Phase 1 – Deliverable
Due: 03/20/2015

Team: 15
Team / Product Name: Control Freak
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Phase 1 - Analysis

Introduction

The *Control Freak* will allow residents to remotely monitor and control electronic features of their home with a powerful, dynamic web application that can be accessed from any location or device. The user will be able to control features of their home including, but not limited to, alarms, door locks, lights, television, thermostat, washer, dryer, dishwasher, oven, garage door, and coffee maker. A focus on the simple, intuitive interface will give users information about their home while they are away, leaving them with a sense of security and ease. The *Control Freak* will secure the users home and reduce the time it takes to perform everyday chores. A hands-free feature will give users information and access to their home, even while driving.

Preparation

To tailor the scope of this assignment for this specific project we decided to focus more on the automation of household appliances, rather than simply the monitoring and utilization of appliances. We also decided to pay less attention to how the appliances work specifically. Originally, we were focused specifically on homeowners; however, we decided to focus more on the functional aspect of the user, rather than the fact they are a homeowner. Therefore, *Control Freak* will apply to any residential person, regardless of their type of residence.

To prepare for interviews and observation, we took the following steps:

1. Research current home automation tools that currently exist.
2. Generate questions that focus on the current situation.
3. Create a list of potential people to interview and observe.
4. Determine a way to record gathered information.

Contextual Inquiry

We decided to interview a total of six people, because we wanted to obtain a variety of information from different residential locations and different ages. Below is a list of the people we interviewed, including some relevant information.

1. *Name*: Stephanie Robohn
   Job Title: Assistant Teacher
   Responsibilities: Homeowner; mother; dog owner

2. *Name*: James Henry
   Job Title: Bartender
   Responsibilities: Cat owner; apartment renter; hosts D&D Nights

3. *Name*: Ramona Jeffries
   Job Title: Librarian Assistant
   Responsibilities: Homeowner; mother; cat owner

4. *Name*: Jessica Gil
   Job Title: Student
   Responsibilities: provide for self; town house renter

5. *Name*: Mckenna Millington
   Job Title: Student
   Responsibilities: provide for self; duplex renter; cat owner

6. *Name*: Eddie Jeffries
   Job Title: Group Manager
   Responsibilities: homeowner; father; cat owner

The initial interview questions we constructed are below.

1. What electronic devices / appliances do you own in your house?
2. How often do you use these devices / appliances?
3. Who in your home uses the devices / appliances?
4. What do you use to control these devices / appliances?
5. Note if it is an application or a physical device
6. If it is an application, what is the compatibility?
7. Does it work on Android, iPhone, Windows Phone, desktop computer?
8. What do you think about the security of the application?
9. How often do you use these controls for the electronic devices / appliances?
10. Who in your home uses these control devices / services?
11. Why do you use these control devices / services?
12. How would you rate the control device / service?
13. What is your favorite aspect or feature of the control device / service?
14. What are some flaws in the control device / service?
15. What do you think about the price of your control device / service?
16. What are some activities you perform with these appliances that you do every day at the same time of day?
17. Are there any common times that you leave your house everyday / come back every day? If so, what are these times?
18. Is there anything you would want to know about your appliances while you are away?

From meeting with our initial contacts we obtained very useful information from the questions we asked. Most interviewees were very interested and talkative about the subject; however, there were some that did not have much input on the topic. The raw data we collected included answers to the interview questions, photos of current appliances, and videos of how the appliances are currently used. We collected this data by interviewing a variety of residents and observing their use of current house hold appliances. Below are some of the artifacts we acquired during the interviews. We used these artifacts to evaluate the different settings on various devices and analyze how they are currently being used before the *Control Freak*.


1.A

1.B


1.C


1.D

Figure 1.A,B,C,D – Some examples of devices to be controlled by the Control Freak. These will range from large appliances like washers and dryers to a ceiling fan with a light. An apartment renter is shown manually controlling her dishwasher.

Some conclusions we were able to infer from the artifacts include the following.

