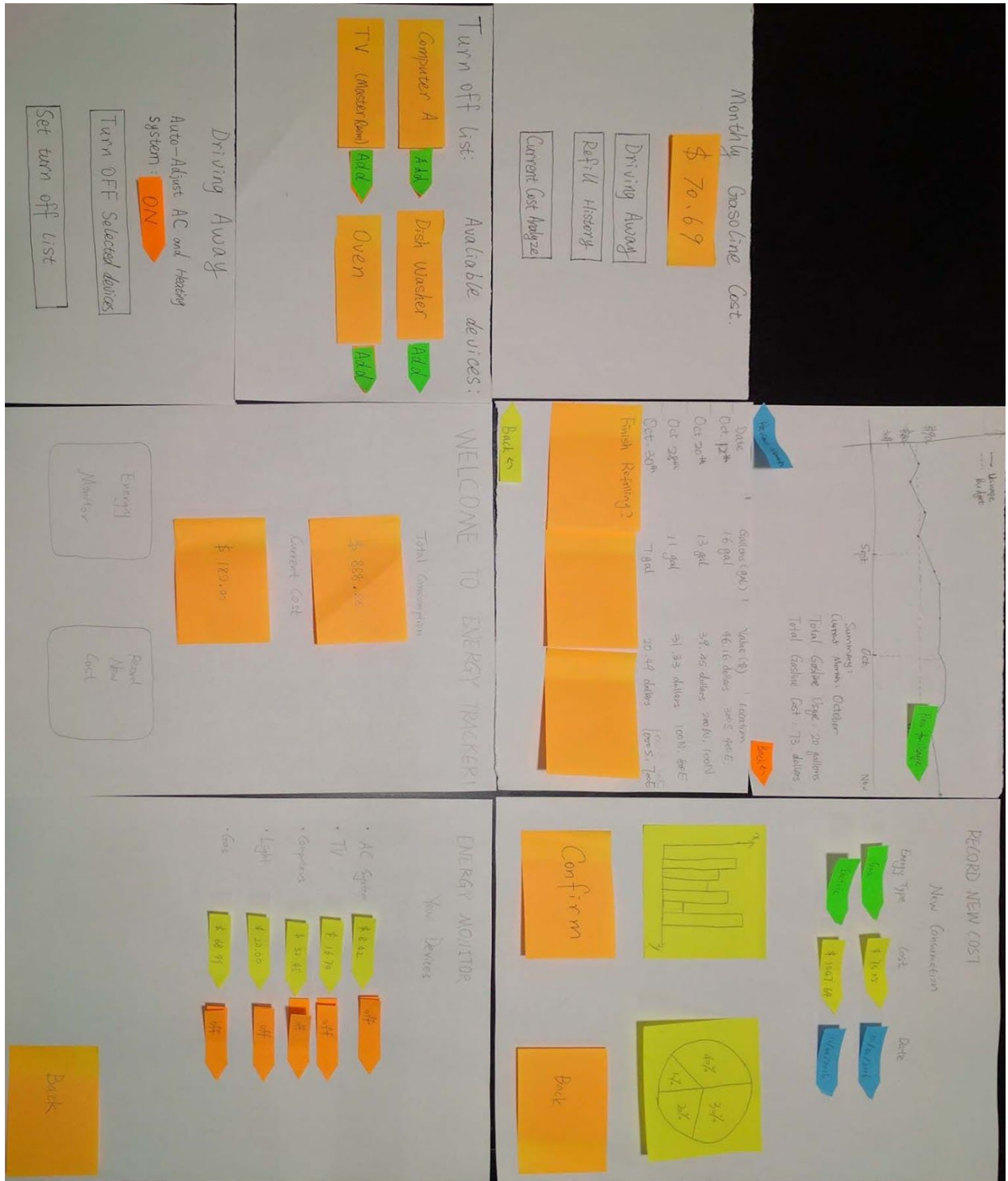
Whether one agrees or disagrees with global warming, scientists have proven that it is in fact happening. Global warming is likely one of, if not the biggest problem affecting people's lives today. They may not see the immediate effect, but viewed over a long period of time, and the effect is quite obvious. But to tackle a big problem, one must start small. Therefore, we decided to approach the problem of energy usage and waste. Focusing primarily on larger consumers of energy like gas and electricity. The problem is: people are not usually aware of the amount of energy that they use, nor are they aware of the amount of energy that they waste. If we were able to reduce such waste, we would be able to live much more efficiently. The proposed solution is to create a design where people can become more aware of and can understand to a better degree how much energy they are using and how much energy they are wasting, thereby helping them to save money as well. In our design, we focus on reminding users to turn off devices that they do not need and recording data such as household utility consumption as well as fuel consumed when driving.

INITIAL PAPER PROTOTYPE

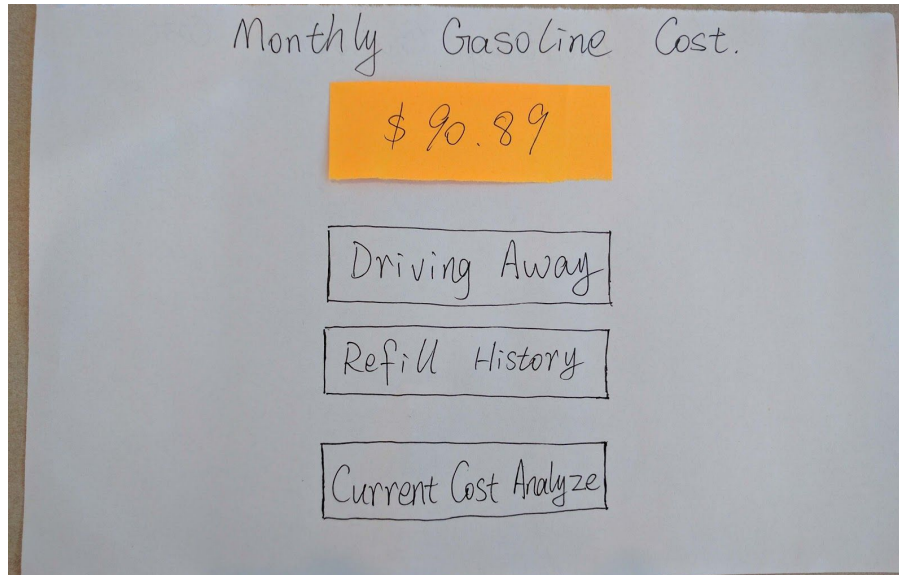
Our paper prototype consists of two tasks. The first task in the design is a feature that reminds the user to turn off specific devices. The interface provides the user with the ability to add or remove devices if they support remote power control, as well as notifying the user which devices are on. The second task in the design is a feature that records driving data as well as household utility consumption to provide the user with a general overview of their overall energy and monetary consumption.

The design itself runs on a custom built device that the user can either dock at home or in their car. It has two different modes: home and car. Each mode has different functionality regarding

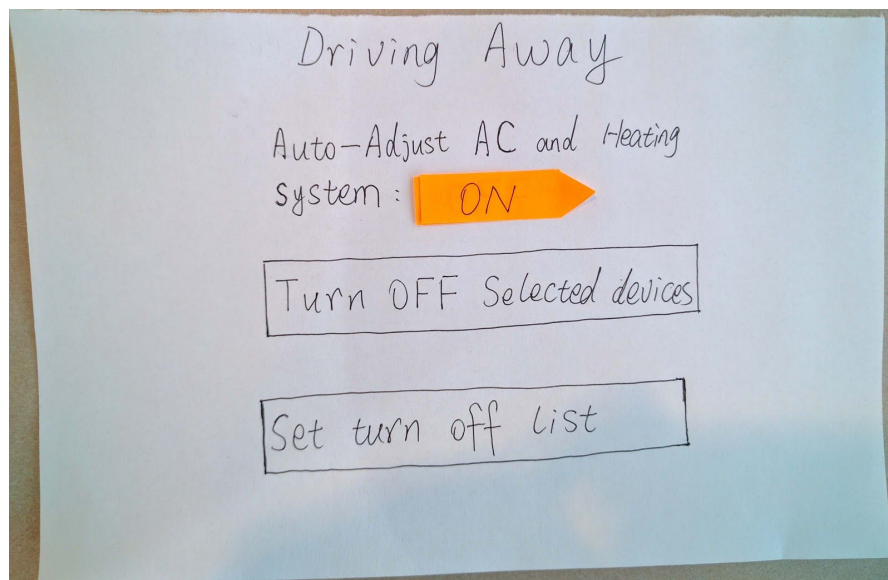
that mode. For example, in car-mode, the device displays fuel data as well as the option to turn off devices. In home-mode, the display shows relevant information such as total consumption of utilities in the household. The default screen for each mode summarizes the data for the respective relevant information.



