

HOUSE

Preface

The intention of this project was to explore the possibilities of home comfort. I was specifically intrigued with creating an interface that would allow users to confidently control the temperature of their home without needing to see the actual value. This spun into the idea of adjusting comfort relative to how you feel and changing the the paradigm of thermostat control via iOS app.

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RESEARCH



KEEN

home

RESEARCH 1.1

Smart vents

Keen Home sells Smart Vents - a system of vents that are connected wirelessly through the internet.

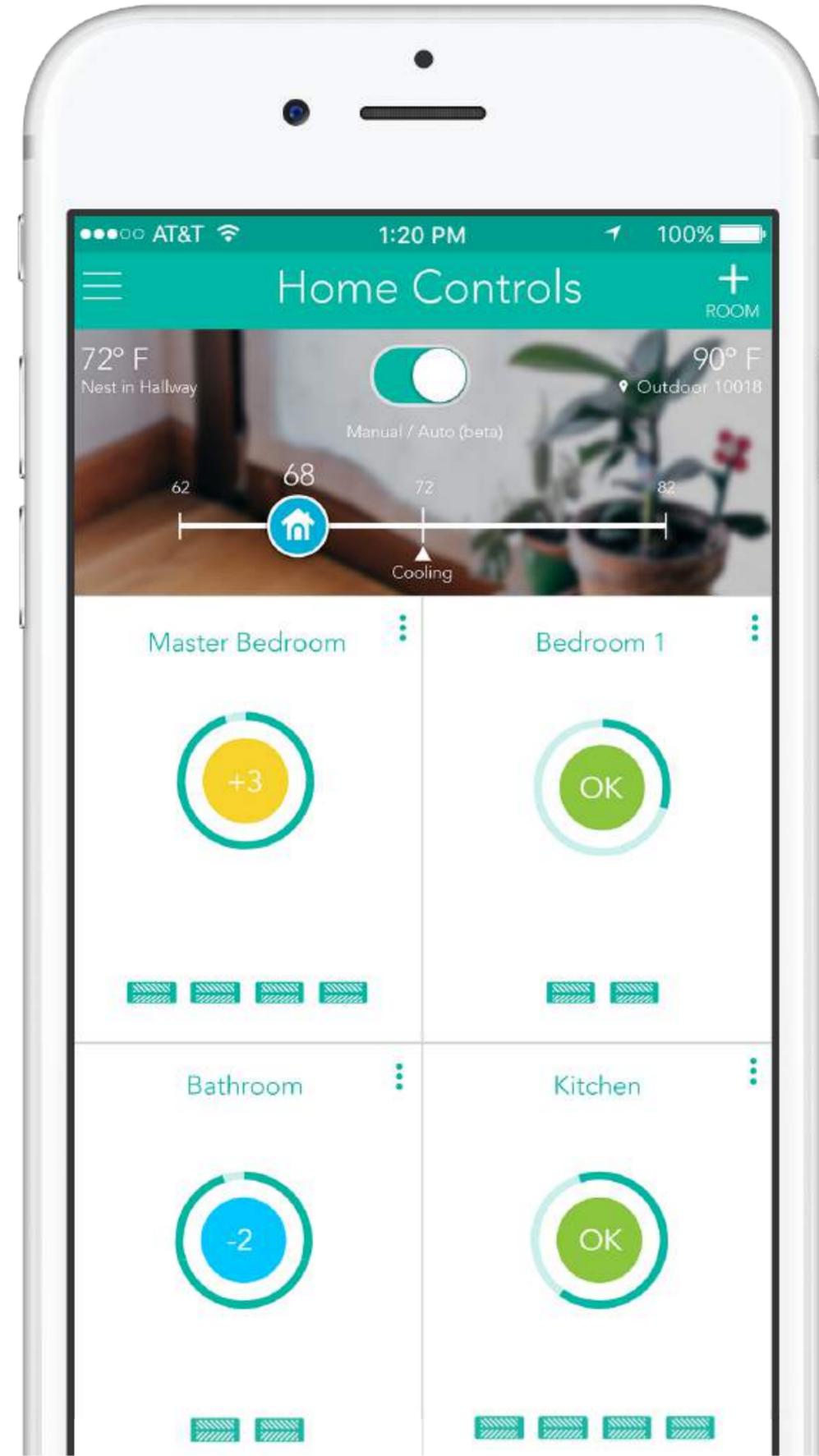
Adjusting airflow in each vent allows for control over heating and cooling in individual rooms.

These vents are also equipped with air purifying technology that provides an added benefit.



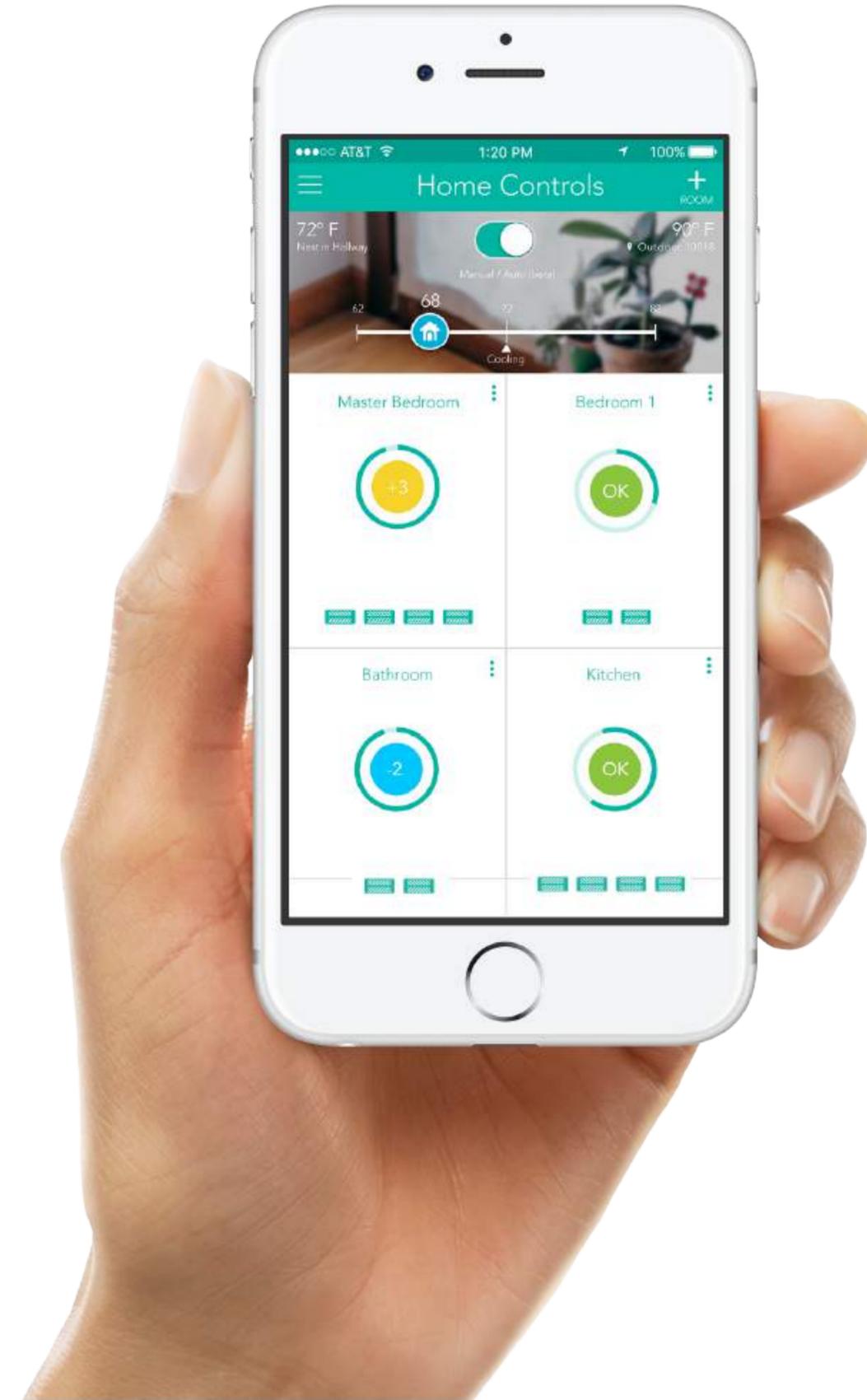
App features

- Analyze your home to determine the right number of Smart Vents
- Activate your Keen Home Smart Bridge.
- Add and control Keen Home Smart Vents manually or in Auto Balancing mode (Beta).
- Displays the outdoor temperature
- Set occupancy schedules for each room of your home.



Takeaways

- They found a need to clearly demonstrate the operation and function of the vents
- The app assists homeowners in determining the quantity and placement of the vents. This means they were onboarding users who didn't have the physical product yet.
- They found it beneficial to help homeowners understand the interplay between airflow and temperature
- The outdoor temperature seems to be an important factor in the users decision





Patent App. #14951206

- Wirelessly controlled vents that restrict airflow in order to control individual room temperature.
- Uses sensors on each vent in order to detect the conditions in that room or zone.
- Vents communicate with a central system that oversees and controls the vents.
- The vents must be programmed to awake periodically in order to check for new signals from the home base.