- *Figure* 1.A and 1.B
    - We are able to conclude that although two devices may be the same, they can still be very different.
        - There are different setting choices for the same appliance, in this case, a washer machine
    - *Figure* 1.A is a washer / dryer combo while *Figure* 1.B is a separate washer and dryer
    - We can generalize that for various appliances there are many different models and different settings that must be accounted for to create a generalizable application that controls multiple appliances of different models
        - Something we may need to consider is requiring a particular model for the universal control system so that these factors are accounted for
- *Figure* 1. C
    - In this photograph we can see two different versions of lights
        - One has a is a ceiling light with a fan attached
        - The other is a standing lamp
    - There may be different architectural different in turning on different types of lights
    - What about the light switches that turn lights on and off via a gradient? (slide the switch up to make the light brighter or down to make it dimmer)
    - The *control freak* will need to account for different types of lights or decide whether gradients or settings will be eliminated, accounting for only turning on and off appliances
- *Figure* 1. D
    - This figure shows a user actually turning on an appliance, the dishwasher
    - This shows us that the user has to actually approach the appliance and physically turn dials to use the appliance
    - This may be a more difficult appliance to control if it involves dial-turning rather than button pushing, which should be accounted for when devising the applicant and / or deciding which appliances should be included in the *Control Freak*

Some of the raw notes we obtained during the interviews include the following.

- What electronic devices do you own in your house?
    - TV, Washer/Dryer, oven, fridge, dishwasher, microwave, stereo, thermostat, computer, telephone, coffee maker, tea pot, mixer, wine cooler, bar fridge
- How often do you use these devices?
    - Appliances, daily. Coffee maker, teapot, daily.
- Who in your home uses the devices?
    - Self mainly for kitchen things, husband more TV electronics
- What do you use to control these devices?

    - Manual input for everything but the TV/stereo
- Control physical or application?
    - Physical device, universal remote for tv/stereo etc