Task: Reminders to Save Energy

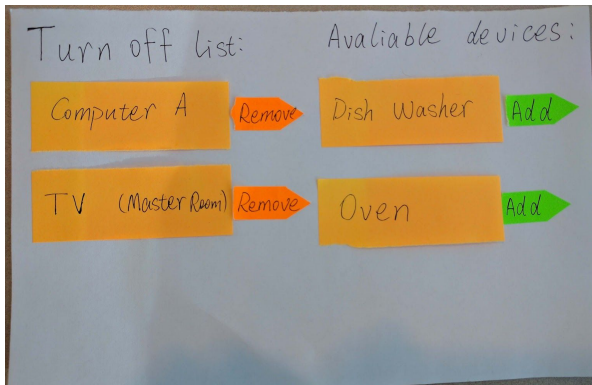


At the home screen when the design is in vehicle-mode, the user can immediately see an average monthly consumption of gasoline for the vehicle. They also have three options to choose from: Driving Away, to manually indicate that they are driving away; Refill History, to see a summary of their refueling history; and Current Cost, to see a brief cost analysis.

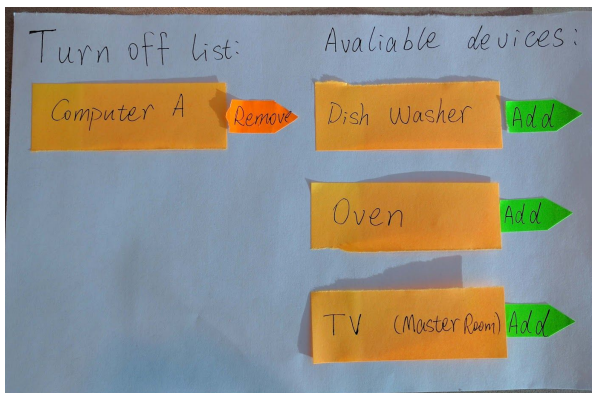


When the user begins to leave their household, they will receive a notification that gives them the option to turn off all their chosen devices with one easy click. In this screen they can also

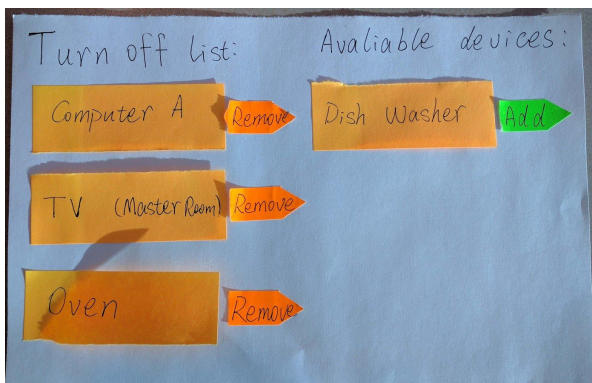
configure what devices are on that list. If they choose the option to, they can set it so that the devices are automatically turned off when they are driving away.



When the user chooses to set the devices to turn off they are taken to this screen.



If they tap on the remove button next to a device, it moves that device to the list of devices that can be added and is removed from the list of devices that are turned off.



If they tap on the add button next to a device, it moves that device to the list of devices that are turned off and can be removed.

Task: Recording Data

Date	Gallons (gal.)	Value (\$)	Location
Oct. 12 th	16 gal	46.16 dollars	300 S, 400 E
Oct 20 th	13 gal	39.45 dollars	200 N, 100 N
Oct 28 th	11 gal	31.33 dollars	100 N, 800 E

Finish Refueling?

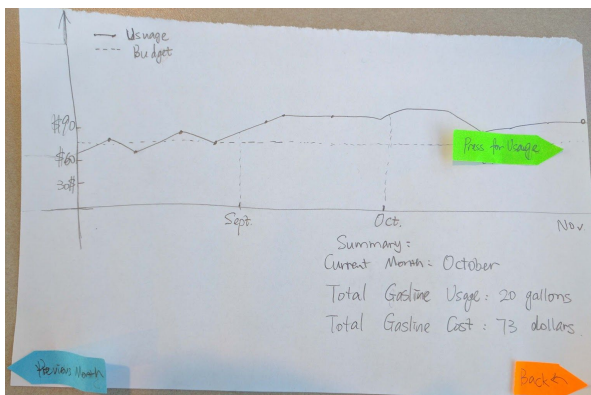
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The design can automatically detect when the user has refueled their car. After they have refueled, the user can manually indicate that they are done.

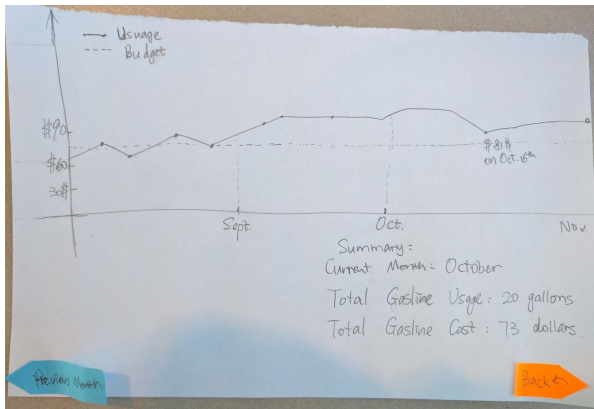
Date	Gallons (gal.)	Value (\$)	Location
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Oct. 30 th	7 gal	20.49 dollars	1000 S, 100 E

Back ←

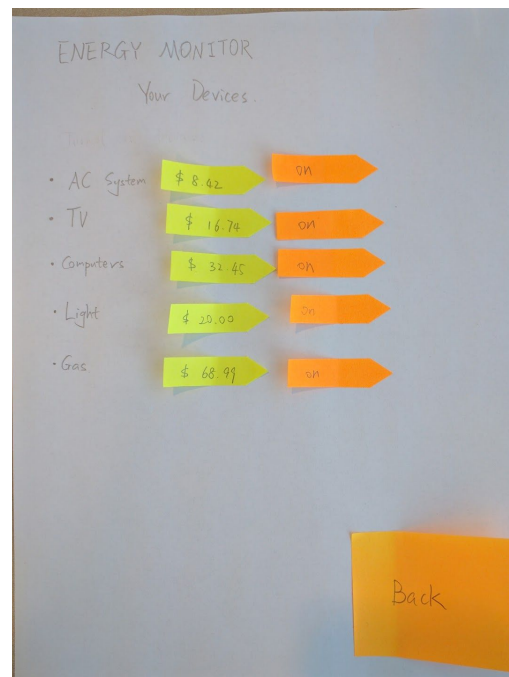
After which, the display will show the relevant data regarding the previous trip.



This view displays the dollar amount of fuel consumption over a period of time.



If the user taps on a section of the graph, they can see a more specific data point along the graph displaying precise information.

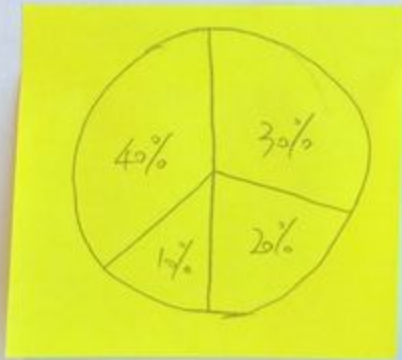


When the design is in home-mode, for all devices it will display the status of the device as well as the cost to power the device for the month.