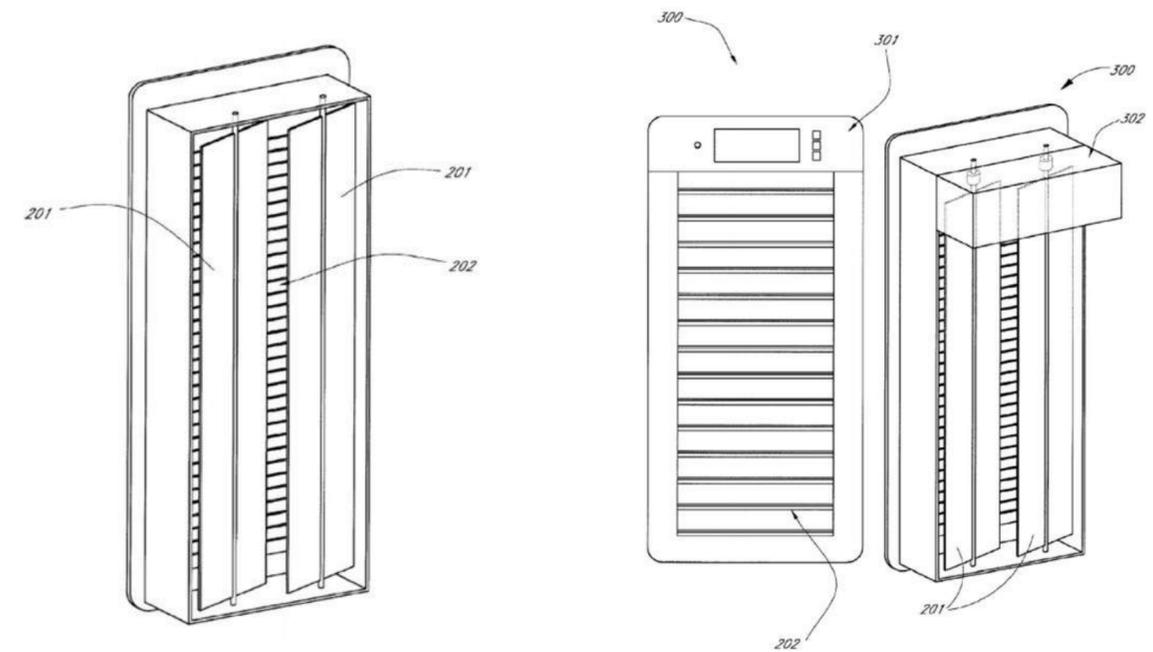
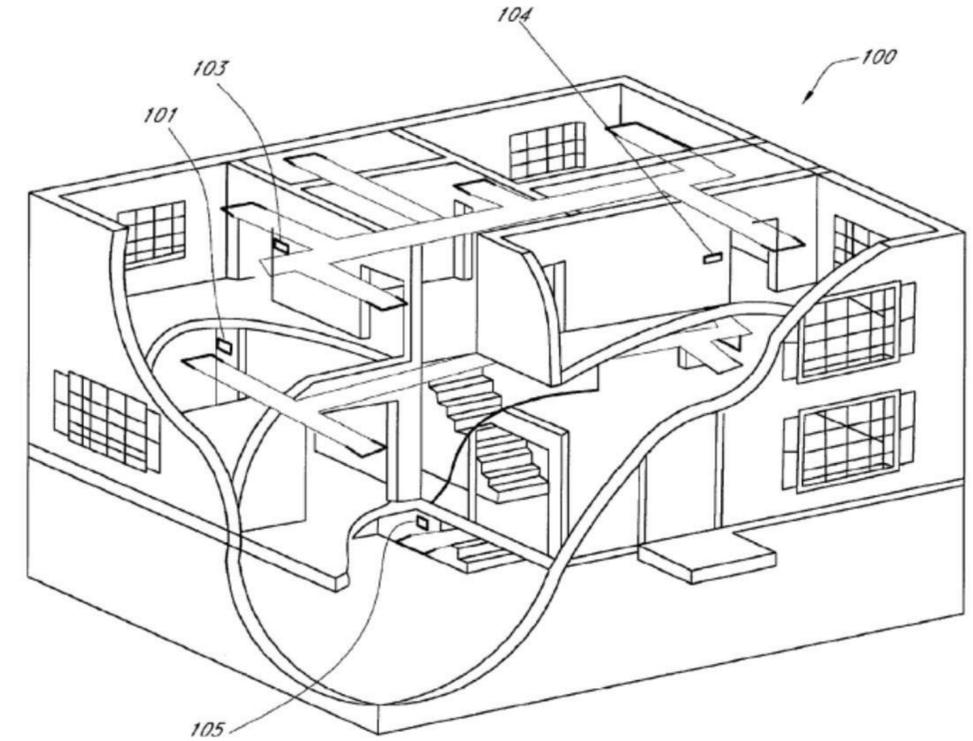


FIG. 3A

FIG. 3B

Google Home

- A voice assistant that provides real-time answers, contextual updates, and voice-control over smart devices
- Particularly provides voice access to the Nest thermostat system
- Uses lights on the top surface to indicate whether or not the system is listening
- User can assign smart device tasks to any voice command using IFTTT



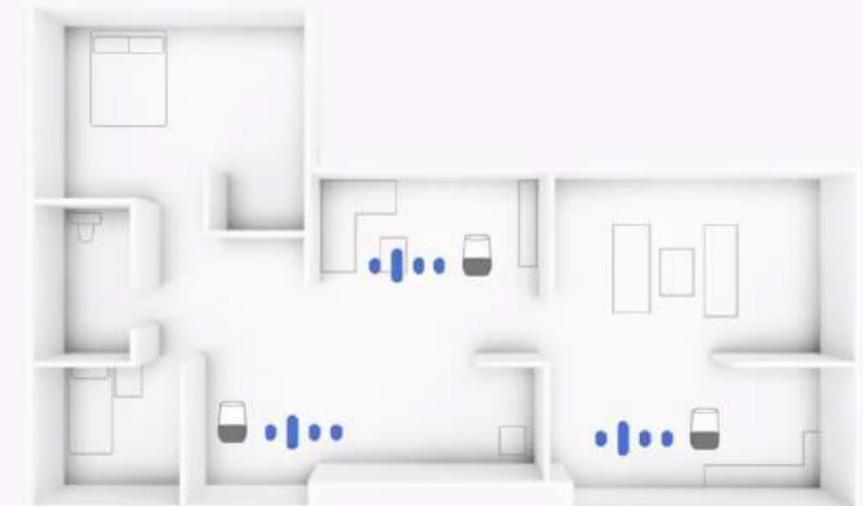
Takeaways

- Voice interactions are becoming more seamless with natural language processing and offer a platform for an intuitive interface
- The direction that big players intend to push home automation is away from a GUI and towards a voice-command interface
- Multiple Google Home devices spread across different rooms can provide even more contextual interactions and collaborate

Set the thermostat to 72 degrees.

Turn up the thermostat.

What's the temperature inside?



nest®

Prevalance

Nest is the most popular smart thermostat and everyone's initial thought when one is mentioned. Breaking into the smart home market means an inevitable comparison to the Nest system.

The device detects temperature, humidity, near-field activity, far-field activity, and ambient light.

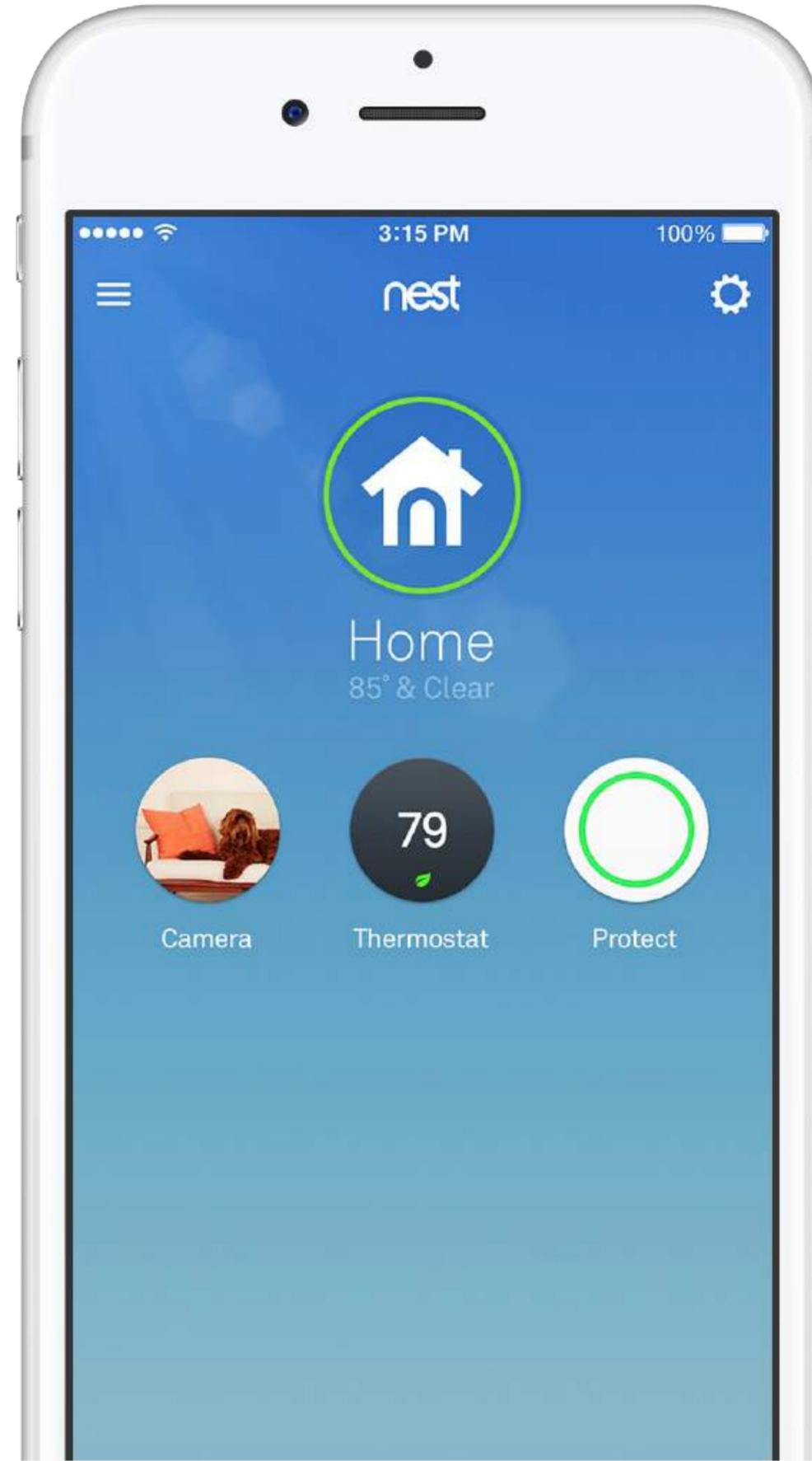
Nest has branched out beyond the thermostat into other areas of home automation including smoke/CO detectors and security cameras.

