NRGY

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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.

CONTEXTUAL INQUIRY PARTICIPANTS

In the initial set of our contextual inquiries, we located a few students who lived in their own houses. Some of them shared houses with other roommates, while others lived at home with their parents. One of our interviewees does not live locally, which made it slightly more difficult to observe, but we were able to walk through the contextual inquiry and observe their actions over video chat. Additionally, to protect the identities of the participants, we have changed their names here to more generic pseudonyms.

Our first participant, Tom is a graduate student at the University of Utah with a major in Mathematics. He has lived in Salt Lake City for a few years having moved from China a few years ago. He resides about 20 min away from school which restricts him to either driving or

taking public transportation to school, of which he prefers the former. The vehicle that he drives to school everyday is a large truck with a proportionately large engine. However, he was very insistent that he does care about the environment, but only drives a large truck because of how dangerous the roads of Utah's icy cold winters can be. We ran a second contextual inquiry also in his house.

The next participant is also another student at the University of Utah. Tony is pursuing a major in Business Administration, but is considering switching to Information Systems because he has a keen interest in technology. He moved from San Diego a couple years ago, and lives relatively close to campus. He lives in his a house that he shares with a couple of housemates, and prefers to drive to school everyday. Tony and his housemates all split the bill when it comes to paying utilities, but he is usually the one that handles and manages all the bills and payments.

Our third participant, Edward, who is a a senior student who majors in Chemistry Engineering at University of Utah. He is about to graduate so he wants to reduce energy usage to save more money. He currently lives close to school, so he chooses to take the bus or walk to school instead of driving. As with the other contextual inquiries, we visited Edward's home. Edward does not usually stay home, since he needs to go to school and work. He found that his electricity bill is around 60 dollars, but because English is not his native language he has trouble understanding what different abbreviations and codewords indicate. He wants to be able to get to know all usages at his home, so he could try to reduce some unnecessary usage. Edward does not have any ways to keep track of energy. He wanted something that could help him do that.

We chose these participants because they all have concerns about their energy usage, either want to save energy to slow down global warming effect, or want to save money. These kind of person are our potential users, so we can get to know how they keep track of energy usage, and their complaints about existing ways. The primary users of our design is likely to be those who want to reduce their carbon footprint. Therefore our participant Edward chooses to take public transportation in order to curtail his own carbon footprint. Tom tries to reduce some utility usage. Other candidates may include millennials where technology and the digital age has seemingly grown side by side with them, like Tony. Advancements in technology has made these millennials more in tune with their ecological impact as well as provided technology to analyze some of their impact. But because the factors of one's carbon footprint can vary widely between people, we have decided to focus primarily on homeowners, as well as people who may not necessarily own a home, but occupy an entire household. This way we can get chances to visit their home and actually see how they manage energy usage, and our design

can start with things that are more easily trackable and have a greater impact on the environment such as a household's gas usage, electricity usage, and water usage.

CONTEXTUAL INQUIRY RESULTS AND THEMES

From all of our contextual inquiries, we found that most of our participants are willing to put forth some effort to have an environmentally conscious lifestyle by tracking the energy that the consume, since unnecessary energy consumption not only harms the environment but is also money wasted. Our participants attempted to track and monitor the energy they consumed by analyzing their utility bills, but it after some time it became difficult and monotonous to have to constantly input data into files like spreadsheets. It was painful enough to have to pay the bill.

Based on our contextual inquiries result, one of the biggest and inevitable factor in energy consumption is gasoline, both in vehicle transportation and as a utility. Most of our participants are willing to save energy at different fields they tried to avoid using dishwasher and AC system, however they choose to ignore the consumptions of driving and regarded driving as an important activities in their daily life. Although public transportation can help them save gasoline, it can be difficult to catch them on time, some of them also could find the right bus they need to take since the route is too complex.

