



NEAT

A solution for every home

Team

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Problem and Solution Overview

Most people aspire to live in a clean home but often fail to make time or gather enough energy to take action on the idea of doing a chore. Having a clean home not only has several health benefits like reducing allergies, but it also has a psychological component, reducing a major source of stress in the house. The problem is that cleaning is not a top priority for many. People would rather spend their free time with their families and having fun than performing tedious house chores. Our goal is to create a design that promotes the idea of a clean house without introducing more work for the user. Our solution is a centralized dashboard to be placed at a highly trafficked area of the house. This hub enlists the help of other smart devices around the house like TVs, computers, smartphones, smart bands, and such for data collection and data output. Our system uses current motivators in the form of internal and external triggers (e.g. people coming over, how long has it really been since you last cleaned, cleaning in small bursts, etc) to get you cleaning. Finally, the hub processes your home and personal data to show you how to stay neat.



Contextual Inquiry Participants

We conducted four contextual inquiries with people who are busy and don't have a lot of time for cleaning. These participants are students and working professionals. The methodology used was interviews in context. We visited participants in their homes and conducted semi-structured interviews to understand the motivation and practices around cleaning behaviors. After requesting their permission, we were able to capture some pictures of our participants homes like the one seen in **Figure 1**.



Figure 1 Jane's Apartment

Mark is a 28 years old software engineer at a East side software engineering company. He moved to Seattle 18 months ago with his wife. They own a condo in Capitol Hill. Commuting is a big part of Mark's routine, he spends about an hour and a half every day driving or riding the bus. He is a very active person. Mark loves to watch and participates in sports and he also goes to the gym regularly. Mark is a very busy guy and he has been taking over the household cleaning activities since his wife started grad school. His wife also works full time and goes to school which means, she does not have a lot of free time. Therefore, they decided that Mark will be the one who is mainly responsible for the housework until she finishes her degree and has more time to help.

Jane is a 23 years old Master's student at a Seattle university who lives in the dorms with 3 other roommates. Since her major requires a lot of work inside and outside her apartment she doesn't have time to clean. She always procrastinates and her room is a mess. She starts to clean in two conditions, if her apartment's floor starts to become invisible from all the mess, and if someone is coming over. To avoid her messy apartment and clean-ups she spends most of her time on campus or in coffee shops.

Lola is a 21 year old undergraduate nursing student at a university in Seattle. She's lived around Seattle all of her life and comes from the eastside, specifically Issaquah. However, she lives somewhat close to campus now in a house of eight total roommates. Lola has various time commitments. First, she commutes on average 20-30 minutes to school and another 20 minutes to work at a medical center. Second, Lola participates in a swimming team, which has several routine practices a week, each of which take approximately 2 hours. In addition to being a full time student, she is also a nursing technician, spending 20 hours a week at the medical center.

Vish is 20 year old undergraduate student at a university in Seattle. He is currently pursuing pre-med and hopes to apply to medical schools in the near future. Now a Junior, he recently moved into a 2-bedroom condo in Belltown, a neighborhood of downtown Seattle. His parents are currently the owners of the condo and are renting the other bedroom out. He commutes to school everyday using public transit which he says is sometimes time consuming. In addition to his heavy course load, Vish is part of several on campus organizations which often leads to him staying late on campus and coming back to his condo very late. Vish, by nature is a very clean person, but is finding it hard to keep up with his busy schedule.

Contextual Inquiry Results

From the information that we gathered, it was evident that most people have a desire to maintain a clean environment. Although the definition of what clean meant differed from person to person, most of the people we interviewed saw the benefits of a clean environment. Contrary to our initial belief that some people scheduled their cleaning we found that cleaning was almost exclusively 'triggered' by internal and external factors. For some people, the internal factors included things like pent-up guilt that would build over days as was the case with Mark. He says "I would tell myself that I should clean, then I tell myself the same thing for several days until I notice that I have been telling myself the same thing very frequently, then I clean". For others, the internal triggers included an innate desire to maintain a clean environment as was the case with Vish. Vish remarked, "I believe that a mess free environment results in better organization and focus". External triggers were commonly the result of friends or family coming over. An interesting thing to note is that external triggers commonly resulted in the cleaning of the 'outer' areas of the home such as the living room or kitchen. We can infer that the reason behind this is that those areas would be visible to incoming guests or spouses. Internal triggers often resulted in the cleaning of private areas such as the bedroom.