Nest's learning capabilities reduced the energy used on heating by 12% and on cooling by 15% based on a study in 41 US states in 2014.

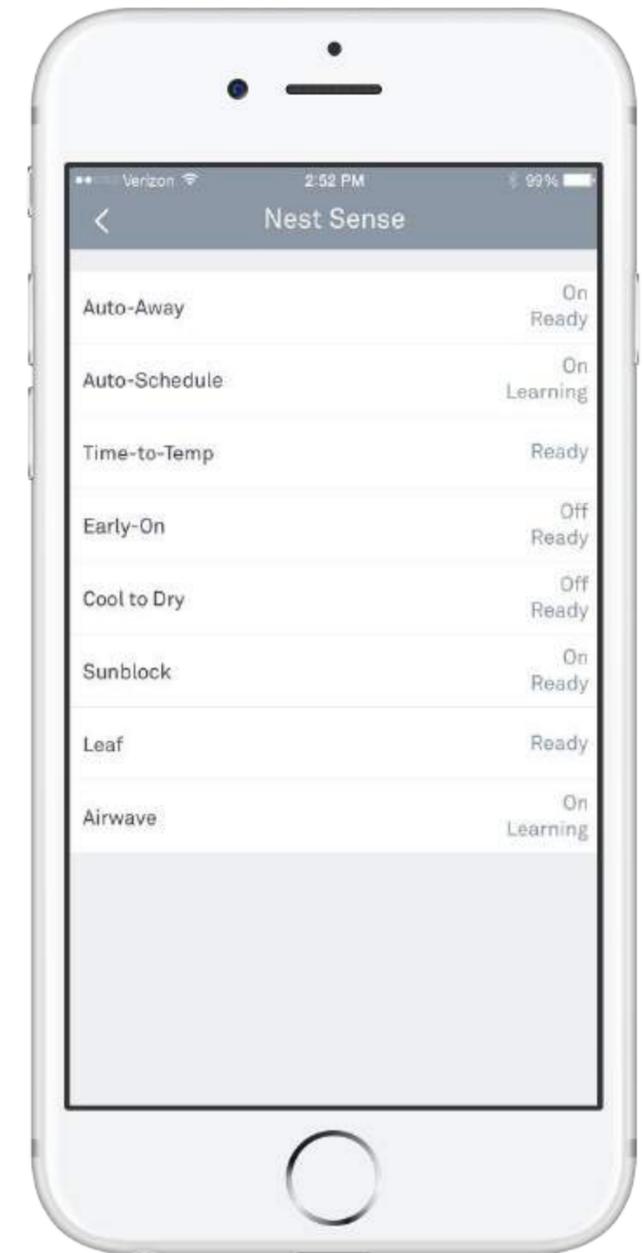


App features

- Uses sensors, algorithms and the location of your phone to program itself in about a week
- Family accounts in order to give/adjust access of various users
- Provides 10 day Energy History and Safety History and provides insights
- Adjust thermostat temperature and fan speed and create a schedule manually



iOS screens



Apple Watch features

- Focused on immediately adjusting the thermostat (instead of scheduling, etc.)
- Manually set your thermostat and other connected products to Home or Away mode
- Set and adjust your thermostat's current target temperature
- Switch your thermostat between Heating, Cooling and Off modes
- Recieve all of the same Nest notifications that you get on your iPhone



Apple Watch screens



Takeaways

- A bridge between analog and digital with beautiful UI controls
- Provides an affordance by utilizing one traditional way of adjusting a wall-mounted thermostat with a number on a dial
- Strong use of color to easily indicate the different heating/cooling states
- Designers of the app were challenged to emulate the actual Nest device on the wall



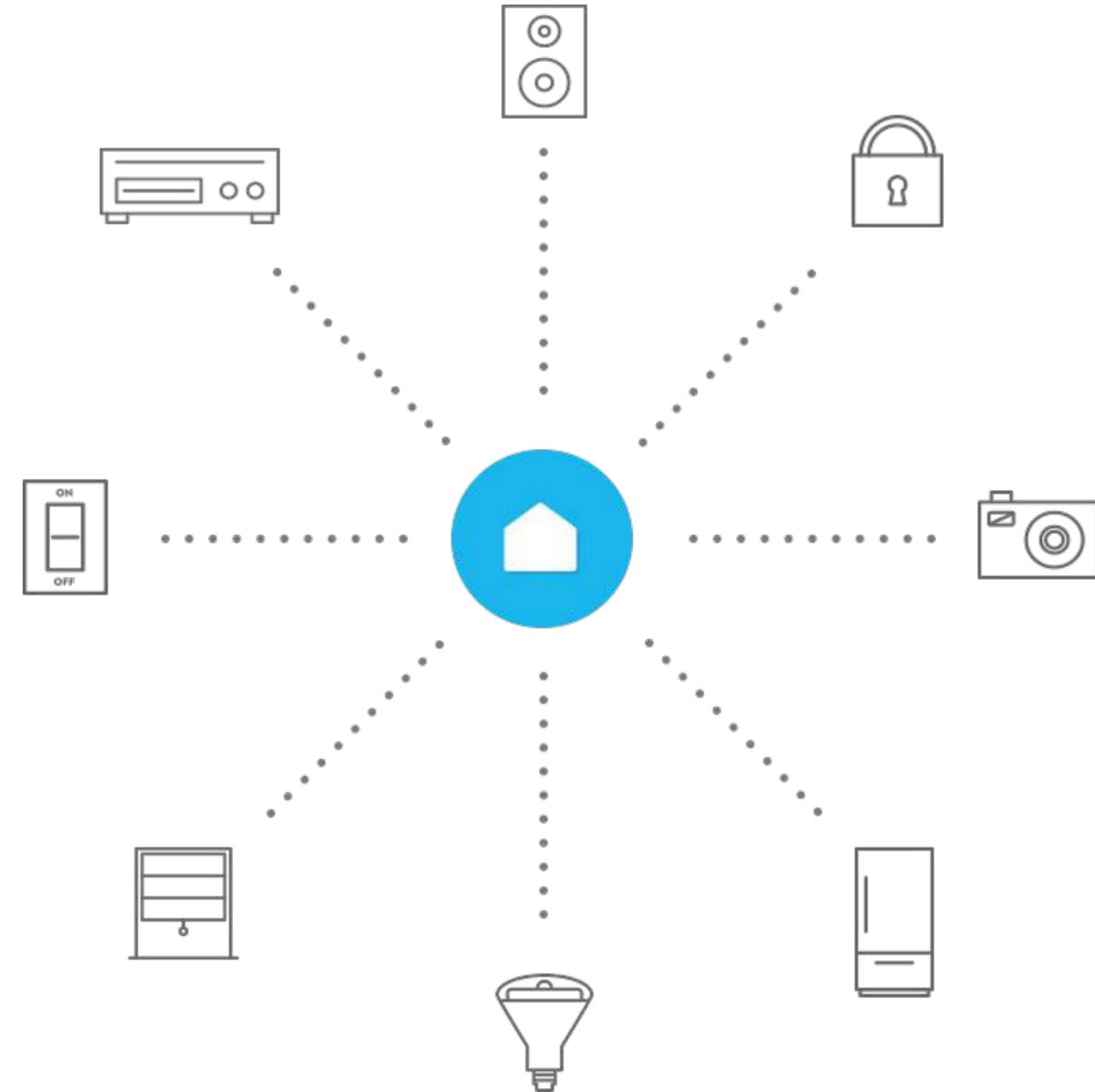
wink

Control everything

Wink is a mobile app that provides a universal platform for all of your smart-home objects.

The app boasts ease of use and aims to be the right solution for user of all ages. There is plenty of instruction provided along any entire user case.

The app brilliantly combines flat interface design with skewmorphic objects. This approach provides affordance to the user and helps explain the real-life results of their in-app actions.