From all the three interviews above, we find out that most people who want to have environment-friendly lives, also care about the energy usage at their home. After some of them have used Google's Nest, they felt that it helped but did little to motivate or inspire them to save energy. The data it displayed was also not very accurate. These devices now cannot fulfill the user's' need and not detailed enough to make people totally understand how much energy they used in their daily lives. For this reason, the users need to have a new way to provide them with more detailed data about energy usage in their lives, not only knowing: this device is saving energy for me. By having a device that tells you how much energy one saves, they are more likely to try to save more energy.

We have also found that the most popular strategy our participants tend to use to save energy is stopping or reducing times of using a specific electrical equipments. Since all of our participants have concerns about their energy usages, they choose to stop using dishwasher because water fee is too much, or turn off AC when it is not in use because electricity fee costs higher than they think. Nevertheless, if they have no clues what is costing so much energy, they have no way to save the energy. Therefore, informing users the exactly energy usage would be a reasonable approach for our design.

TASK ANALYSIS

1. Who is going to use the design?

   The design is useful for those people who want to save energy but do not have the correct tools to help them do so. It will be useful to people who are looking for more precise data that is easy to understand and will not take significant effort to create.

2. What tasks do they now perform?

   Most people tend to record their data by manually recording it into some software. This can be both inconvenient as well as time-consuming. In some cases they also have to remember how much something was used, which reduces accuracy a bit.

3. What tasks are desired?

   Likely one of the most sought after tasks is something that will automatically record data for the user, or at the very least, something that simplifies recording data and simplifies such a task. Reminders to perform certain tasks would also be very helpful. The main desire is to inspire people to save energy and to not waste energy that they aren't using.

4. How are the tasks learned?

   The tasks can be learned largely by experimentation. But such tasks can also be learned by searching on the Internet. There is a lot of information out there in the world that informs people on how saving energy can be achieved as well as how people might be able to monitor their energy consumption.

5. Where are the tasks performed?

   The tasks will be performed primarily in the home. Because the goal is to make it as seamless and as autonomous as possible, there will hopefully be minimal interaction during data collection, but will be used when the user wants to view the usage.

6. What is the relationship between the person and data?

   Users need a good way to view all the data that has been collected throughout the months, and possibly years. As the information is collected, they can get a better understanding of energy usage as well as predicting future energy consumption to a certain degree of accuracy rather than just guessing.

7. What other tools does the person have?

Existing tools such some digital programmable thermostats have the ability to collect similar information, but because it is only connected to the HVAC systems in houses, the data it collects is not precise. Other tools include software that has support for, but may not be designed for, recording the usage of a generic thing over time.

8. How do people communicate with each other?

   Because the design is centered around a household, there is likely to be little added interaction between the users. There is a possibility in the future that people may eventually compete with each other to see who might be able to reduce their usage of energy the most. This might provide users with more motivation to conserve energy.

9. How often are the tasks performed?

   Due to the autonomous nature of the design, the tasks are performed by the design possibly every day, or at the very least every month. But also when user interaction is required, which is difficult to narrow down occurrences.

10. What are the time constraints on the tasks?

    These tasks have not time constraints because the design collecting and analyzing data over long periods of time.

11. What happens when things go wrong?

    In the worst case scenario, the design was unable to collect data for some reason. At this point, it might alert the user to resolve the issue. It might also come that the user completely ignores the information that is presented to them or has been collected, in which then we hope to be able to help them realize that everything they do has an impact on the world.