When house maintenance was brought up another thing we were able to glean from our contextual inquiry was that maintenance of the house and appliances was largely related to ownership. Those that owned their house or apartment showed more interest in the maintenance of their house. The reason behind this became apparent as we completed more of contextual inquiries. We found that for renters, maintenance of their heater or refrigerator was performed by their landlord or apartment complex whereas for owners, fixing a broken heating unit required either time, money or both. Monetary interests are what really drove people to take household maintenance into their hands.

From our inquiries were also able to get a better understanding of what was stopping people from completing their cleaning chores. As mentioned, keeping a clean area was basically a universal desire but most people failed to make it a priority or consider when planning out their day. For a lot of the people, cleaning was an annoyance and some did not feel it was worth their time. Others kept ignoring the problem until it became too massive to ignore.

Lastly, we were able to get a better picture of what motivates people to clean or lack thereof and we were awarded with better understanding of the cleaning behaviors of people. We found that most of the people that we talked to liked to clean in short bursts. Instead of spending large amounts of time planning and cleaning most people often made a decision to clean and focused on what was nearest around them. Because they only focused on what was nearby when they made their decision to clean, some areas of the house became largely ignored.

Task Analysis Questions

Who is going to use the design?

This design is primarily for busy people who don't prioritize cleaning. This includes people who have a hard time keeping the house clean and organized. It could also serve those who want to prevent their guests from arriving to a messy home. Additionally, people who are interested in visualizing the cleanliness of their home would find this design useful. Overall, people who have busy schedules and wish to prioritize cleaning higher are our target audience.

What tasks do they now perform?

We have seen that many people tend to keep some sort of mental to-do list. This to-do list comes to fruition especially when they need to force, or in other words, shame themselves into cleaning, and when they run into scheduling and visual triggers in their surrounding environments.



What tasks are desired?

We want people to be able to see how clean -- or not clean -- their house is at any point in time, whether past or present. From this overview, they'll be able to quickly find out what next steps they need and how long those steps will take. Our overall goal is to motivate people to clean utilizing their own data and internal and external triggers.

How are the tasks learned?

The tasks are learned through an intuitive user interface that takes advantage of preexisting notions of gestures and interaction to help the user learn and execute the tasks of interest. Both obtaining/tracking cleaning information and the interaction with the physical peripherals will be intuitive and easy such that the barriers to the use of the design will be as minimal as possible.

Where are the tasks performed?

There are numerous places of interest where the tasks will be performed. Each living space has specific requirements and todo lists that have to be completed for the cleaning task to be finished. A few places include, but are not limited to: living room, bathroom, bedrooms, backyard, kitchen, garage, lawn.

What is the relationship between the person and data?

The relationship between the person and the data is very personal and intimate. The person will have full control of the data and its respective privacy and uses. Of the data's uses, the person will receive benefits. From being able to track cleaning tasks' duration to receiving suggestions based on past cleaning behavior, the person will be able to be more motivated about cleaning as it has now become more actionable and trackable.

What other tools does the person have?

The person could potentially have apps for scheduling cleaning, paper to do lists, house boards to distribute cleaning tasks and note when was a task last performed or other ways of keeping their house clean. However, the barriers to all of these tools tend to be high, and as such these tools haven't been quite successful.

How do people communicate with each other?

The design calls for tracking of the cleanliness of each room in particular. This data would sync across the system and allow all users to know whether or not a particular room has been cleaned or not, or if the room has actionable items to be cleaned. However, we mainly target users as a household, so most of the time users do not need to communicate with each other as



the system displays information pertinent to the whole house. These tasks can be split up if necessary and actioned upon by any user.

How often are the tasks performed?

The duration and frequency of the tasks to be performed are dependent on the individual behavior. Some factors that come to mind that would affect frequency would be how messy this person of interest is, how regularly he or she cleans, and how consistently he or she thinks about or wants to clean and whether or not they respond to the cleaning prompts provided by our design. However, as a baseline estimate, we think the average person will clean, in some form, one to two times a week.