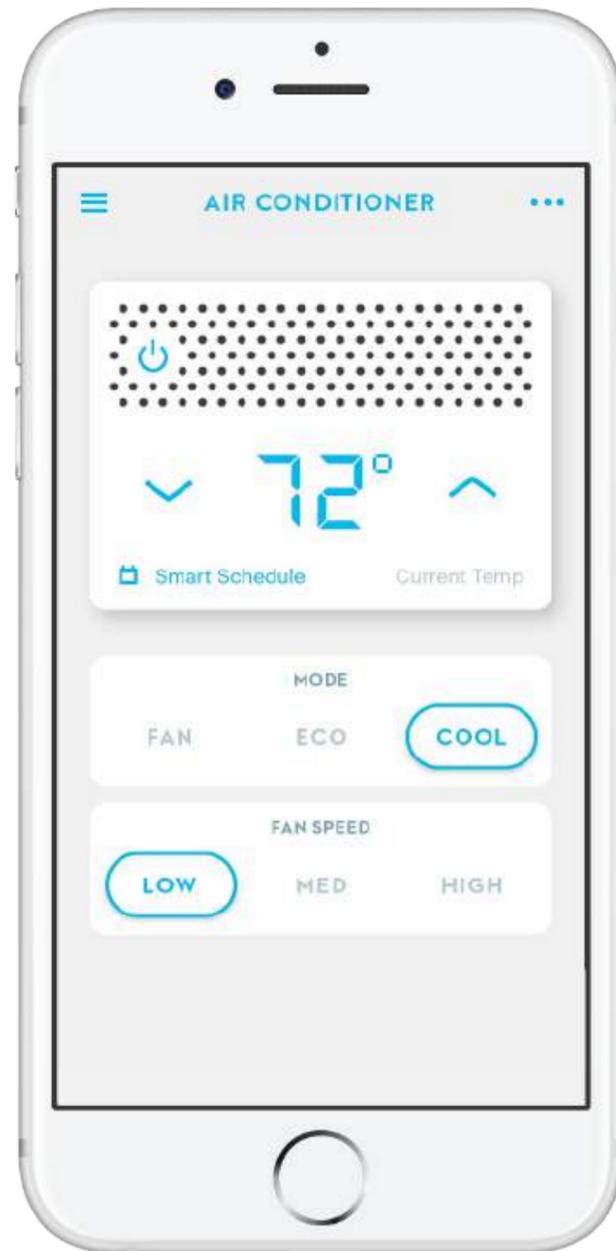


App features

- Ability to add a huge range of internet enabled devices available for your home
- Provides budgeting assistance for utility bills
- Compatibility with Amazon Alexa and IFTTT for voice control and automation shortcuts
- Built-in Wink Robots system to program your devices to all work together and automate your home with triggers based on activity or your location



iOS screens



Takeaways

- Uses skewmorphic design in representing each element. Each the digital version of each device includes details specific physical details and work in nearly the same way.
- Tremendous amount of help and guidance provided by the app with a step-by-step, onboarding-like process for every task
- Relies on words, instead of color of symbol, for affordance of interaction and task options in a suprising number of cases



USERS

USERS 1

Economic Adapter

- Homeowners aged 30-55
- Trying to save money on energy bills using the scheduling features
- The last generation raised before the internet and devices became common so are often hesitant to leave a trusted analog device for digital a digital rework.
- Receive a heavy tech influence from younger family members and youthful coworkers

USERS 1.1

Economic Adapter

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- Receive a heavy tech influence from younger family members and youthful coworkers

An ideal solution would be quick and easy to use and understand every time while providing an economic benefit.

USERS 1.2

The Mother, 42

- Shares 4 bedroom house in a Toronto suburb with her husband, son (8), and daughter (6).
- Commutes 15 minutes to her job as a teacher at her kids' school
- Manages the home's bills and is very environmentally conscious
- Uses her iPhone for communication but uses the mid 2010's family PC for daily computer tasks at home



Competent Explorer

- Renters aged 20-30
- Willing and eager to use technology and the internet to make life more convenient
- Comfortable navigating user interfaces on both screens and desktop with “gesture affordances” seemingly instinctual
- Expectations of digital aesthetics for a solid, smooth, and trustworthy experience
- Short attention span and will dismiss technology before waiting for it to work

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An ideal solution would be convenient and cool to use while providing comfort more efficiently.

USERS 2.2

The Bachelor, 24

- Lives alone in a 1 bedroom condo
- Renting on his own for the first time and must pay for all of his utilities
- Commutes 45 minutes to and from work using the public metro system
- Raised with technology and has already been exposed in home automation with Phillips Hue lightbulbs and a timed kurig machine



Required Renter

- 51% of all renters in America are less than 30 years old
- At least 32% of renters in America live with someone who isn't a spouse or family member
- 60% of renters are in structures likely to have an individual HVAC system and thermostat
- Forced to adapt to whatever system the landlord has in place
- Initially unfamiliar with the intricacies of the new home's heating and cooling rhythm

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An ideal solution would allow for control of individual rooms while providing easy way to overview the system.

The Roomates, 28

- Just moved into a small single-family home together in a suburb
- Connected through a friend as Beth was moving into the area for work and Lisa was in search of a new living situation
- Coming from different climates, the two of different preferences for the temperature of the house throughout different times of day
- Neither have ever interacted with a smart thermostat before but their new place has one installed and the landlord wants them to use it
- Both are consistently on their phones and laptops throughout the day reading BuzzFeed or Pinterest, but no huge on social media



USERS 4

Later Learner

- Homeowners aged 60+
- Grew up with very mechanical and analog solutions to heating and cooling
- Limited by eyesight, mobility, and motor skills
- Non-native user of digital interfaces and instinctively not-trusting of technology

USERS 4.1

Later Learner

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An ideal solution would limit ways to screw up while providing easy paths to common tasks.

The Grandpa, 72

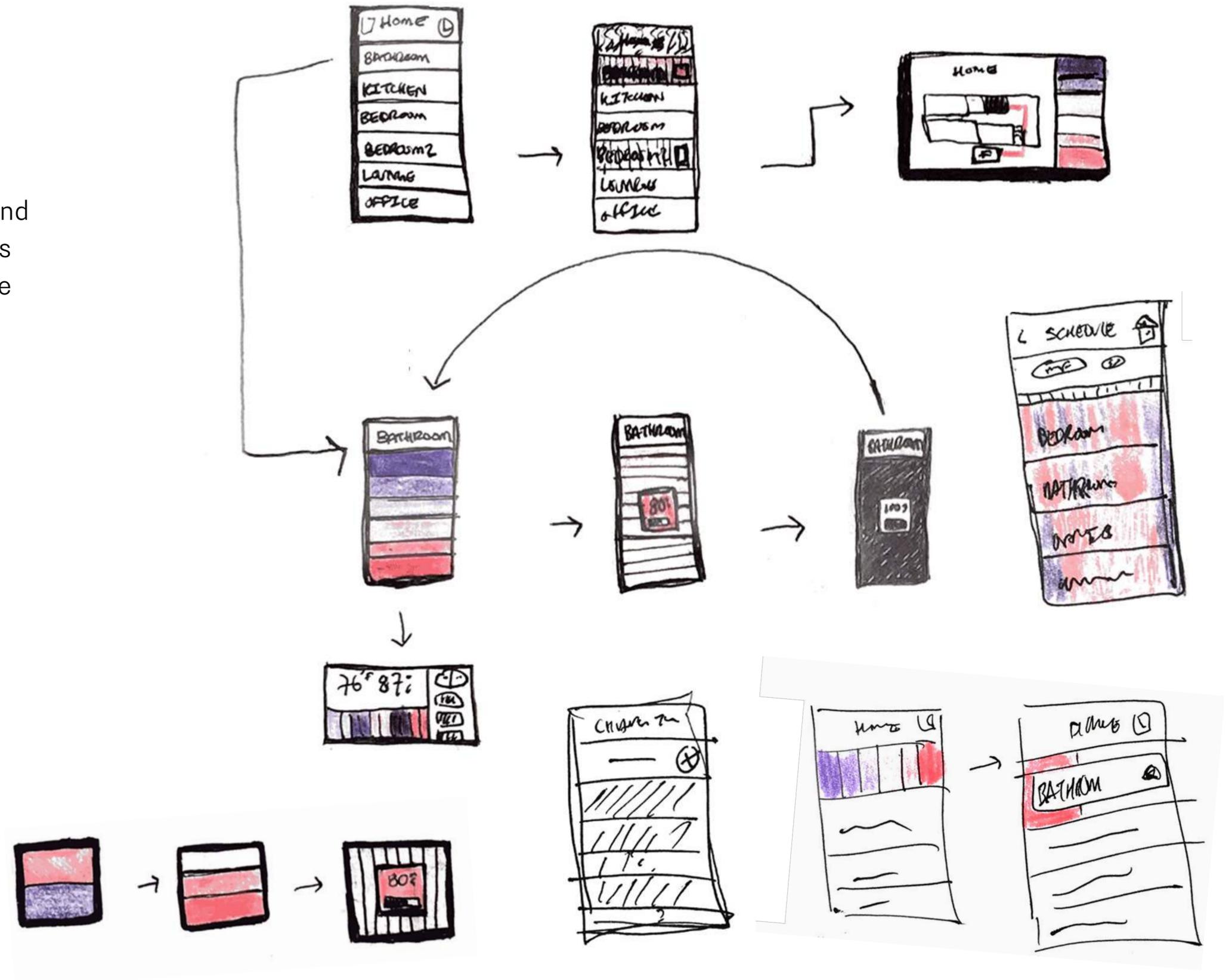
- Lives in large home with his wife of 42 years where they raised 3 kids
- Has paid off mortgage on the house and had the heating/cooling system installed as part of recent renovations
- Hopes the new system's app will save him the struggle of walking down a level of stairs to adjust the home's only thermostat
- Has grandchildren in their young teens and desires to impress them technologically
- Converted to tablet by grandchildren instead of upgrading his old PC and enjoys it



EXPLORATIONS

Inline list

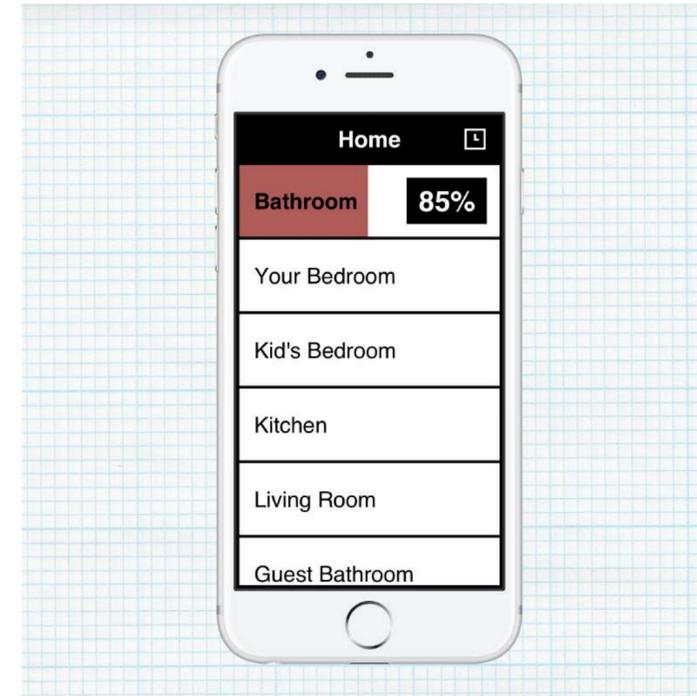
My initial designs centered mostly around a list and inline interaction. There have been countless lists imagined during this process and this is one of the ideas that gained some traction for a bit.