RECORD NEW COST

New Consumption

Energy Type	Cost	Date
Gas	\$ 73.25	10/30/2016
Electric	\$ 1047.64	10/30/2016



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In this mode, the user has the option of adding additional data that was not automatically aggregated. They can also see an overview of consumption in various forms to get a better picture of their total consumption, and areas of greatest consumption.

TESTING PROCESS

Method

In each of the tests we performed we found participants that we thought were as diverse from each other as possible in an attempt to get more varied feedback. Each participant was provided a little context and enough background information to complete the tasks that they were asked to do. They were also informed ahead of time that we would not be answering any questions that they might have during the test so that they could prepare for it. Additionally, based on what we learned from the initial usability test, this time we asked the remaining two participants to be as vocal as possible by speaking their mind and talking about the processes going on in their head. We also recorded both participants in case we needed to go back and review any of the feedback that they might provide with the added benefit of not slowing them down which might affect the usability test for that participant. Through all the tests, each group member rotated through different tasks, some acted as the computer manipulating the design, whilst the remaining members took notes and observed. We agreed that there should be either two or three facilitators in order to not overwhelm the participant during the usability test.

Usability Test Participant 1

The first participant of our usability test was a computer science student at the University of Utah, which was also the setting of the usability test. He was a good archetype of our prospective target users being a busy student living a stressful life while trying to save money and, if at all possible, reduce his energy usage. We chose our location not just because it was convenient for our participant, but also because our scenarios did not require the participant to physically be in the home and because we were unable to procure a closed course to run usability tests on the driving facet of our design.

Usability Test Participant 2

Our second participant is also studying at the University of Utah pursuing a degree in economics. Before performing our test, we inquired what his thoughts were on saving energy in his household as well as what his day-to-day habits were regarding paying bills and monitoring his energy usage. He mentioned that though he does keep an eye on how much he uses month-to-month, he doesn't really keep track of his usage patterns over time, but would like to if it could save him money. We ran his usability test at the Student Union in the University of Utah Campus to accommodate his schedule, and like the first usability test, we were unable to test the driving aspect properly.

Usability Test Participant 3

In our third usability test, our final participant is in his third year majoring in art with an emphasis on photography, who is also studying at the University of Utah. We had also asked him about his views on saving energy and he responded by saying that he was a big proponent in the fight against global warming. His views in conserving energy are definitely a point of view that we are looking for and also makes him a very likely user of our design. We performed his usability test also in the Student Union for his convenience, and because we believed that the environment at the Union would not have much of an affect on the results of the usability test.

TESTING RESULTS

Heuristic Evaluation and Usability Testing Results

Incident 1. Design Simplicity and Cleanliness

One of the comments that our participant had was that he felt the design was simple and clean. There weren't many occasions where he thought that there was information that did not seem appropriate for the view. We lauded this comment because that was what we were going for as we felt that simplicity would make for a product that people would more likely use.

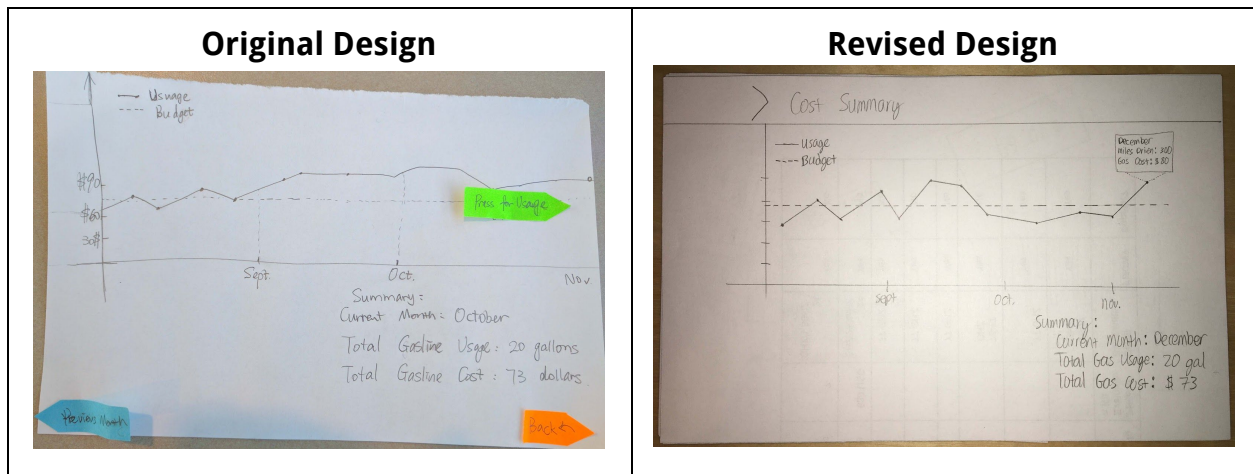
Severity Rating: N/A

Incident 2. Display Data Point on Graph by Default

In the graph view, our original design displayed just a chart with a general view of the trend. The idea was to keep it simple, and then when the user wanted more detail, they would tap on the area of interest, and the closest point would display more precise information. Our participant felt it inconvenient that he had to tap on the display and that instead the values should be shown by default for easier at-a-glance reading.

Severity Rating: 2

Revision Notes: For the revision, we added a popup box that displays relevant information of the current point in time. It displays the month that the user is currently in, as well as the number of miles driven and the total amount that they have paid for gas so far.