PROPOSED DESIGN SKETCHES

Design #1

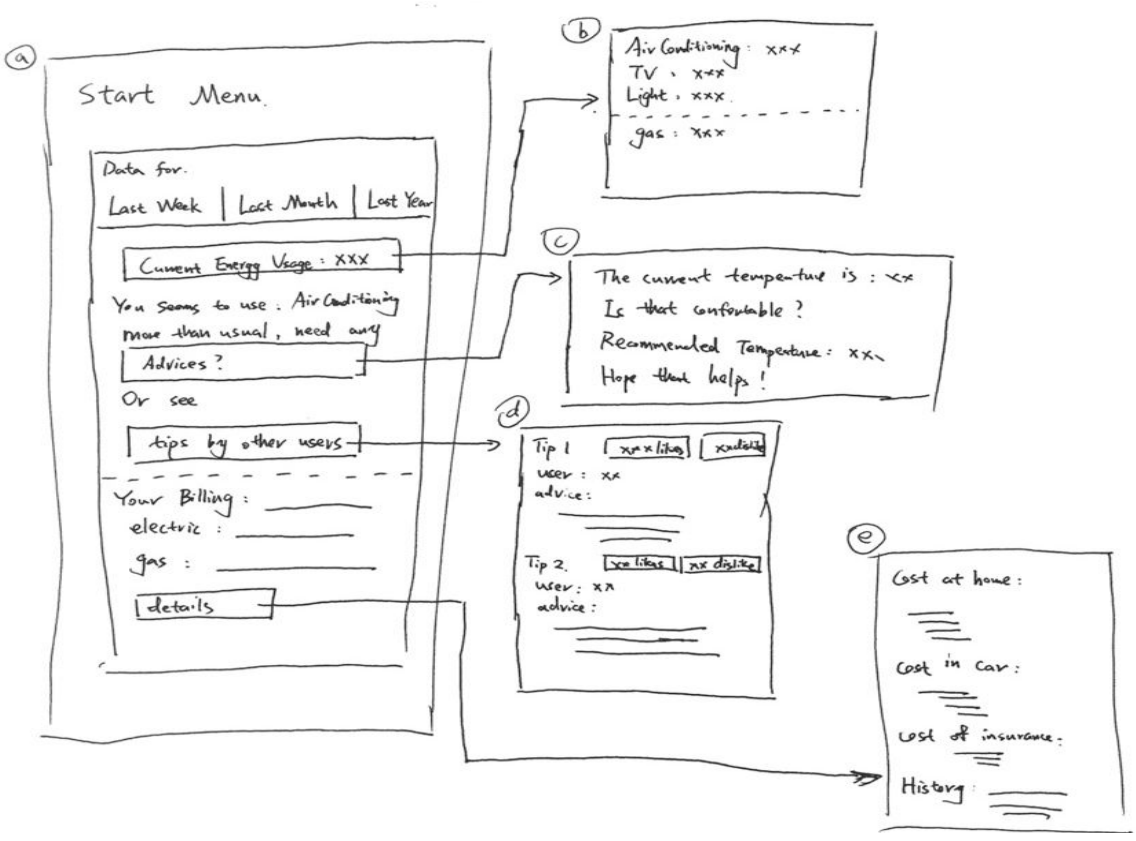
The first design is a mobile application that can be accessed at the user's' convenience. With the widespread availability and usage of mobile phones, people tend to carry these devices with them everywhere they go which makes accessing information easy. This design consists of a few different views that display various pieces of information and that the user can interact with. All the data is collected either through manual input, or through automated collecting.

Task I Recording Data: By having access to the camera on the cellphone, the application can take pictures of bills to analyze and record the data. But if needed, the user can also use the form to type in data.

Task II Reminders to Save Energy: When the user starts to leave their house, the app can identify devices or appliances that have been left on. Anything that has been left on that should not be will be broadcasted to the user.

Task III Budgeting Overtime: With all the data collected the application will display monthly usages to the user. And using historical data as well as state or city averages, the application will predict cost of utilities for upcoming months.

Task V Simplification of Data: By summarizing all the data it has collected from various sources, the application can display it all in one simplified and easy to understand view. Helping out with budgeting, the user can plan accordingly.