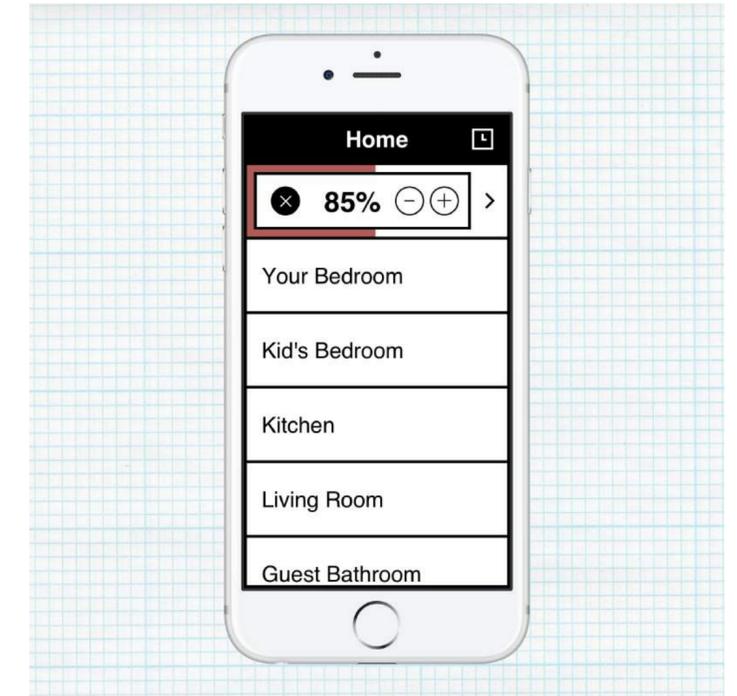
Inline list

These are images from a demo of this idea I had prepared for class and used to get feedback from my peers.

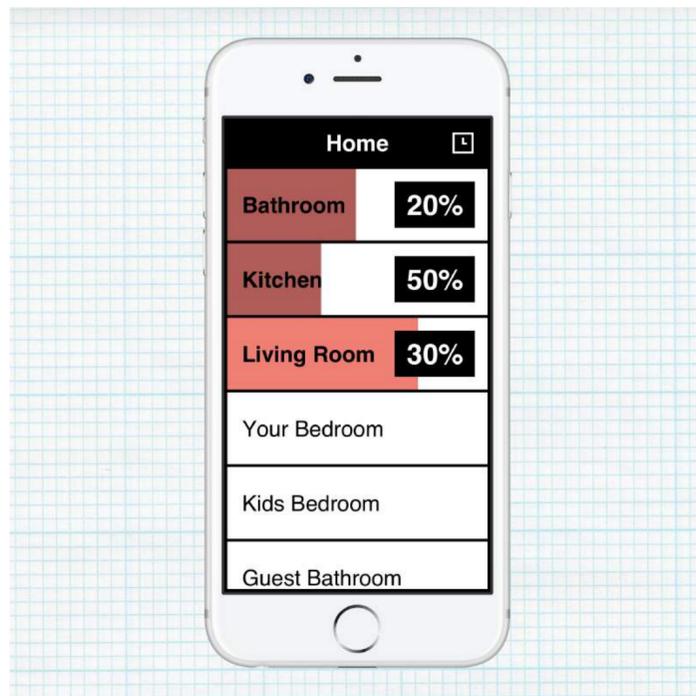
Feedback recieved was that the direction was disorienting with the in and out of pages. During this round it was realized that airflow rate was not the right element to focus control on.