What are the time constraints on the tasks?

Often times, especially people with busy lifestyles, cleaning is not considered a priority. They find that it is a better use of time to do something else. Thus, there is not a lot of free time set aside specifically for the tasks of interest. For us to properly motivate people to complete these tasks, we need to make it easier for them to decide what to clean and utilize existing internal and external triggers such as parents coming over.

What happens when things go wrong?

Health issues tend to occur when things go wrong. Often times, when maintenance tasks such as cleaning an air filter aren't completed, the results are bothersome to a person's health. In the example of the air filter, the air quality in the room or house would drop, resulting in potential for more present allergens. This is rather stressful for those who suffer from seasonal allergies. Additionally, these failures can pile up, creating a negative feedback loop that dominoes and harms other health related areas.

Proposed Design Sketches

Design 1

Our first design is very focused on using a centralized dashboard that provides a comprehensive view of home. This design can be seen in **Figure 2**. The dashboard allows the home to be broken up by individual rooms. In each individual room, you can see more detail concerning tasks related to the room. You can also see that room's cleaning history, how long it has been since each task had been last performed, and how long it normally takes to accomplish a task. This detailed view is illustrated in **Figure 4**. This design requires some initial setup for maintenance and task reminders as shown in **Figure 3**. Additionally, the dashboard main menu shows notifications for when maintenance tasks should be performed and warns users of future visitors.