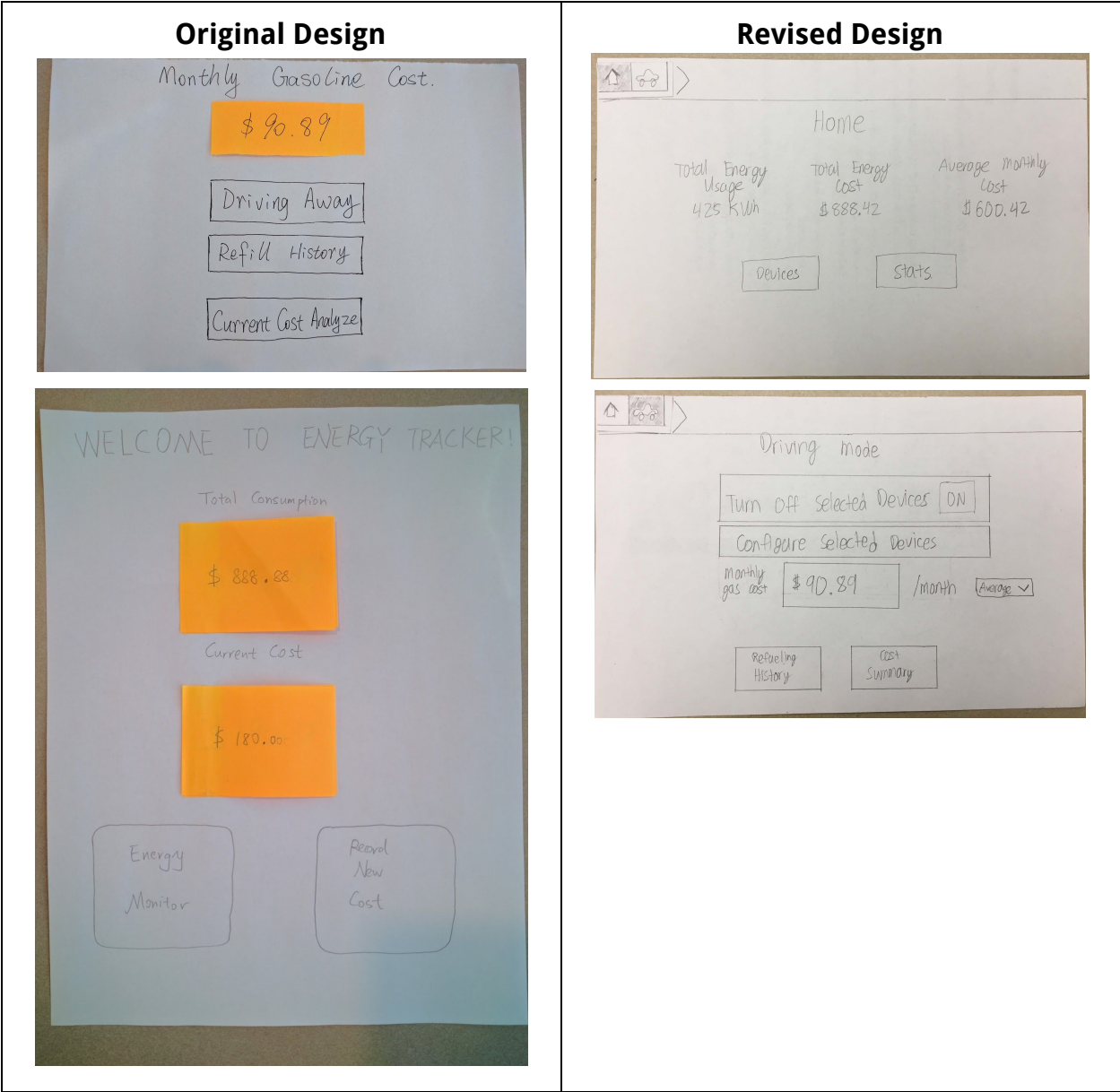


Incident 3. Differentiate Between Home-mode and Car-Mode

The duality of our design, having both a car-mode and a house-mode, lend to a bit of confusion. In the initial design, the car-mode was displayed in a landscape fashion and the house-mode was displayed in portrait rotation. But our participant found this not only cumbersome, but also annoying with having to constantly rotate it. He thought that devices should have one orientation unless there was a good reason to have multiple orientations.

Severity Rating: 3

Revision Notes: While revising our design, we added a switch at the top left-hand corner of the screen that allows the user to tap to switch between the two different modes. Being a switch, the change in the state of the switch gives the user feedback as to which mode it has switched to. Additionally, for easier navigation this switch is included at the top of every screen in the design. It acts as a “home” point of navigation for the user. If the user wants to jump back to the home screen, they can tap on the respective icon matching their current mode and the design will jump back to the home screen matching that mode.



Incident 4. Automatic Switching of Modes based on Geolocation

In addition to having a button that established the current mode of the device, another one of our participants wondered why we did not include a location-based switch into our design. By adding allowing the device to switch modes based on location would essentially automate the task so that the user would not have to manually switch it. But if needed, as revised in Incident 3, the user has the option to switch modes using the buttons given.

Severity Rating: 2

Revision Notes: As this revision is something that runs in the background, there is not really an applicable design aspect for the device, but the revision would be that when the user leaves their property, or the device is mounted in their car, the design will switch to Driving mode, thereby the switch at the top left will switch to the Car icon. And when the user arrives back at home, or docks the device on the wall, the device will switch to home-mode automatically as would be indicated by the switch at the top left highlighting the House icon.

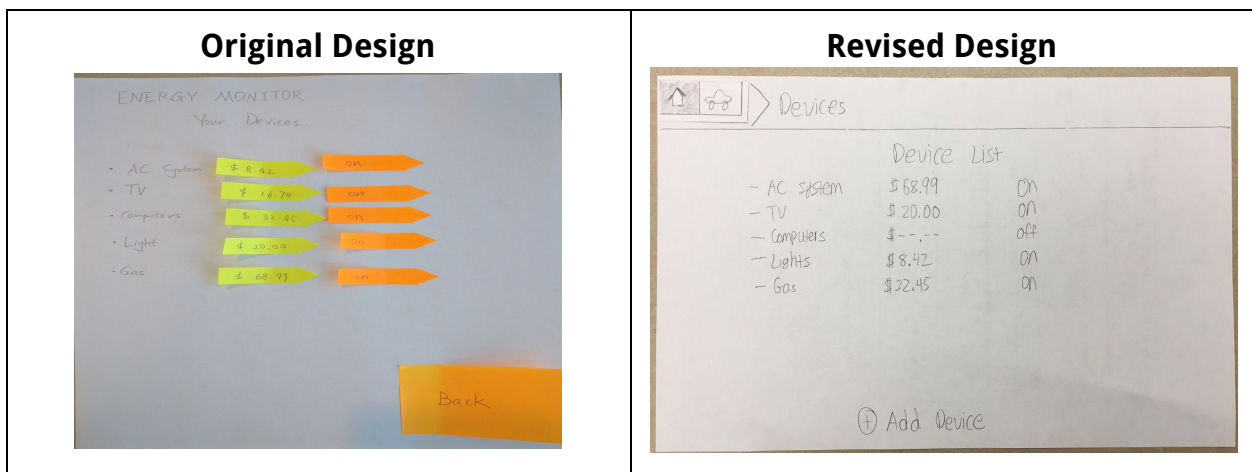
Original Design	Revised Design
N/A	N/A

Incident 5. Button to Add Device to Monitoring Page

In our initial design in home-mode, we had a functionality where the user could view the power state of the device as well as the total consumption of the device. But our participant identified that there wasn't any apparent way to add or remove the device from the interface. We had initially thought that they would be added automatically, but adding a button would improve usability.

Severity Rating: 5

Revision Notes: As a group, we felt that this was a major oversight. The user definitely needs a way to add a device to their list of devices. So we included a button and interface for the user to add a device to their list of devices.

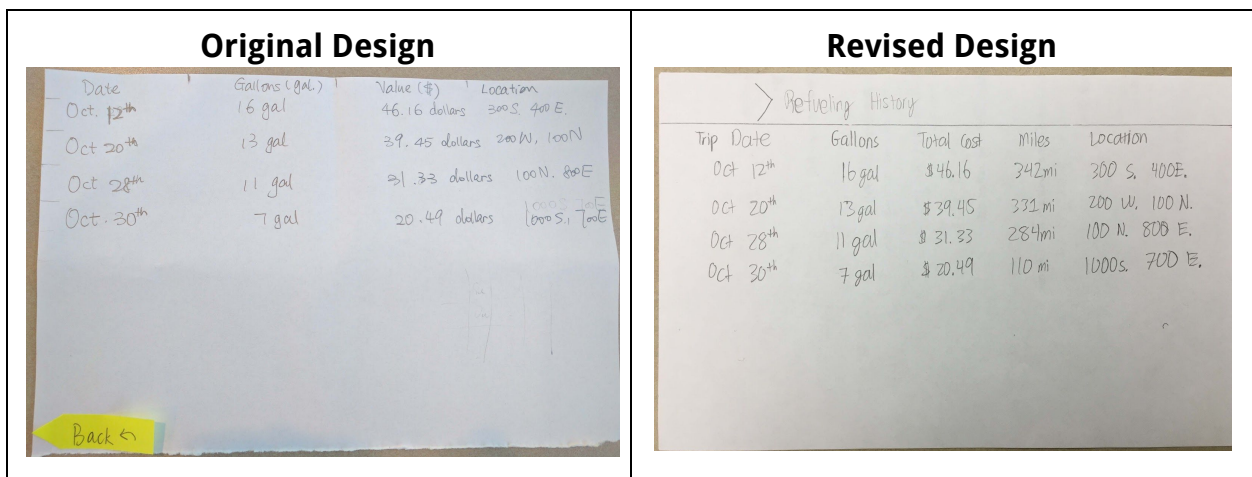


Incident 6. Sort Columns in Tableview

In the second usability test, the participant pointed out that as the number of rows began to increase in table views such as the refueling history, users may want to be able to sort the table to gain a better understanding of the data that they are being presented. He commented that not including such a feature may not be critical, but for many users it may end up being useful.

Severity Rating: 1

Revision Notes: In this revision we changed it so that the header row of the tables acted as buttons. When the user clicks on the header, the table will sort in ascending order by that column, and when the user clicks on the same header again, it will sort the table by that column in descending order.