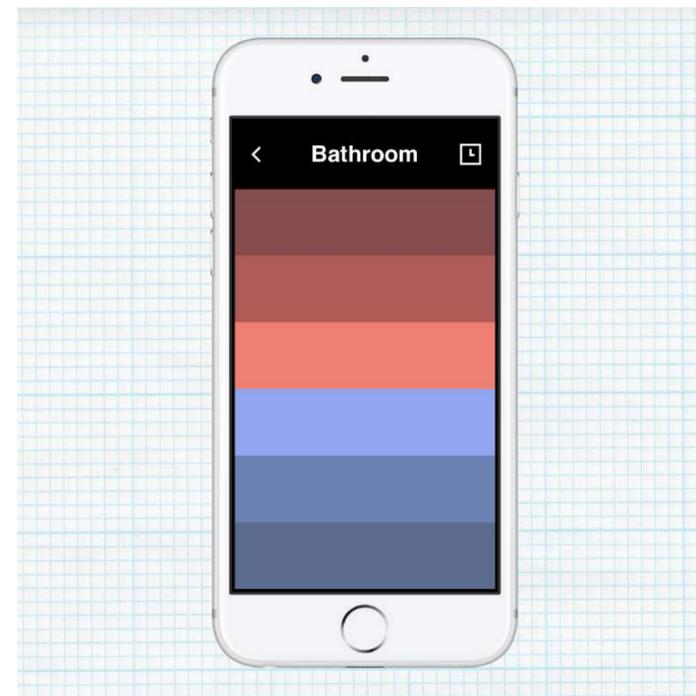
Heating a room



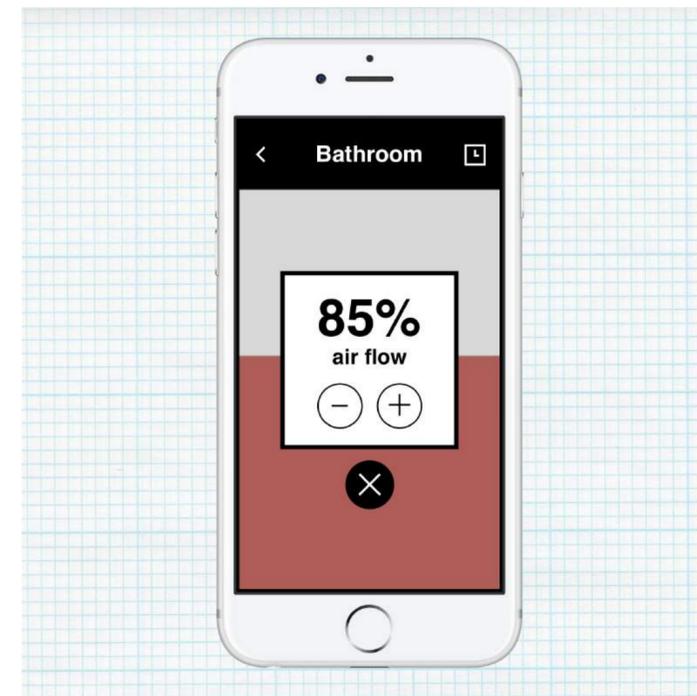
Adjust airflow inline



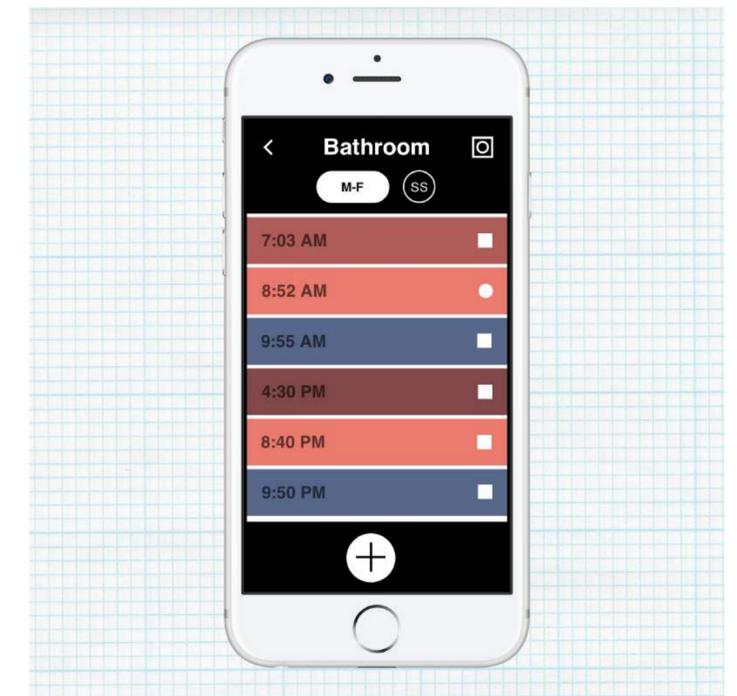
Heating rooms



Adjusting temperature



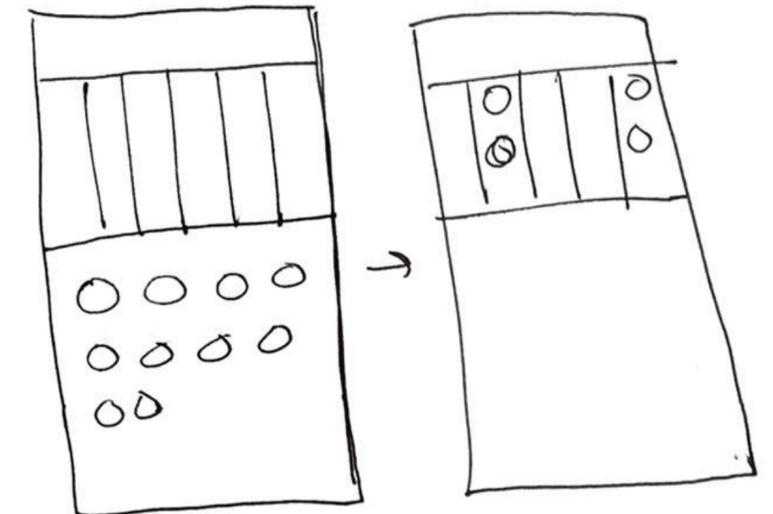
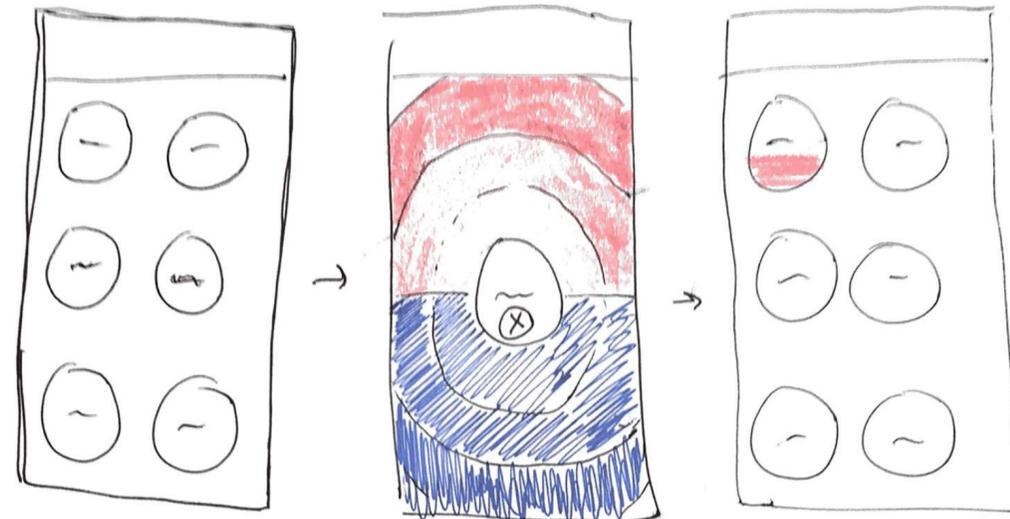
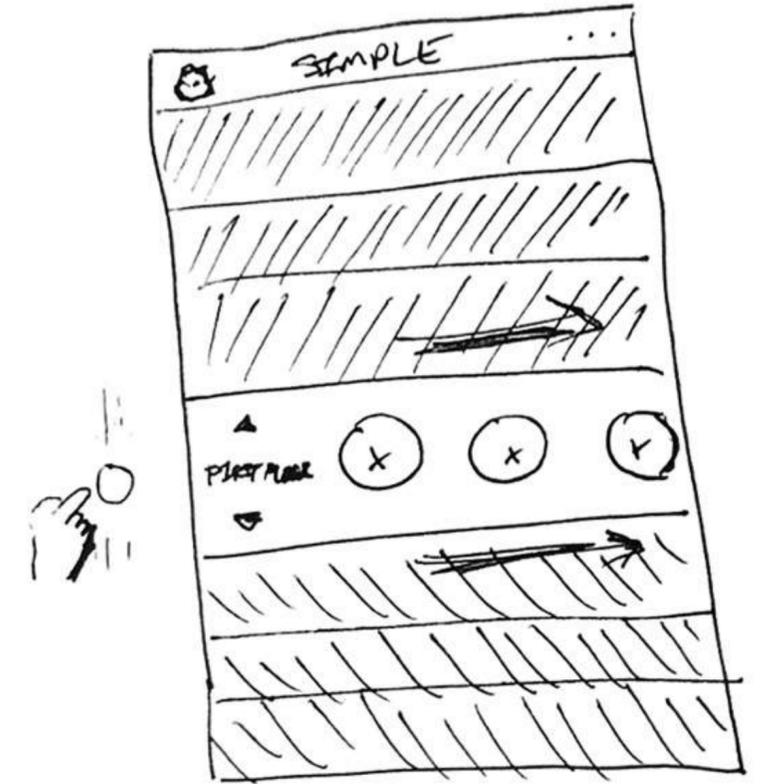
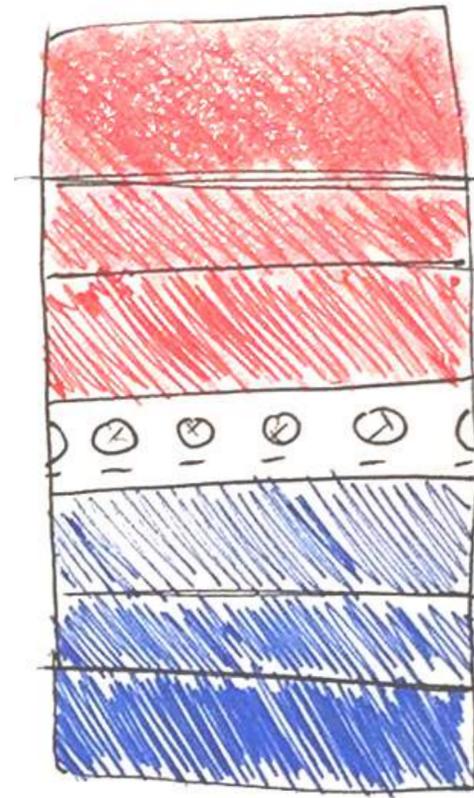
Adjusting airflow



Room schedule

Drag + Drop

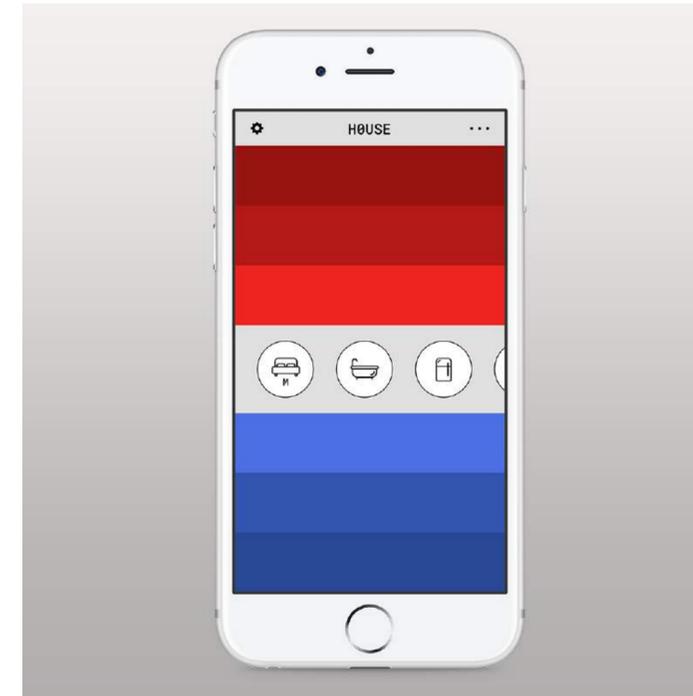
Tried to give the user awareness of their requests in by having them drag to the desired temperature. The idea was to have the tokens slide down towards to equilibrium row in the center.



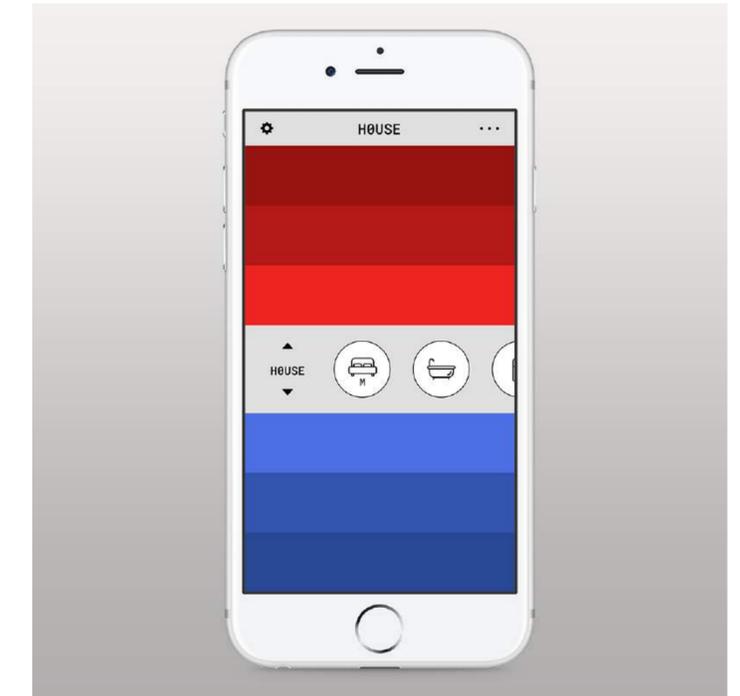
Drag + Drop

These are images from a demo I gave of this idea during class using hands to show interactions instead of just explaining them.