Figure 2 Tab design shown in context

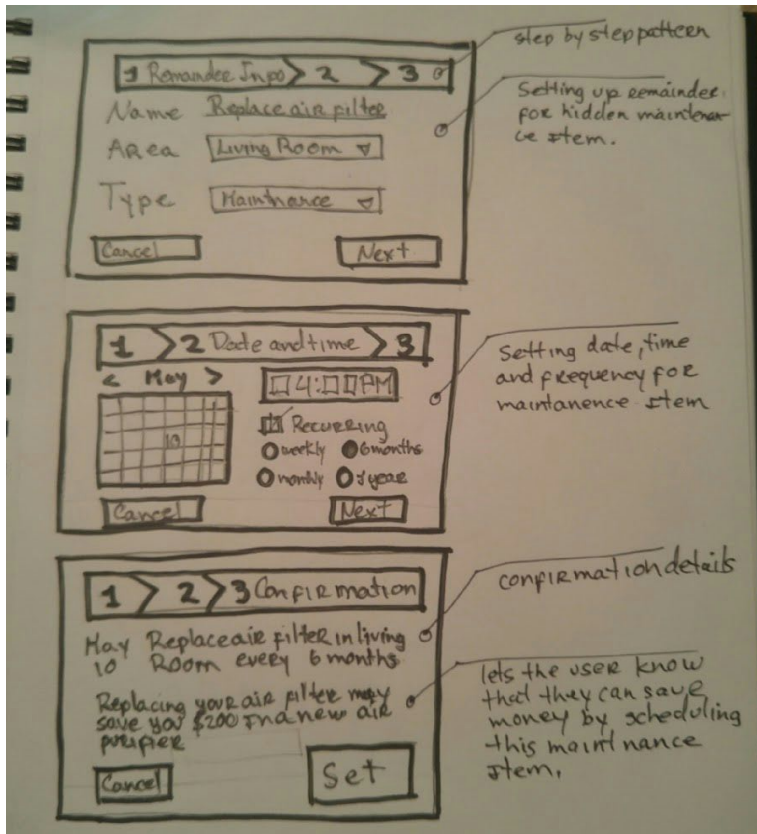


Figure 3 Entering a maintenance reminder

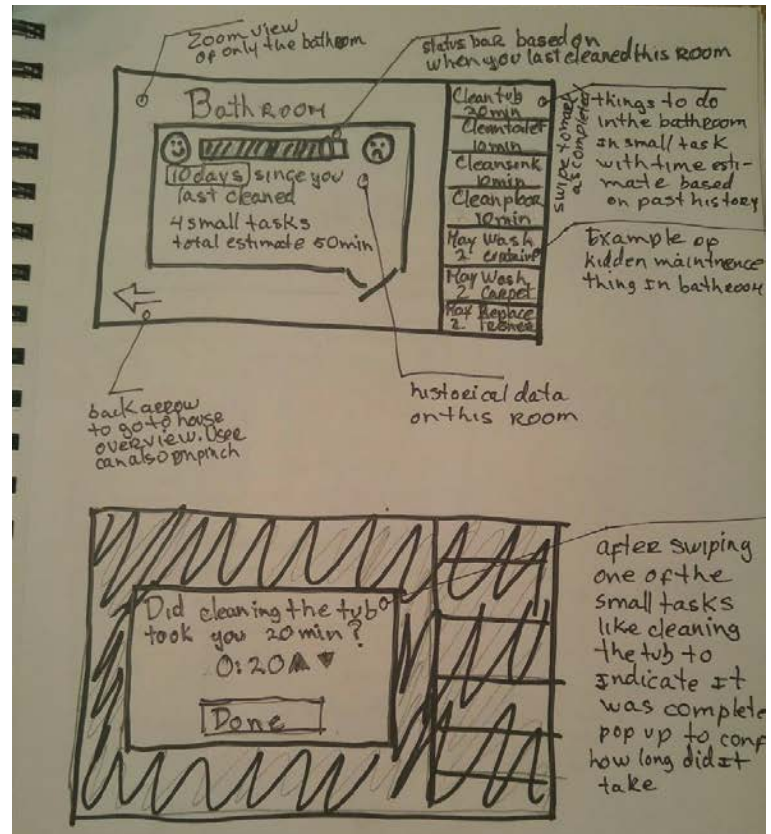


Figure 4 Showing room status and marking task as completed

Design 2

Our second design is focused on tracking cleaning chores in a manner that requires minimal input from the user. Data input from the user's end is simplified when compared to the dashboard design. We use a waterproof wearable concept that communicates to a smartphone application that allows users to input data simply with their voices. This can be seen in **Figure 5**. Users can record data by speaking into the wearable, saying for example, "start cleaning bathroom" or "stop cleaning bathroom". Then, from the smartphone app the user can have access to their cleaning history. Additionally, the user can enter the time they have available for cleaning through the app and get suggestions based on their cleaning history of what will benefit the overall cleaning state of the house the most. This feature is shown in **Figure 5**. The app also offers cleaning reminders and provides a plan of action when it detects external triggers such as friends coming over. This last feature can be seen in **Figure 6**.