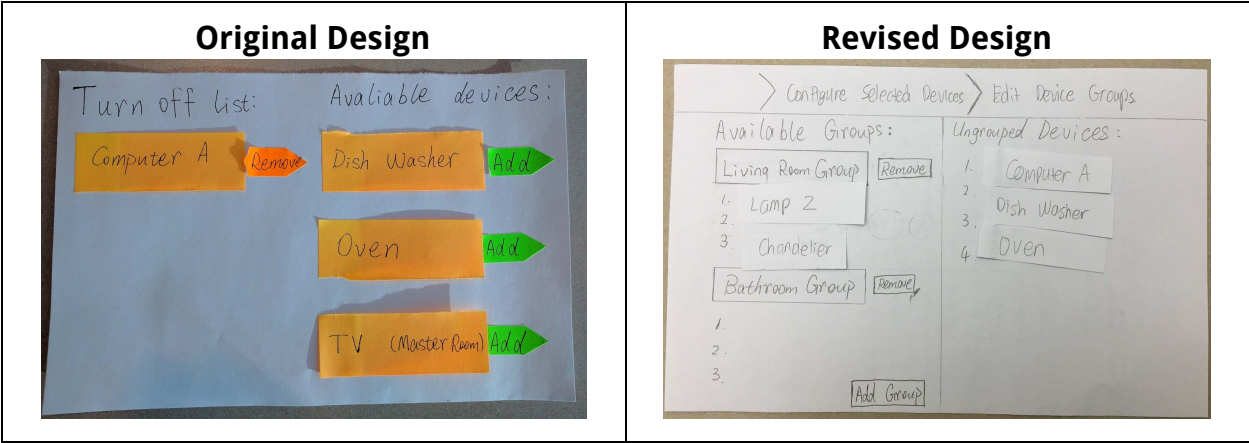


Incident 7. Group Devices to Manage Device in Bulk

Also from the second usability test, as our participant was adding devices to the list of devices, he expressed concern about when users like him who have a relatively large house may have a large number of devices to manage. It can become quite cumbersome and disorganized when he has to add 20 or 40 devices to the list.

Severity Rating: 2

Revision Notes: To address this issue, we settled on adding a grouping functionality for when the user is adding devices to their device list. As shown in the revision image below, the user can add a group to which they can add devices from the list of ungrouped devices. As a result, the user could sort devices by user or maybe the floor of the household.

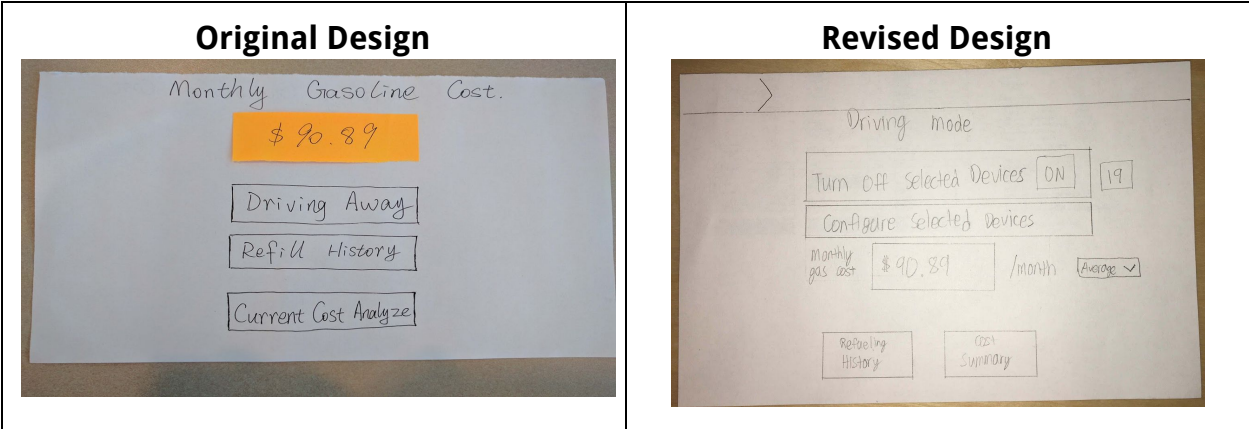


Incident 8. Indicate Number of Devices That Are Turning Off

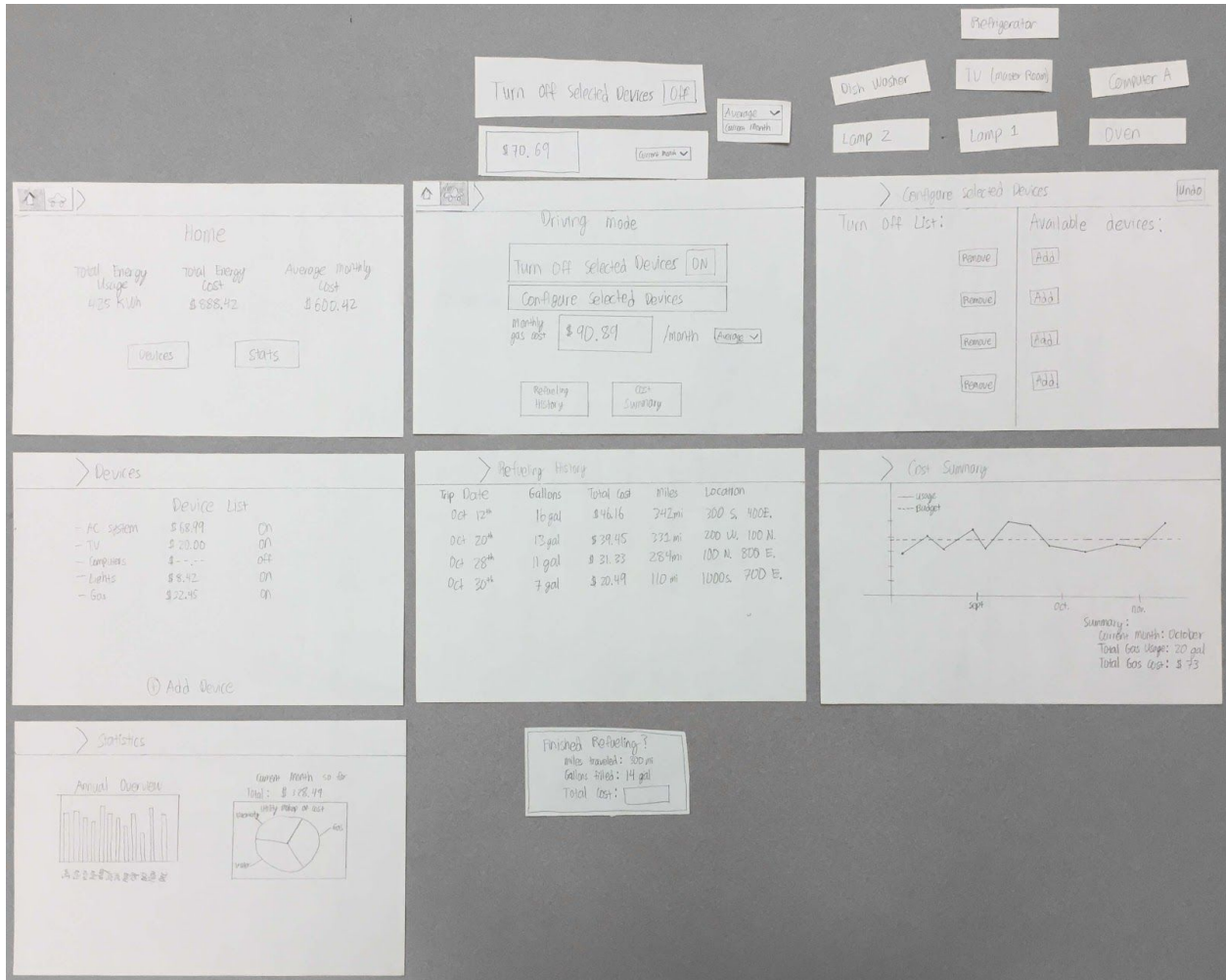
In the final usability test, the user did come across a couple of the same incidents stated above. But as a general point, he said that perhaps it would be nice to include the number of devices that were being turned off when you're tapping on the button to turn them off. It adds a certain feeling to turning the devices off.