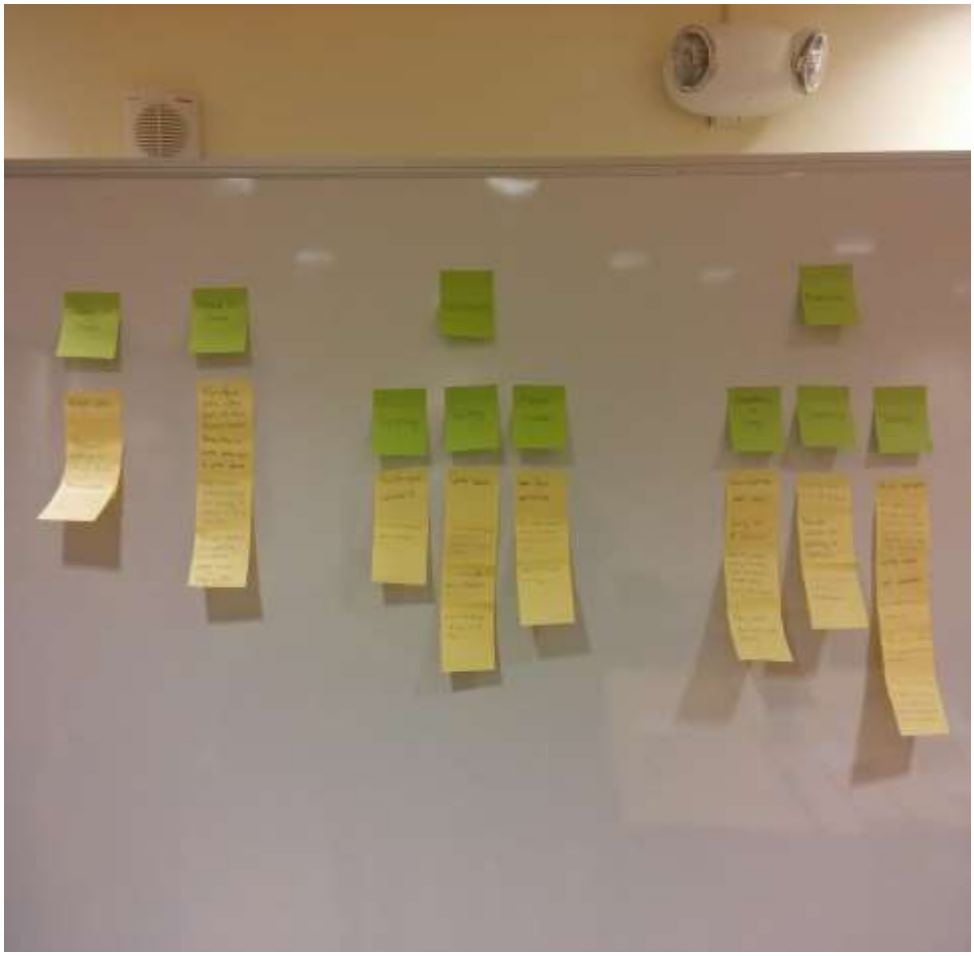
Contextual Analysis

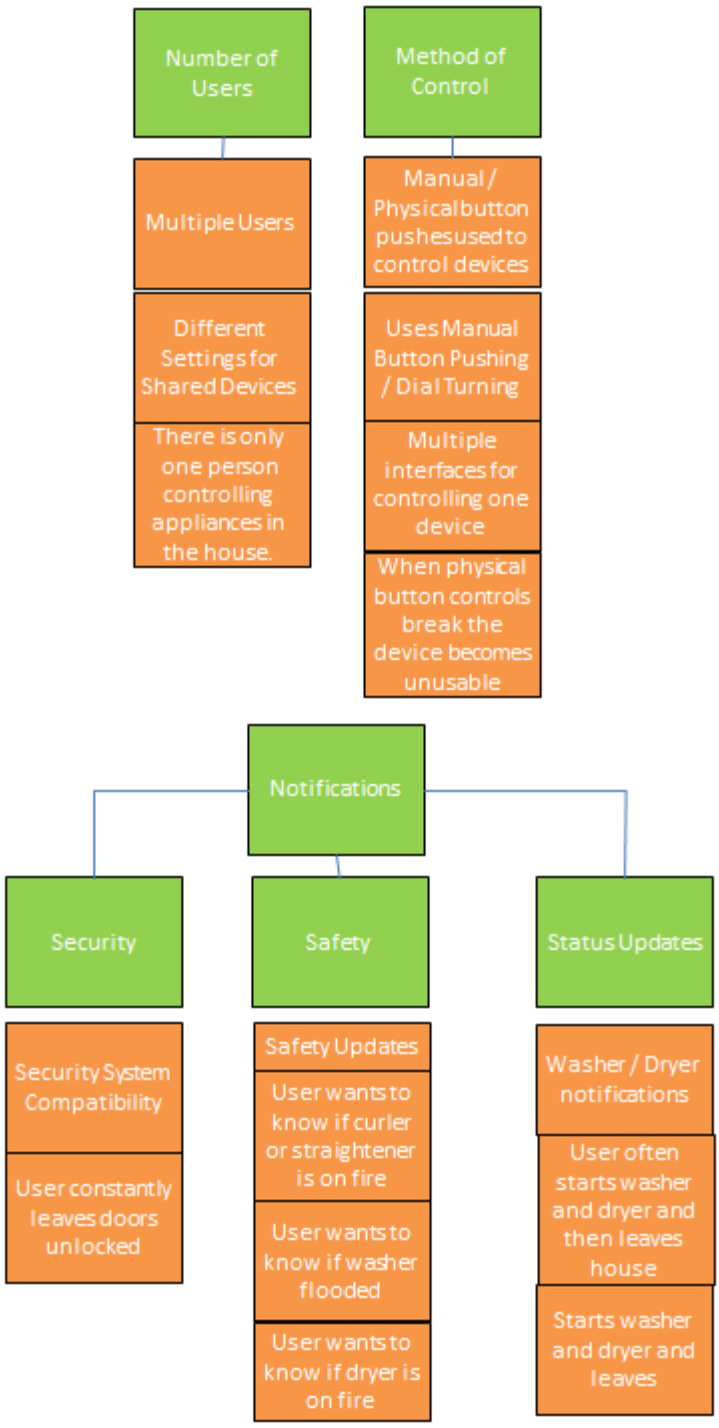
To build our work activity affinity diagram (WAAD), we performed the following steps.