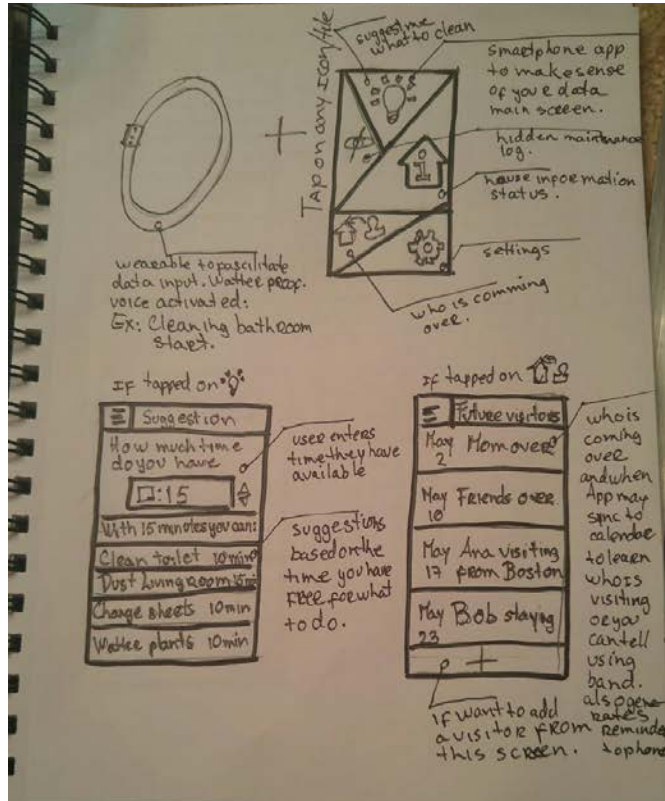


Figure 5 Wearable + Smartphone App

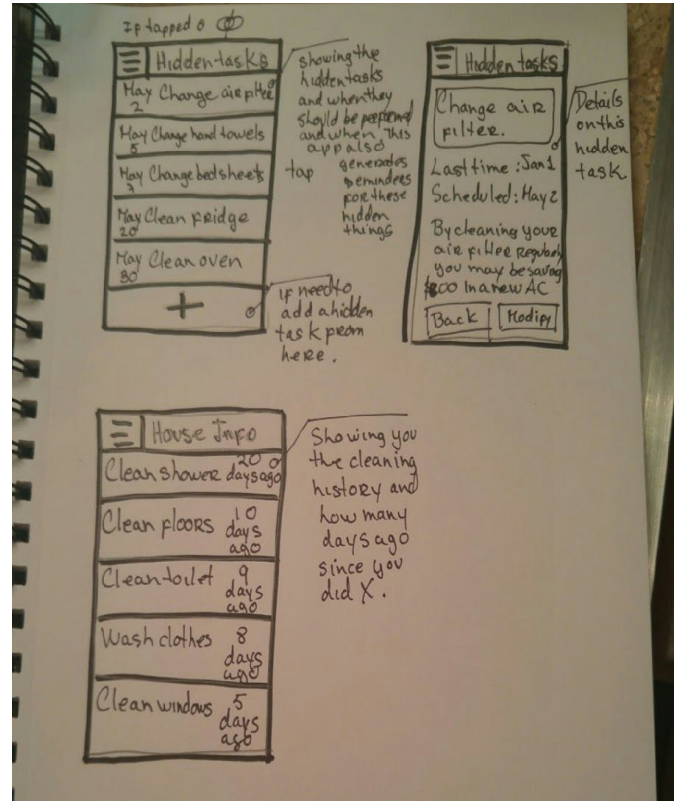


Figure 6 Suggested Cleaning Chores

Design 3

Our third design is focused on setting aside time for cleaning. The mobile app will work from the lock screen to help you find time to perform house chores. Scheduling happens via two routes: active scheduling, or passive suggestions. In active scheduling in **Figure 7**, the user sees his or her schedule and decides themselves when it would be best to clean by dragging out a specific time slot. In passive suggestions in **Figure 8**, the user sees different tailored options for when he or she could clean and simply selects which suggestion is best. This app will also deliver notifications to warn users with enough time of potential visitors and generate reminders to perform maintenance to house appliances.