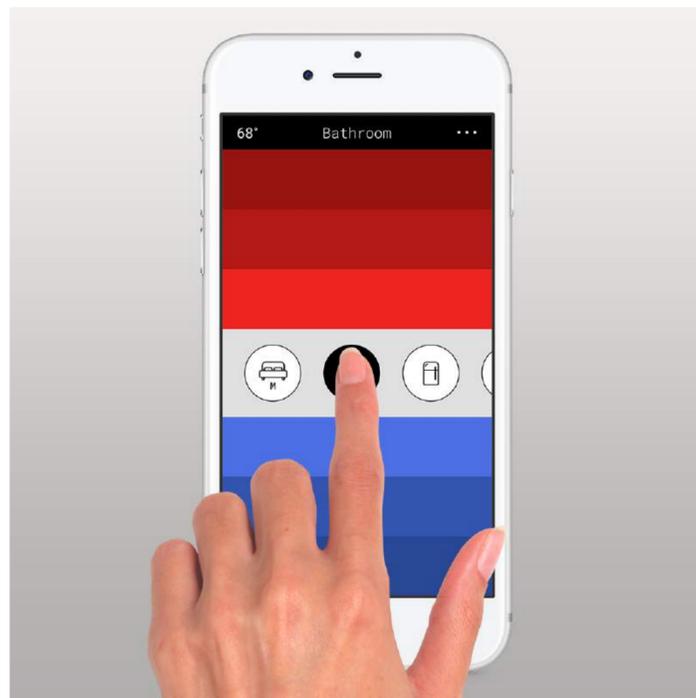
I tried to make the temperature area as prominent as possible to try and make the interaction seem more obvious, but the way the space worked in relation to temperature changing was too tough.