Design #2

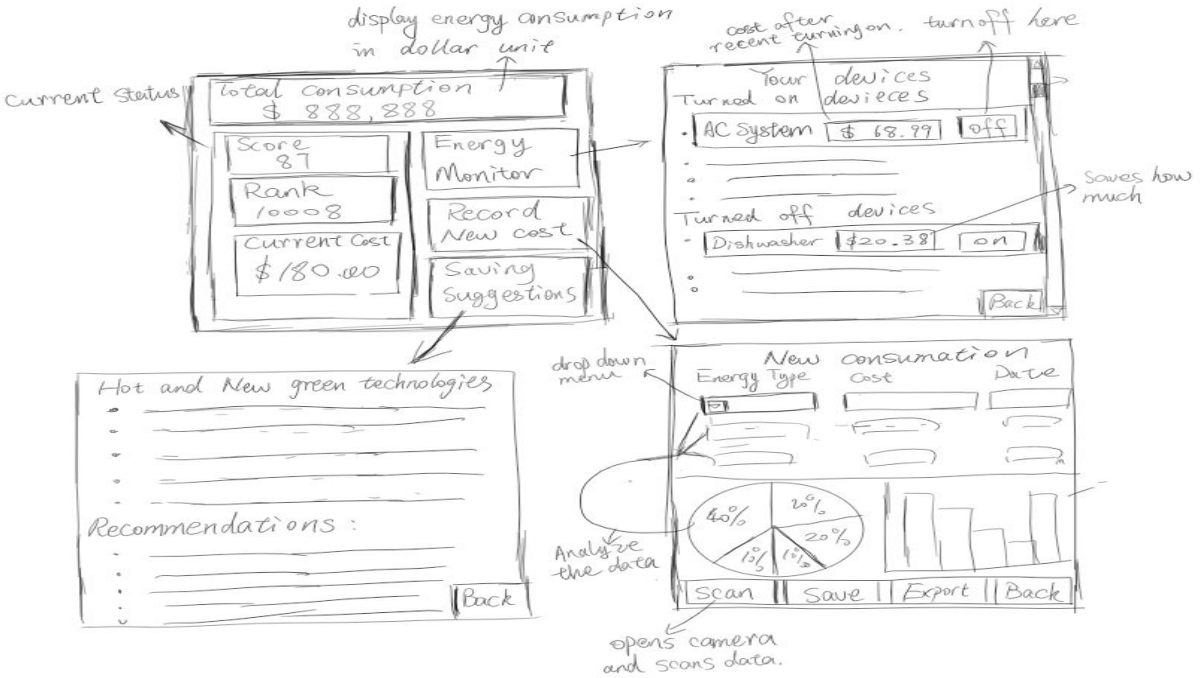
The second design is a wall-mounted touchscreen device that provides at-a-glance information to the user. It connects to the internet through WiFi to collect weather, temperature, and news data, but can also connect to a user's device to synchronize or collect information from it. It is also connected to the building's central HVAC system allowing the device to intelligently control utilities such as heating and cooling, as well as monitor the usage of such utilities. If additional data is needed, it can also be collected either manually or automatically, such as input with the touchscreen or via the scanning of bills with a camera respectively.

Task I Recording Data: In order to collect data that cannot be compiled autonomously, the user can choose to scan a bill with the integrated camera. This will automatically analyze and save the information for the user, making the experience much smoother by not requiring them to type in all the information.

Task IV Switching to Green Energy: On one of the docked widgets, the device will aggregate news stories and product releases related to decreasing one's carbon footprint. The user can then find new technologies much more easily and can see how much money they can save when the device compares current usage with possible usage.

Task V Simplification of Data: Just by walking up to the device, the user can see immediately all the relevant information they need. For example, their consumption and the cost incurred for the past day, week, or month.

Task VI Changing Utilities Based on Weather: When the user first starts using the device, it will ask what is a comfortable setting for them. It will compare that data with weather information and ambient temperature, and will over time identify and adjust the indoor temperature automatically to the users' preference.