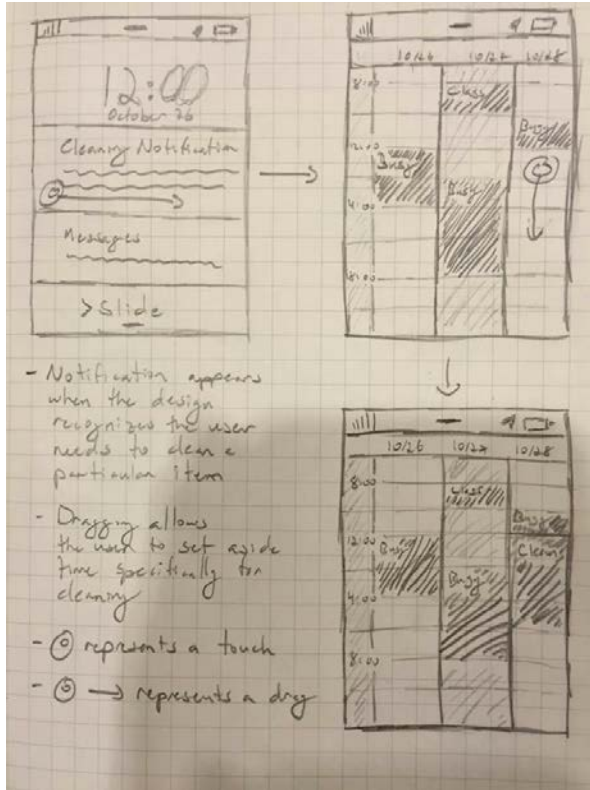


Figure 7 Active Scheduling

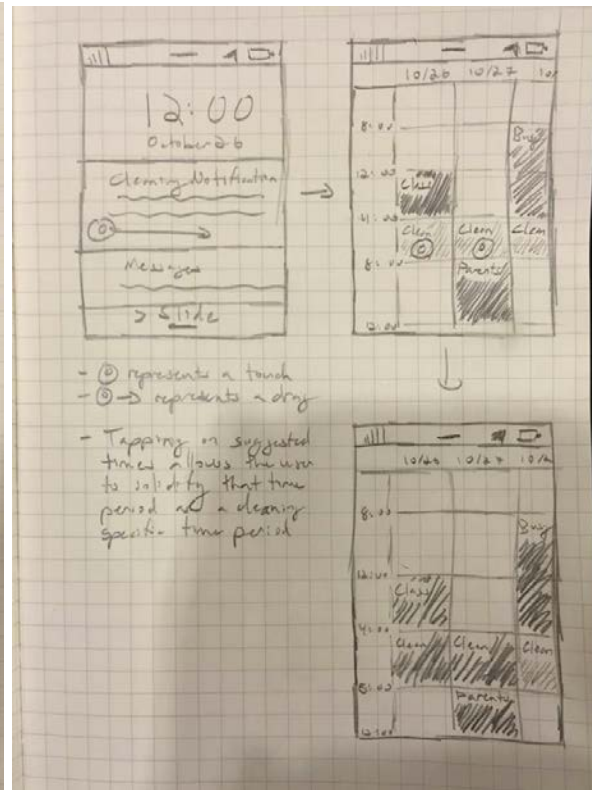


Figure 8 Passive Scheduling

Design to Pursue

After receiving feedback, we realized that none of our designs were quite complete. We had some good ideas, but we needed to go back to our contextual inquiries and ask ourselves how we could help our users keep their homes clean without adding more work or being obtrusive. We went with a home system that takes advantage of smart devices around the house for data input and output. This interaction between devices can be seen in **Figure 9**. Neat will use the user's personal data such as emails and text messages to determine external triggers such as throwing a party or having the parents come over. Additionally, we will use a waterproof wearable to collect the following cleaning metrics through voice commands: time on task, frequency and what the task is. The voice commands will be short and simple. For example, "start cleaning bedroom" and "stop cleaning bedroom" are phrases to mark the beginning and end of a bedroom cleaning session. We will use those tracked cleaning metrics to generate task estimates and cleaning plans. Neat will also take advantage of TVs and computers to determine what the user is doing and display messages to them to encourage cleaning activities if possible. For example, if the user has been watching TV for the last couple of hours, Neat will



detect that behavior. Then, during commercial breaks or right after an episode ends, it will generate a message on the TV or computer letting the user know how long they have been at that activity and how can they contribute to cleaning the house if they were to dedicate a few minutes. This feature is exhibited in **Figure 11**. With this approach of using the smart device ecosystem around the house, we can also motivate the user by using external triggers to jump start cleaning activities. This feature is also shown in **Figure 11**. This system will also support basic tasks like providing an overview of the cleanliness of the house, historical data on when was the last time something got cleaned, and an estimate for how long it will be before an appliance needs to be cleaned again. This predictive feature is shown in **Figure 10**.