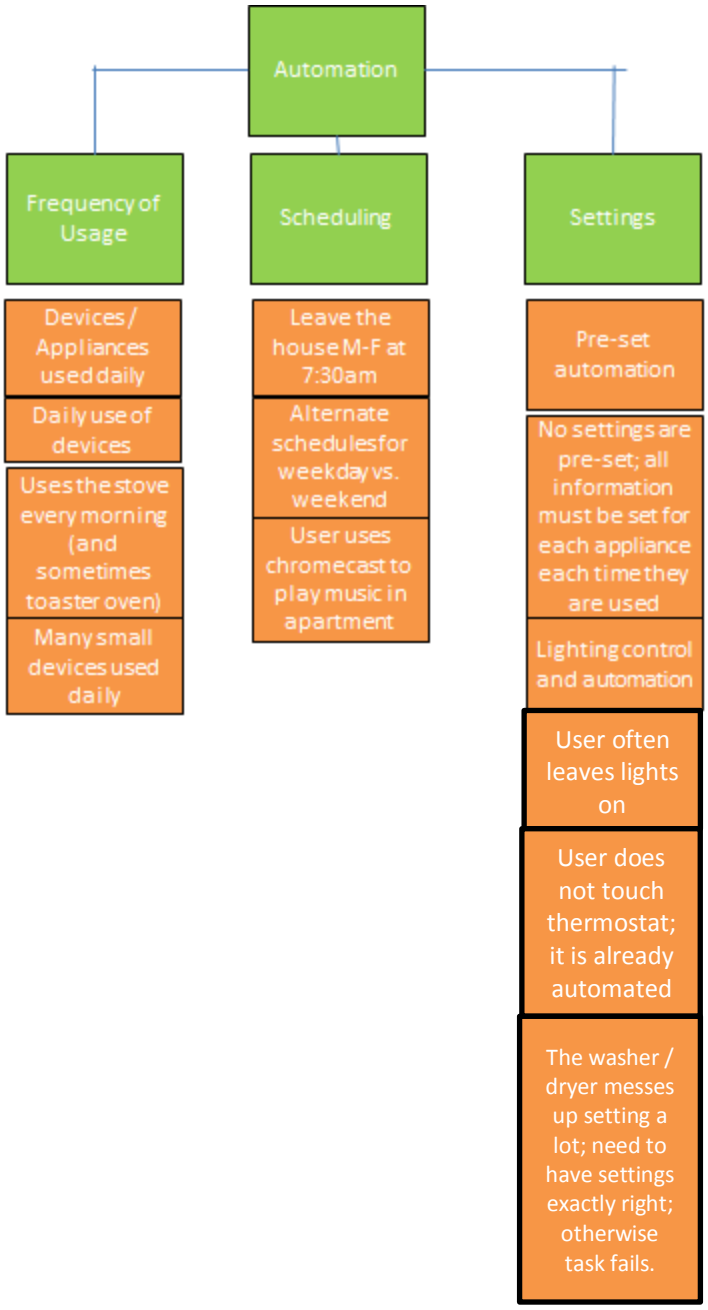
1. Evaluated the answers we received to the interview questions.
2. Synthesized work activity notes on post-it notes based on the data we received.
3. Grouped similar post-it notes together.
4. Came up with categories based on the similar groupings.
5. Evaluated what we had and moved items around based on team consensus.
6. Iterated this process several times.
7. Concluded the process and obtained final WAAD.

Below are some photos of us working together to construct the WAAD.

Below is the final version of the WAAD in an overall picture format and a more computer-readable format.




Number of Users
Multiple Users
Different Settings for Shared Devices
There is only one person controlling appliances in the house.
Method of Control
Manual / Physical button pushes used to control devices
Uses Manual Button Pushing / Dial Turning
Multiple interfaces for controlling one device
When physical button controls break the device becomes unusable
Notifications
Security
Security System Compatibility
User constantly leaves doors unlocked
Safety
Safety Updates
User wants to know if curler or straightener is on fire
User wants to know if washer flooded
User wants to know if dryer is on fire
Status Updates
Washer / Dryer notifications
User often starts washer and dryer and then leaves house
Starts washer and dryer and leaves



This project requires various work roles, sub-roles, and machine roles. The roles are below.