Severity Rating: 1

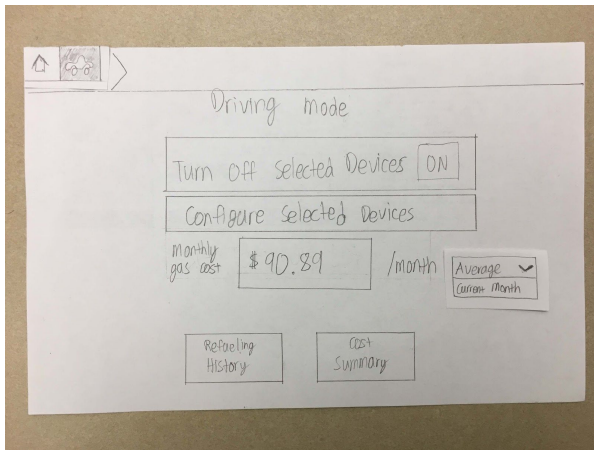
Revision Notes: As a group we agreed that this was not a major incident, but we decided that it would be a nice touch to the interface. As such, we added a box with a number to give the interface more effectiveness.



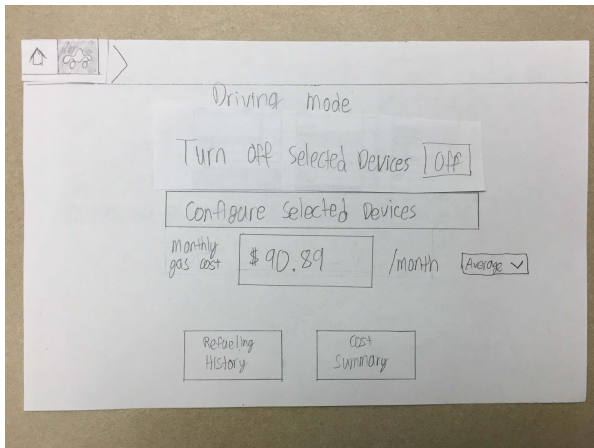
FINAL PAPER PROTOTYPE



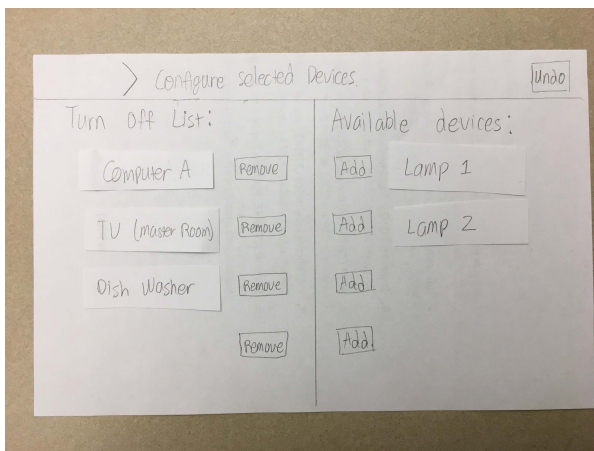
Task 1: Reminders to Save Energy



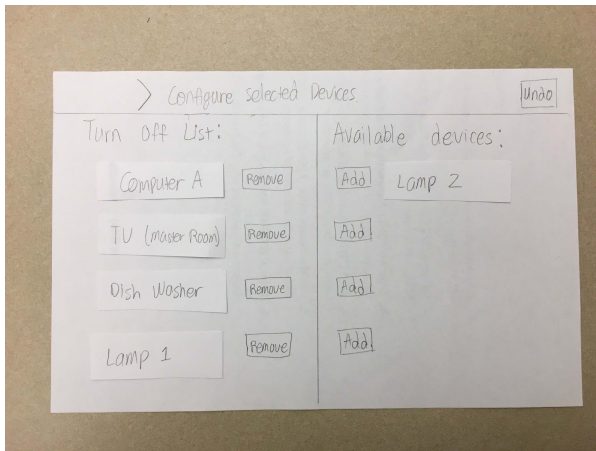
In the home page of the car-mode, the user can see a summary of data. There is also a big button for easy access when driving to manually turn off the selected device.



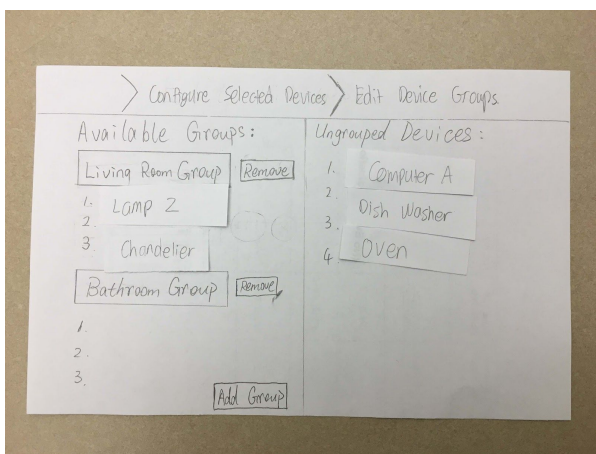
When the user taps on the button, the button changes its state and appearance along with switching the word from “On” to “Off” for a redundant appearance of change.



If the user taps on “Configure Selected Devices” on the home screen, the design takes them to this page. Here they can add or remove devices from the list of devices to turn off.

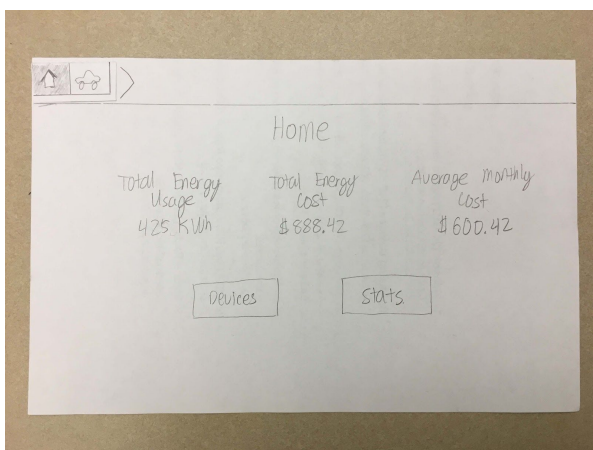


When the user taps the “Add” button, the design adds the respective device to the list of devices to turn off, and vice-versa.

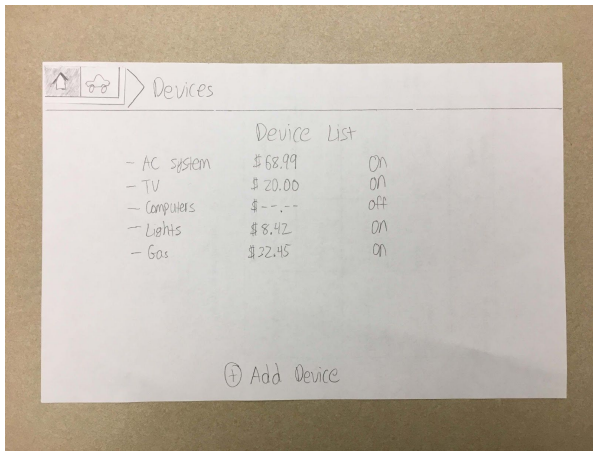


In this screen the user can configure it so that they can organize their devices into groups so that they can more easily be added and removed from the list multiple devices at a time.