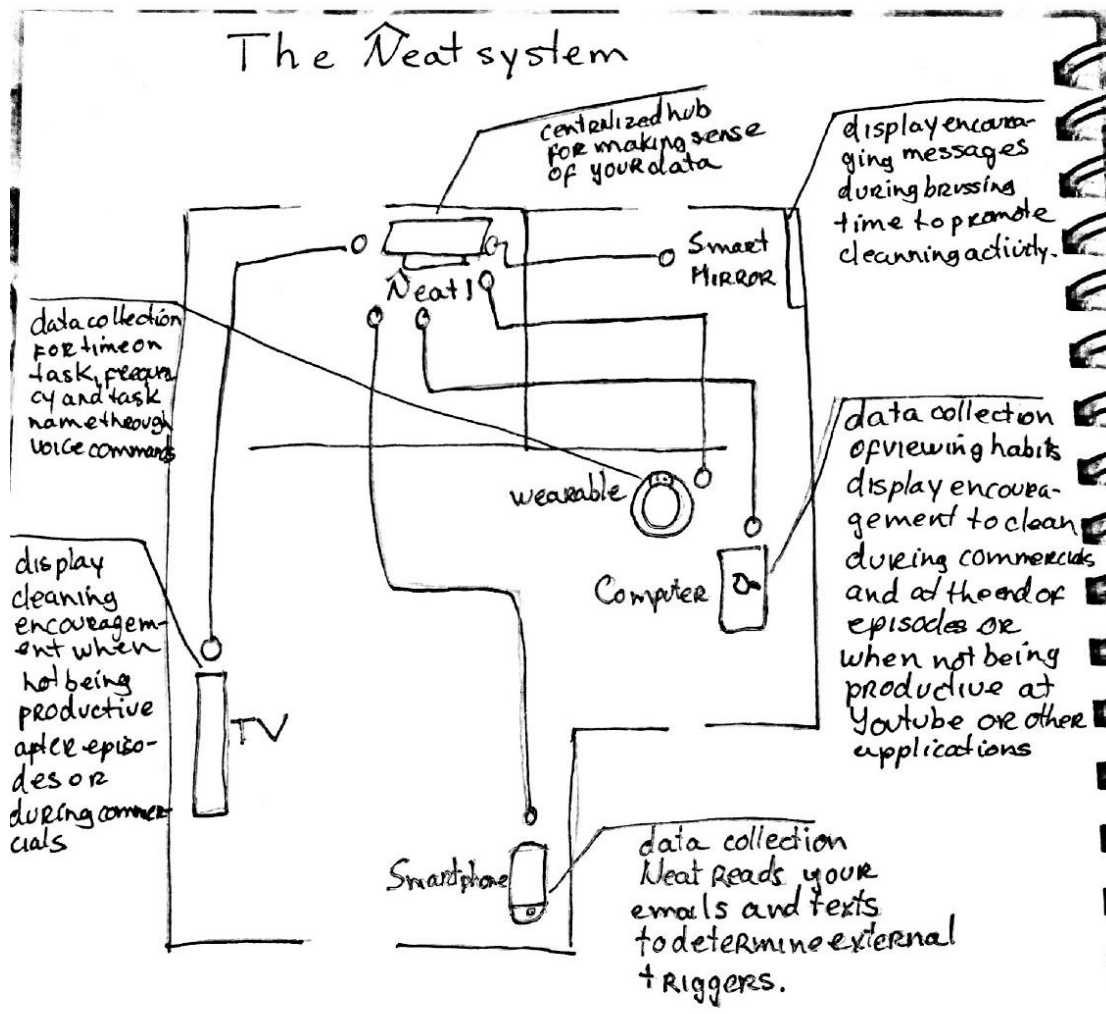






Figure 9 Interaction between smart devices within the home

		
Neat suggests you do the following tasks before mom arrives		 Mom is arriving in 4 days Have the house ready. To do: 6 tasks Total time: 50"
Today	Clean bath sink 10"	
Tomorrow	Clean toilet 15"	
Tomorrow	Swipe floors/living 10"	
Tomorrow	Clean kitchen counter 10"	
Friday	Change sheets 5"	

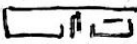



						
In 15" you could ...		 How much time do you have?				
	Dust the floor 15"					
	Clean the toilet 15"					
	Clean the mirrors 10"					
	Change towels 5"					
	Wipe counters 10"	<table border="1"> <tr> <td>15"</td> <td>30"</td> </tr> <tr> <td>45"</td> <td>60"</td> </tr> </table>	15"	30"	45"	60"
15"	30"					
45"	60"					

Figure 11 External triggers and suggested cleaning tasks given the user's available free time

Written Scenarios

Scenario 1 (Storyboard 1)