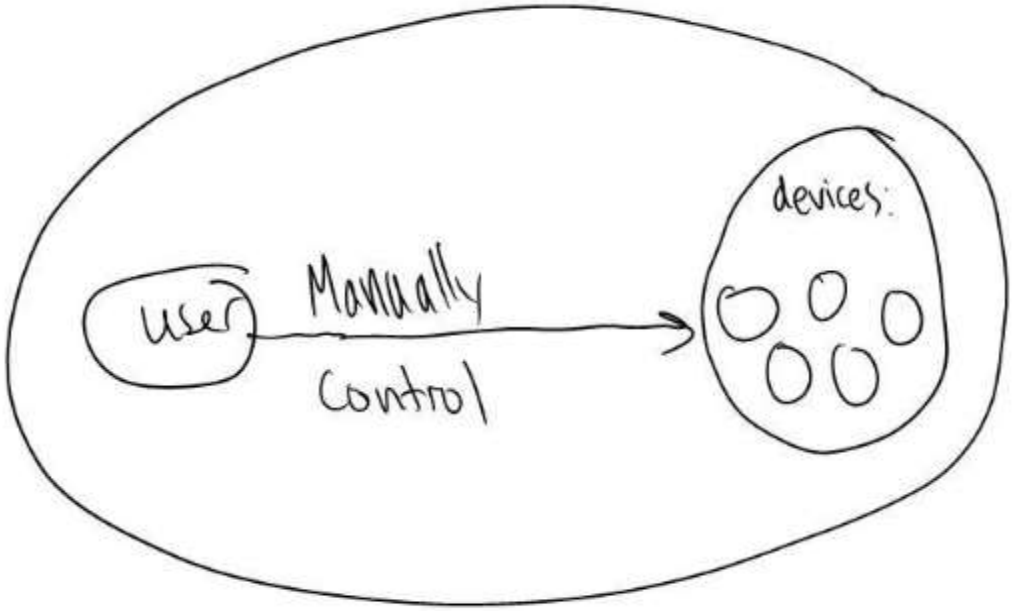
- Work roles and Sub-Roles:
    - Checking Status of Appliances
      Users are able to check the status of appliances
        - Warnings
          Users receive warning if there is a hazardous situation such as the washer flooding or the stove catching fire.
        - Simple statuses