Design #3

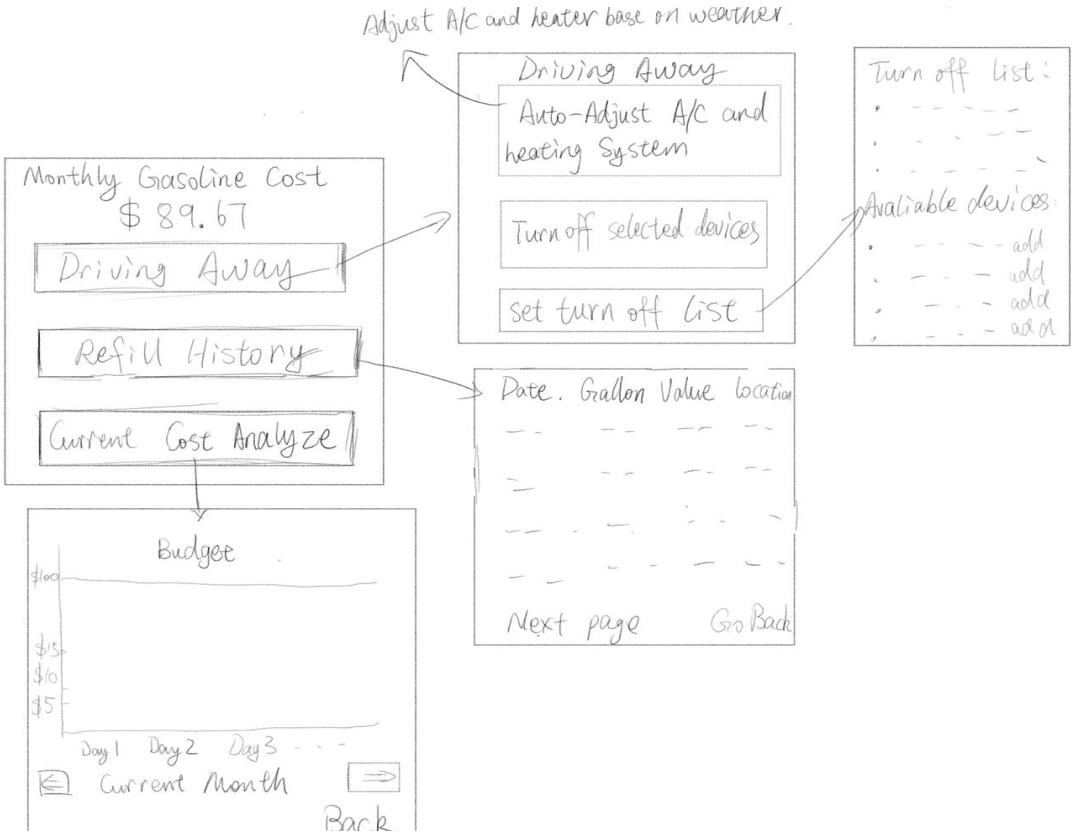
The third and final design is a dashboard that is installed in the user's vehicle. It is connected to the car's onboard diagnostic port to collect as much data as it can as precisely as possible. By collecting this data, the design can analyze the user's driving habits, how aggressively or how calm they drive, as well as the fuel efficiency plotted over time compared to GPS location data and driving conditions. This allows the user to assess how their driving habits affect fuel economy while being able to take into account external factors such as terrain grade, and adverse weather conditions.

Task I Recording Data: By connecting to the diagnostic port of the vehicle, the dashboard has access to an unprecedented amount of data regarding the status of the vehicle. It can use this data to precisely measure energy consumption.

Task II Reminders to Save Energy: When the user starts to leave their house, the app can identify devices or appliances that have been left on. Anything that has been left on that should not be will be broadcasted to the user.

Task III Budgeting Overtime: Using all the data collected, the dashboard can estimate future cost of trips using predictive modeling taking into account the cost of fuel. It can also display historical data.

Task V Simplification of Data: By summarizing all the data it has collected from various sources, the dashboard can display relevant information that can give the user an easy to understand overview of their usage.



Choice of Design

For the final design, we decided to merge the second and third design, and a little of the first design because we felt that they complemented each other really well. We wanted a design that was both comprehensive and redundant in its functionality. Some might think that redundancy is wasted effort, but we felt that through redundancy, there is less of a possibility that the user might miss a notification as well as being able to record various data points from any location. Additionally, by having three or more devices connected together, the data is accessible from virtually anywhere, and can be controlled from anywhere. This accomplishes the two tasks that were selected: reminders to save energy and recording data.