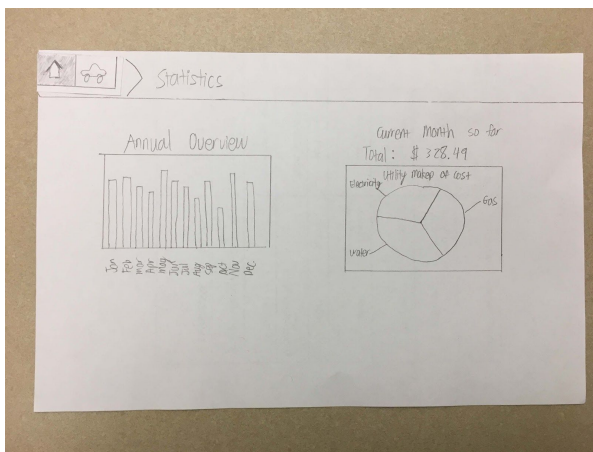
Task 2: Recording Data



In the home screen of the design in home-mode. The user can see a summary of their utility usage in their household. Much of this data is automatically collected.



When the user taps on “Devices”, they can see a list of utilities and devices along with the estimated cost. They also have the ability to add more devices.



When the user taps on the “Stats” it takes them to a this page where they can see their usage over time in a more visual way that is easier to understand.

The 'Refueling History' screen features a title bar with a right-pointing arrow. Below it is a table with five columns: Trip Date, Gallons, Total cost, miles, and Location. The table lists four refueling events from October.

Trip Date	Gallons	Total cost	miles	Location
Oct 12 th	16 gal	\$46.16	342mi	300 S, 400E.
Oct 20 th	13 gal	\$39.45	331 mi	200 W, 100 N.
Oct 28 th	11 gal	\$31.33	284mi	100 N, 800 E.
Oct 30 th	7 gal	\$20.49	110 mi	1000S, 700 E.

In car-mode, when the user taps on “Refueling History” on the home screen, it takes them to this table that includes data points where each refueling stop is separated by rows. They can see the date, amount of gas refueled, cost of the gas, and miles traveled.

> Refueling History

Trip Date	Gallons	Total Cost	Miles	Location
Oct 12 th	16 gal	\$46.16	342 mi	300 S, 400E.
Oct 20 th	14 gal	\$38.45	231 mi	200 W, 100 N.
Oct 28 th				100 N, 800 E.
Oct 30 th				1000s, 700 E.

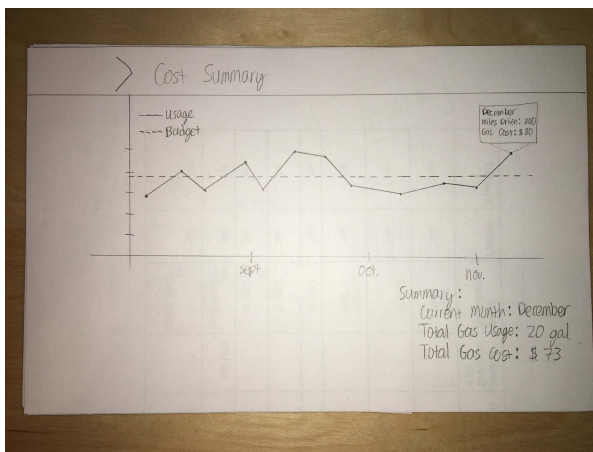
Finished Refueling?

miles traveled: 300 mi

Gallons filled: 14 gal

Total Cost:

When the car automatically recognizes that it has been refueled, it will pop up with this dialog box asking the user for the cost of the fuel up. From here the design uses data already gathered from the car to make remaining calculations.



Also from the home screen of car-mode, when the user taps on "Cost Summary" it takes them to this screen where they can see a timeline of their refueling history in a graphical format.

DIGITAL MOCKUP



REFUELING HISTORY

trip date	gallons	total cost	miles	location
2016/10/12	16.205 gal	\$46.16	110 mi	300 S. 400 E.
2016/10/20				200 W. 100 N.
2016/10/28				100 N. 800 E.
2016/10/30				1000 S. 700 E.

Finished Refueling?

Miles Traveled: mi

Gallons Filled: gal

Total Cost:

REFUELING HISTORY

trip date	gallons	total cost	miles	location
2016/10/12	16.205 gal	\$46.16	110 mi	300 S. 400 E.
2016/10/20	17.300 gal	\$39.45	284 mi	200 W. 100 N.
2016/10/28	10.846 gal	\$31.33	331 mi	100 N. 800 E.
2016/10/30	14.838 gal	\$20.49	342 mi	1000 S. 700 E.
2016/11/13	20.000 gal	\$60.00	300 mi	234 W. 489 S.

COST SUMMARY

Current Month: December Total Gas: 20 gal Total Cost: \$73.24

HOME MODE

Total Energy Usage	Total Energy Cost	Average Monthly Cost
425 kWh	\$888.42	\$600.42

[Devices](#)
[Stats](#)

DEVICES

DEVICE LIST

name	cost	status
Air Conditioning	\$68.99	⬆
Television	\$ - - -	⬆
Computers	\$8.42	⬆
Gas	\$32.45	⬆

[+ Add Device](#)

Statistics

Annual Overview

Current Month

Total: \$328.49

Task 1: Reminders to Save Energy

In this first task the device displays the option for the user to turn off their selected devices. This is displayed in car-mode, because as the user is driving away, they have no further use for certain devices in their home. Each button is made large for easy access. The design also has additional options for configuring each user's settings.



In the home page of the car-mode, the user can see a summary of data. There is also a big button for easy access when driving to manually turn off the selected device.



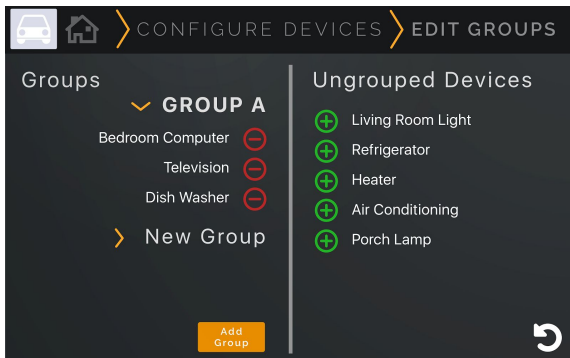
When the user taps on the button, the button changes its state and appearance along with switching the word from “On” to “Off” for a redundant appearance of change.



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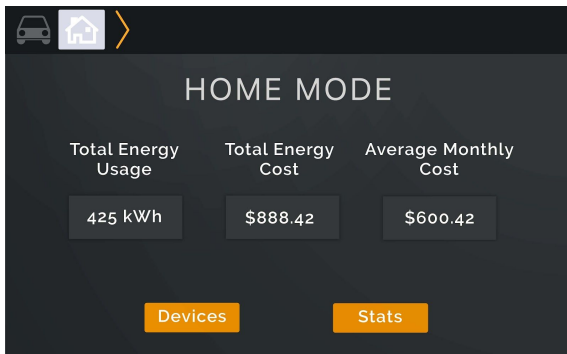
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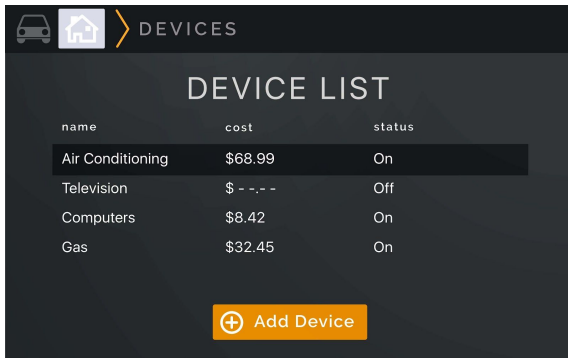
In this screen the user can configure it so that they can organize their devices into groups so that they can more easily be added and removed from the list multiple devices at a time.

Task 2: Recording Data

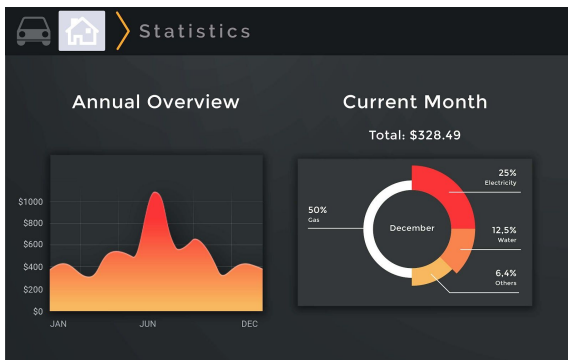
The second task also consist of two different modes. In home-mode the home page displays a summary of the aggregated data. The numbers are displayed in large format for the user to quickly glance when needed. In this mode they can also add devices that they want monitored as well as view graphs of the collected data over time. In car-mode, the design can record fuel-trip data and display that data back at the user over time as well.