User is warned if an appliance is left on or off

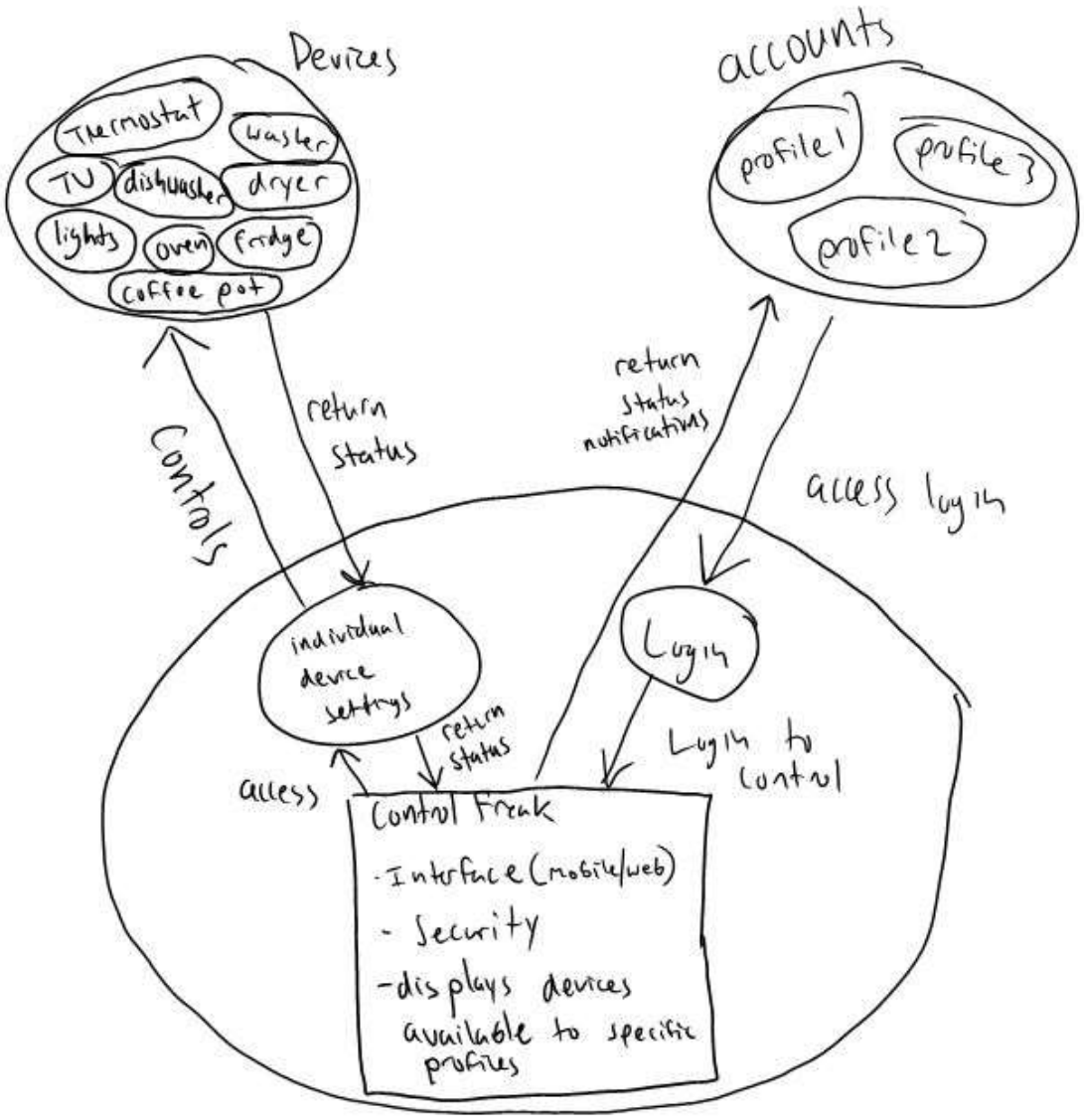
- Automating Appliances
  User is able to automate appliance
  - Turning on Appliance at a certain time
    User can set a certain time to turn an appliance on
  - Turning off Appliance at a certain time
    User can set a certain time to turn off an appliance
  - Saving settings for a particular appliance
    User can save settings of preference for particular appliances (e.g. changing the dishwasher setting to "pots and pans")
- Real-time Appliance Control
  User is able to control an appliance in real time
  - Turning off appliance
    User can turn off an appliance
  - Turning on appliance
    User can turn on an appliance
  - Changing settings of an appliance
    User can change the settings on an appliance
- Permissions
  Different users can only control certain devices
  - Changing control access for certain users
    The user can change who can access certain devices by locking certain devices or requiring passwords

- Machine roles:
  - Physically interface with each device being controlled.
  - Issue commands to each device.
  - Read status of device.
  - Connect each of these devices through Wi-Fi to the application's control system.
  - Provide an interface that can be accessed from a mobile device or desktop computer.
  - Routinely run tasks pre-set by the user
  - Run ad hoc tasks triggered by user.
  - Provide status updates to user.
  - Notify the user of catastrophic equipment failure.
  - Provide an API so that manufacturers can easily design equipment to interface with the Control Freak.