WRITTEN SCENARIOS

Storyboard #1: Reminders to Save Energy

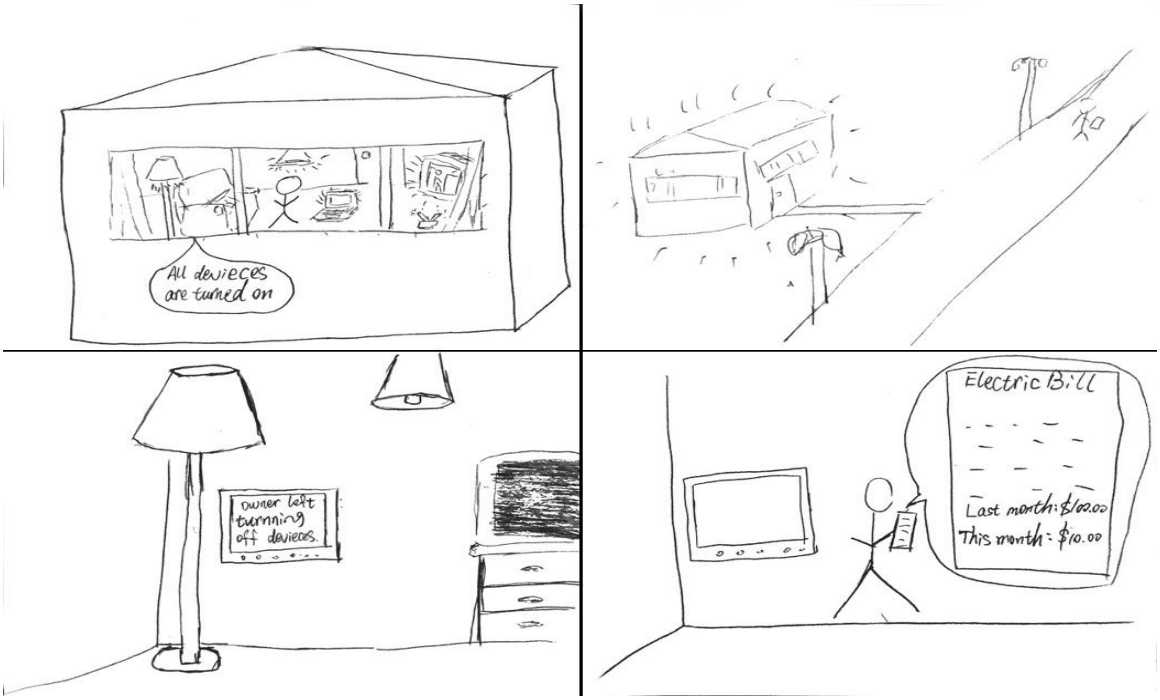
Jim live in his own home where he loves to watch TV, browse the web, and read. However, he lives alone with no one to help him or help to remind him to turn off what he doesn't use. Jim has never really cared what he leaves on because he has not noticed any major impact on his life in doing so. Quite often he will leave his house with much of his lights and electronic devices still turned on. But this time, powered by our design, the wall-mounted dashboard detected that Jim has left his lights on yet again, and he gets a notification that he has left many of his devices still on. When he selects the notification, he has the option to turn off select devices and lights in his home. At the end of the month when he receives his utility bills, he can immediately see a significant reduction in energy used as well as a satisfying increase in the amount of money saved.

Storyboard #2: Recording Data

Johnny is a car aficionado. He loves to take his car out on joyrides where he loves to gun it right off the starting line and breaks really hard. He has learned recently that bad driving habits like that can drastically reduce a vehicle's fuel efficiency. Additionally, with all the modifications he makes to his car, he wants to know if any of those modifications might affect his fuel economy when he is driving. With our vehicle dashboard design installed in his car, and connected to the diagnostic port of his car, he can view such data. The dashboard is also synced with a wall-mounted dashboard, so just in case Johnny does happen to leave devices on when he leaves his house, he still has the option to turn them off without having to touch his phone. And the next time he refuels his car, the dashboard logs the miles-per-gallon overtime, how much he paid, and displays comparison data to him when he gets back in his car to drive away.

STORYBOARDS OF SELECTED DESIGN

Storyboard #1: Reminders to Save Energy



Storyboard #2: Recording Data