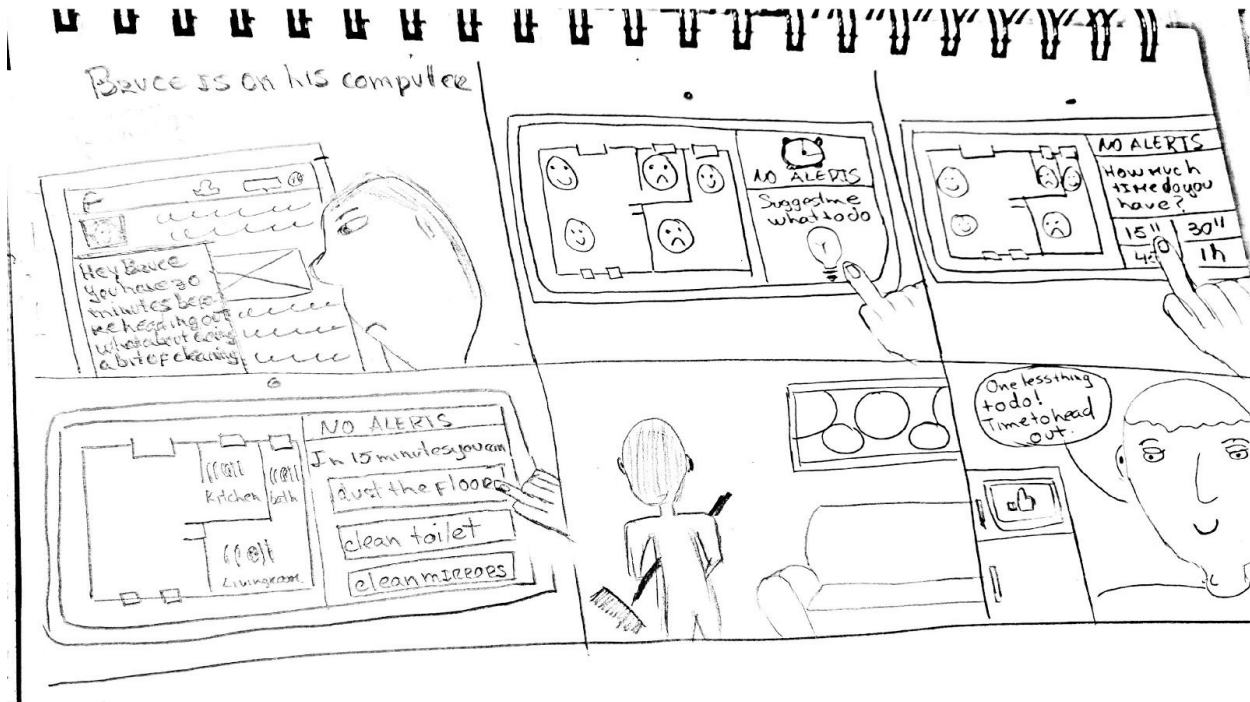
Bruce is a man that works for an Engineering company. He spends most of his time on the computer working and rarely finds time to clean. When Neat detects that he is watching YouTube videos and not working, it automatically displays and suggests that Bruce takes some time to clean in between videos. Bruce mentally agrees and goes to checkout the dashboard. After clicking on the suggestion button, Neat asks him about the amount of time he wants to spend on cleaning. He figures that he only has 15 minutes to spare for cleaning. He enters in 15 minutes, and Neat gives him a task that he will be able to complete within the given timeframe. After he completes the cleaning chore, Neat saves and tracks his cleaning history, and Bruce would not worry about cleaning that space again for a while.

Scenario 2 (Storyboard 2)

Jane is a student at UW in the Biology department. Her studies take up all of her time and she can't wait to have time when she can relax and enjoy her evenings. She works hard to finish her homework early so she can watch TV in the evening. As she watches TV, Neat detects that she has been watching TV for a long time. It sends her a message on the TV screen saying that she has been watching for two hours and reminds her that her mother is visiting in two days. After receiving the notification, she goes to the dashboard and selects alerts, which tells her that her mother is visiting, shows her an overview of the problematic areas, and suggests a cleaning plan. After following the plan and cleaning those rooms, Jane is happy and ready to welcome her mother.



Storyboards



Storyboard 1 Suggest Cleaning Tasks



Storyboard 2 Cleaning Encouragement