In the home screen of the design in home-mode. The user can see a summary of their utility usage in their household. Much of this data is automatically collected.



When the user taps on “Devices”, they can see a list of utilities and devices along with the estimated cost. They also have the ability to add more devices.

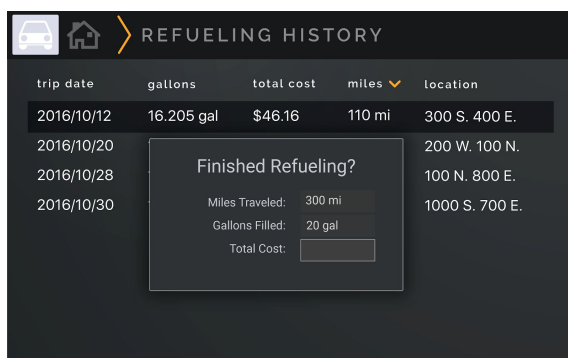


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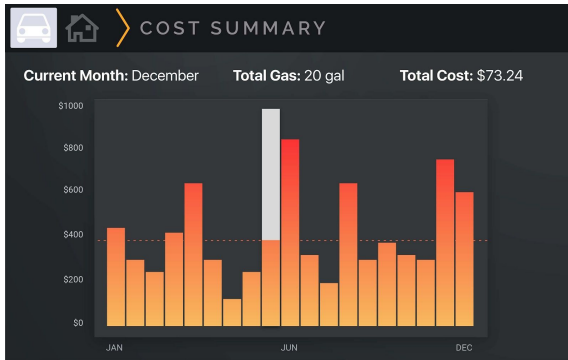
The screenshot shows a dark-themed interface with a header 'REFUELING HISTORY' and a home icon. Below the header is a table with five columns: 'trip date', 'gallons', 'total cost', 'miles', and 'location'. The table lists four refueling events from 2016/10/12 to 2016/10/30.

trip date	gallons	total cost	miles	location
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Also from the home screen of car-mode, when the user taps on “Cost Summary” it takes them to this screen where they can see a timeline of their refueling history in a graphical format.

Changes

The feedback we received on our digital mock up was pretty minimal. One of the bigger points was the poor wording in a title. As it was worded before, it can become pretty confusing to the user, therefore that was changed to a more appropriate title that made more sense to the field that it represented.

The other change that was made was the ability to add a device to a group. The original digital mock up did not make it clear how the user added a group to the list. In the revision of our digital mock up that was made clearer by changing the font weight of the title of the group as well as adding a drop-down functionality to contain the list of devices in the group.

DISCUSSION

What we consider to be the most important thing that we learned from the process of iterative design is how valuable feedback can be when creating a design. Most people imagine creating a design as an art project. They see designers as artists who imagine this amazing idea and have the ability to create an amazing product from such an idea. But what we know now, and what most people don't see when they are using a product, is that each design can go through many iterations before a product can be considered a viable product for release. We also learned that the first design that one creates is usually, if not never, the best design that they can create even if they have given it a lot of thought. As a result, this demonstrated just how valuable it is to iterate over a design to get it as close to right as possible.

The process itself identified a few major problems, but quite a few minor problems. An example of that were things such as misspellings (which most likely would have been caught by the computer), but also things like poorly worded titles or names that may have made sense to the designer, but was unclear to the user. These sort of problems may be considered a minor imperfection, but we realized that if the user has a hard time understanding what is going on, they are less likely to continue using the design. For simple designs, this isn't as much of a

problem, as just playing around with it once or twice will inform the user as to what was meant by the design. But as projects get bigger, small problems can build to bigger frustrations. Other problems that were identified included major issues such as, in our case, the complete lack of an identifiable way to switch the different modes. Without some sort of feedback to the user as well as an identifiable way to switch the different modes there really is no other way to use the app. As such, although we had originally thought to change modes by rotating the device, based on our feedback, we found it better to have a virtual button on the screen that allows the user to both see what mode they are in as well as change the mode themselves if they wanted to.

Our tasks have not really changed as a result of our usability tests. Our aim is still to remind users to save energy as well as to provide them with a good overview of their data.

I think that we definitely could have used some more iterations for our design. The paper prototype may allow for a level of criticism from the participants, but having the digital mockup pass through some usability tests would be valuable as well because it is closer to the actual product that the user would use. Of course, in the real world, there's a point at which a product should be released, but I also feel like there can never be enough iterations to create a better design. I consider our design to be pretty well thought out, but I'm confident that if we were to hand it to more people to use, especially the digital mock up, they would find more usability issues that are more and more likely edge cases as there are more iterations of the design.

APPENDIX

Materials Used

The primary materials used were paper for the paper prototype as well as crafting supplies.

Scripts were not created as we wanted the interaction to be as comfortable and as natural as possible.

Identified Critical Incidents

Incident 1. Design Simplicity and Cleanliness

One of the comments that our participant had was that he felt the design was simple and clean. There weren't many occasions where he thought that there was information that did not seem appropriate for the view. We lauded this comment because that was what we were going for as we felt that simplicity would make for a product that people would more likely use.

Incident 2. Display Data Point on Graph by Default

In the graph view, our original design displayed just a chart with a general view of the trend. The idea was to keep it simple, and then when the user wanted more detail, they would tap on the area of interest, and the closest point would display more precise information. Our participant felt it inconvenient that he had to tap on the display and that instead the values should be shown by default for easier at-a-glance reading.

Incident 3. Differentiate Between Home-mode and Car-Mode

The duality of our design, having both a car-mode and a house-mode, led to a bit of confusion. In the initial design, the car-mode was displayed in a landscape fashion and the house-mode was displayed in portrait rotation. But our participant found this not only cumbersome, but also annoying with having to constantly rotate it. He thought that devices should have one orientation unless there was a good reason to have multiple orientations.

Incident 4. Automatic Switching of Modes based on Geolocation

In addition to having a button that established the current mode of the device, another one of our participants wondered why we did not include a location-based switch into our design. By adding allowing the device to switch modes based on location would essentially automate the task so that the user would not have to manually switch it. But

if needed, as revised in Incident 3, the user has the option to switch modes using the buttons given.

Severity Rating: 2

Revision Notes: As this revision is something that runs in the background, there is not really an applicable design aspect for the device, but the revision would be that when the user leaves their property, or the device is mounted in their car, the design will switch to Driving mode, thereby the switch at the top left will switch to the Car icon. And when the user arrives back at home, or docks the device on the wall, the device will switch to home-mode automatically as would be indicated by the switch at the top left highlighting the House icon.

Incident 5. Button to Add Device to Monitoring Page

In our initial design in home-mode, we had a functionality where the user could view the power state of the device as well as the total consumption of the device. But our participant identified that there wasn't any apparent way to add or remove the device from the interface. We had initially thought that they would be added automatically, but adding a button would improve usability.

Incident 6. Sort Columns in Tableview

In the second usability test, the participant pointed out that as the number of rows began to increase in table views such as the refueling history, users may want to be able to sort the table to gain a better understanding of the data that they are being presented. He commented that not including such a feature may not be critical, but for many users it may end up being useful.

Incident 7. Group Devices to Manage Device in Bulk

Also from the second usability test, as our participant was adding devices to the list of devices, he expressed concern about when users like him who have a relatively large house may have a large number of devices to manage. It can become quite cumbersome and disorganized when he has to add 20 or 40 devices to the list.

Incident 8. Indicate Number of Devices That Are Turning Off

In the final usability test, the user did come across a couple of the same incidents stated above. But as a general point, he said that perhaps it would be nice to include the number of devices that were being turned off when you're tapping on the button to turn them off. It adds a certain feeling to turning the devices off.

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