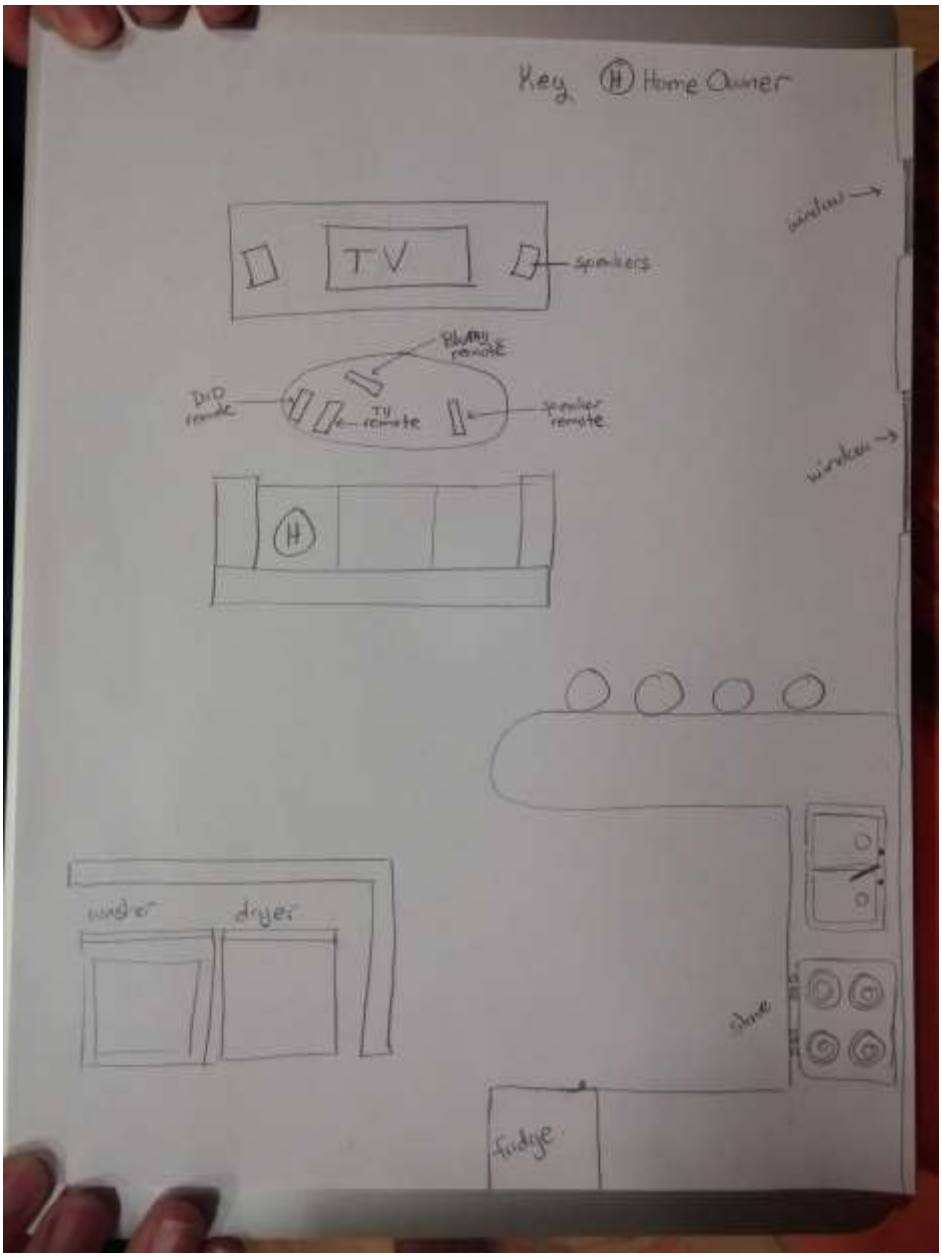
We constructed an initial flow diagram to demonstrate a broad view of controlling appliances with the *Control Freak*. The initial flow diagram is below.



Then we constructed a flow diagram to demonstrate a broad view of a home with the *Control Freak*. The after flow diagram is as follows.



We then also constructed a Physical Model for an average person using appliances in their home before the *Control Freak*. From this figure we see that there are multiple devices for various appliances. The home owner is unable to check the status of the washer and dryer from his / her current location. The home owner is also unable to tell if the kitchen may be on fire.



We were able to develop a list of requirements by: first, creating a WAAD based off of the raw data from the interviews; then performing a "wall walk" in which we determined if certain work activity notes could be constructed into requirements; and finally refining the notes into more specific requirements. Some of the requirements we constructed are below.

1. Control devices.
2. Create multiple users for controlling specific devices / permissions.
    a. e.g. kid can use TV but not thermostat.
3. Create controls for multiple different appliances.
4. Save settings for each appliance.

    a. e.g. Using washer dryer - use “Jeans” setting (created before)
5. Set scheduled times for device to turn on / off.
6. Display the status of appliances.
7. Notify user of critical failures from appliances.
8. Access controls and information from a web / mobile device.
9. User must login to access control of appliances.
10. Customize what device is shown for each user on the main page.

Discussion

For this project we decided to make a before / after flow model and a Physical Model. The before flow model shows the use of every day appliances before our system, and an after one that showed the effects of the *Control Freak*. We decided to use flow models, because they best represent the before and after effects that our system has on residents. The flow model allows the viewer to see all of the various aspects of information and design requirements in a more simple design. Our system is designed to increase efficiency in the user’s workflow, so we determined that a before and after flow model would best present that increase.