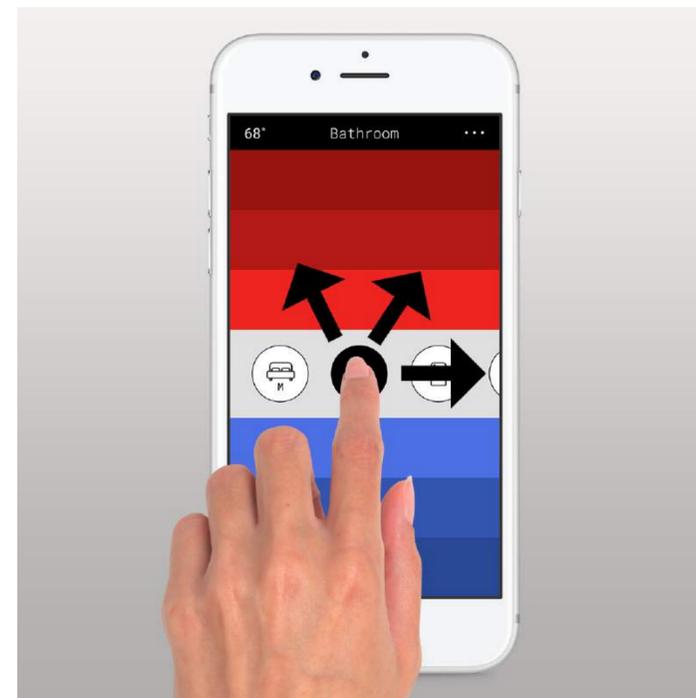
Home screen



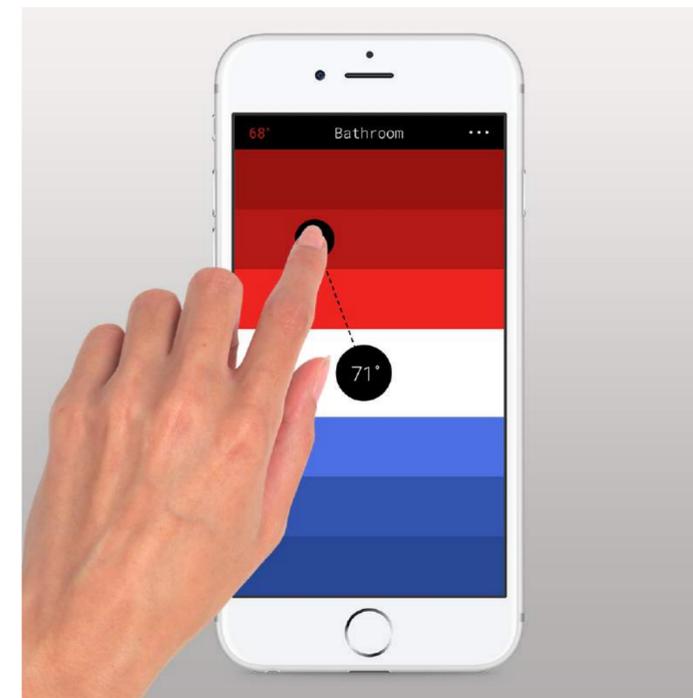
Filtering by floor



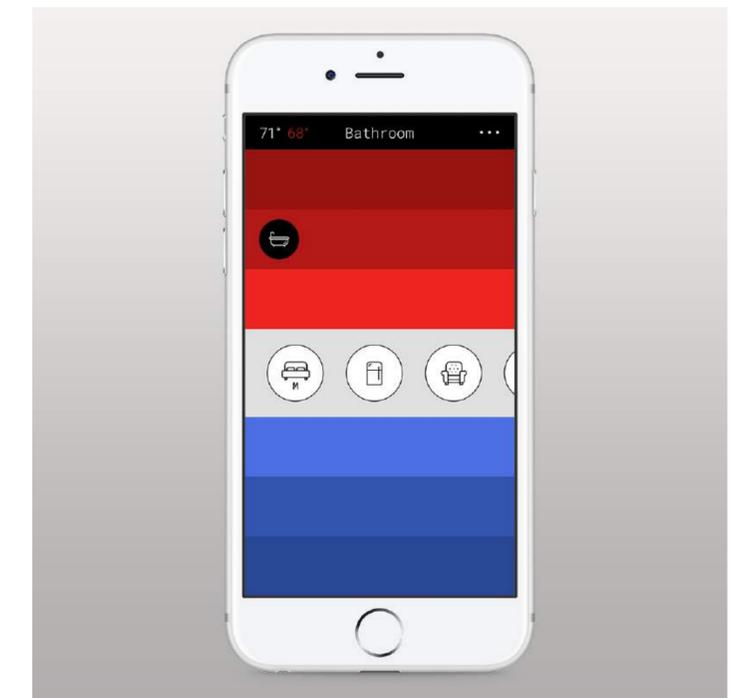
Selecting a room



Adjusting temperature



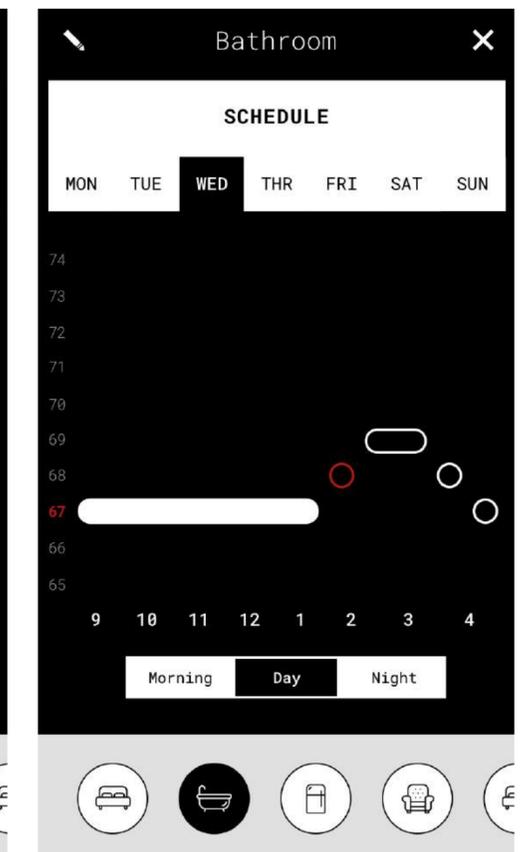
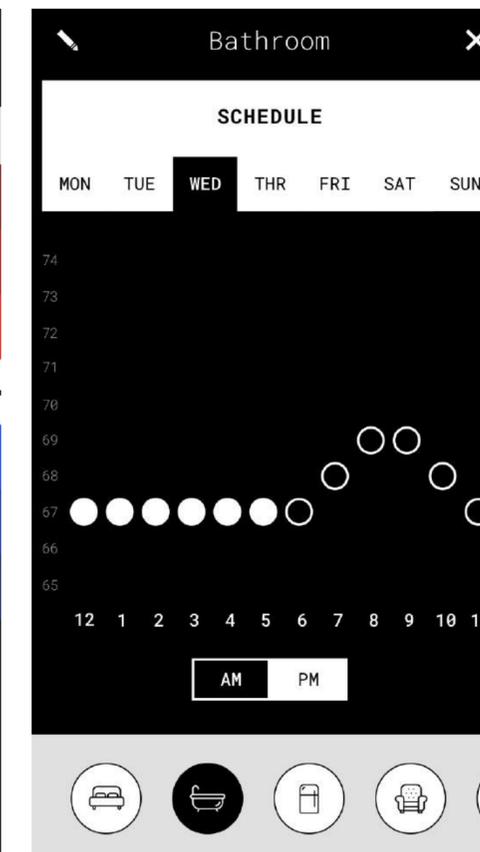
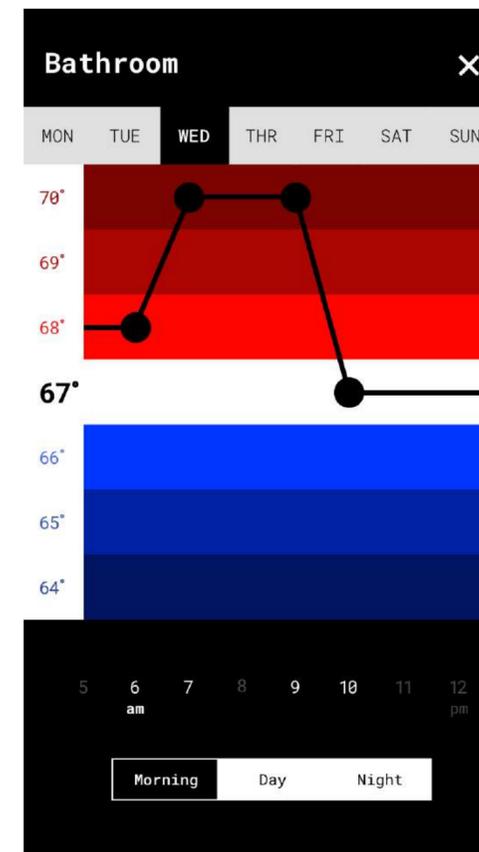
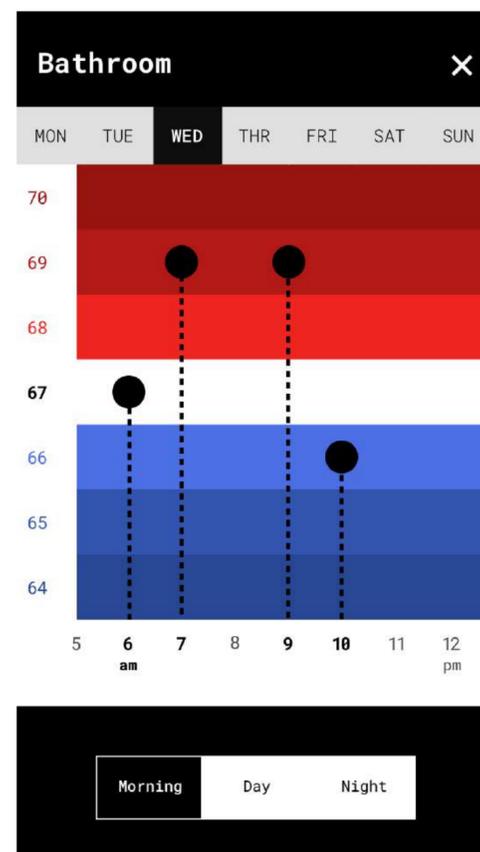
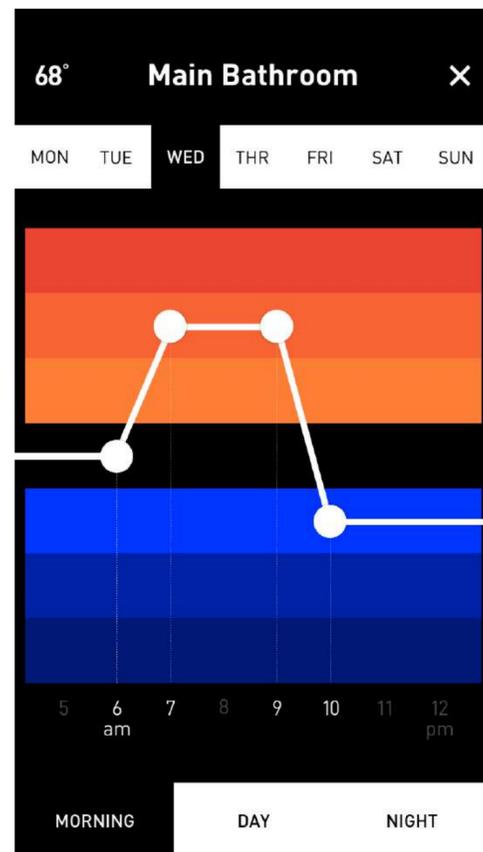
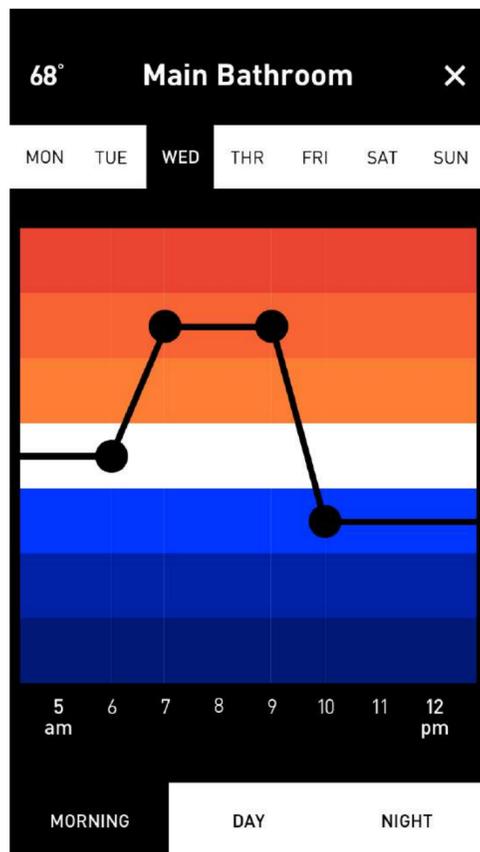
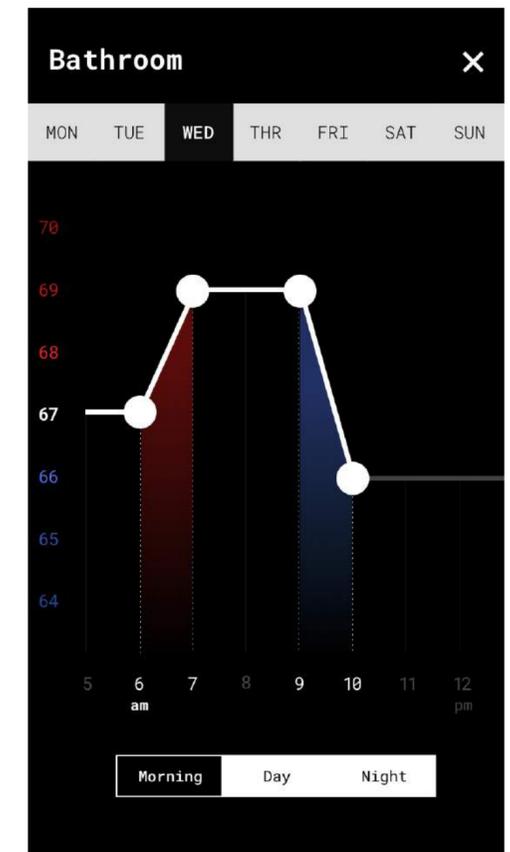
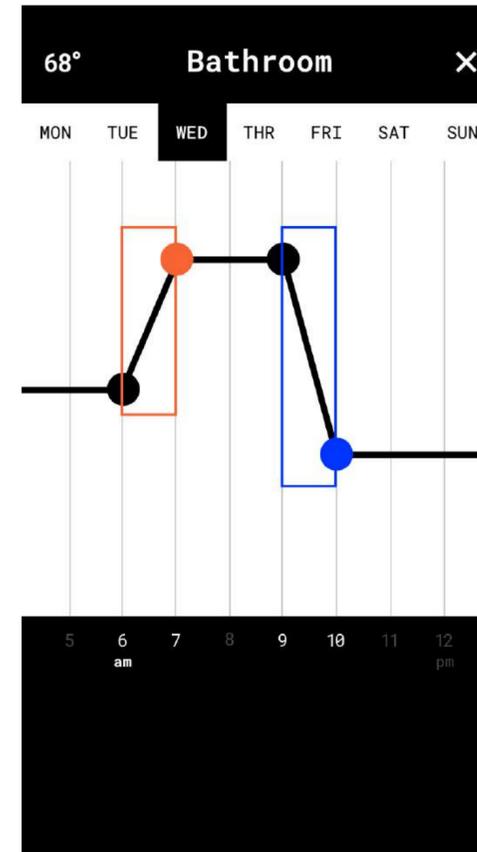
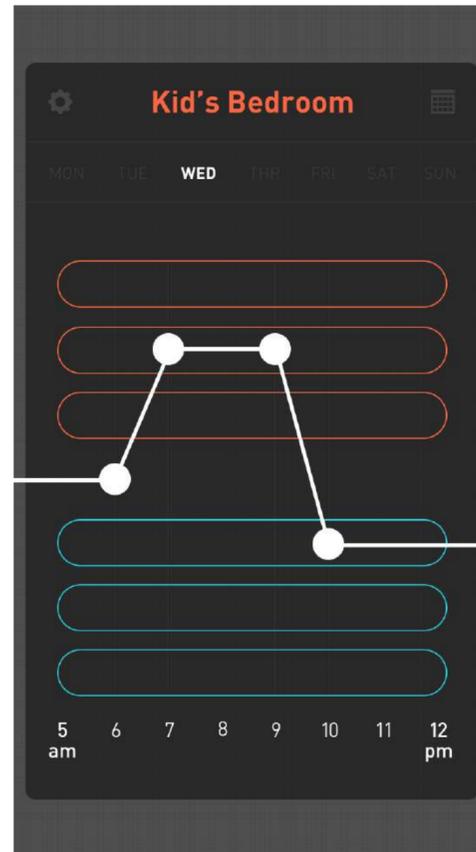
Adjusting temperature



Heating a room

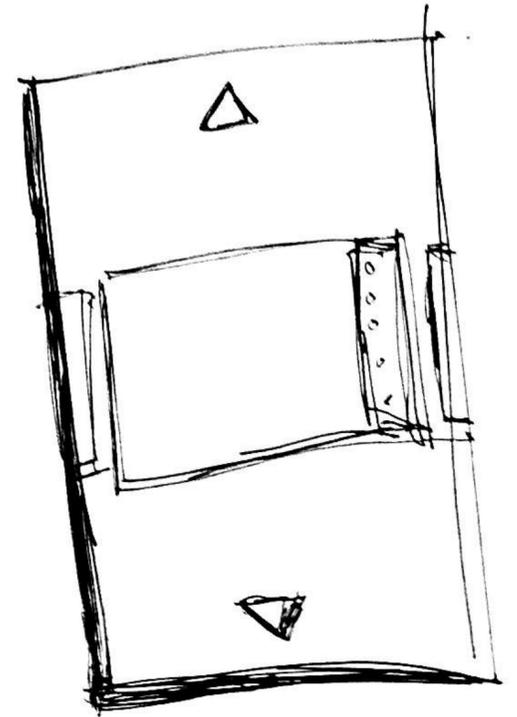
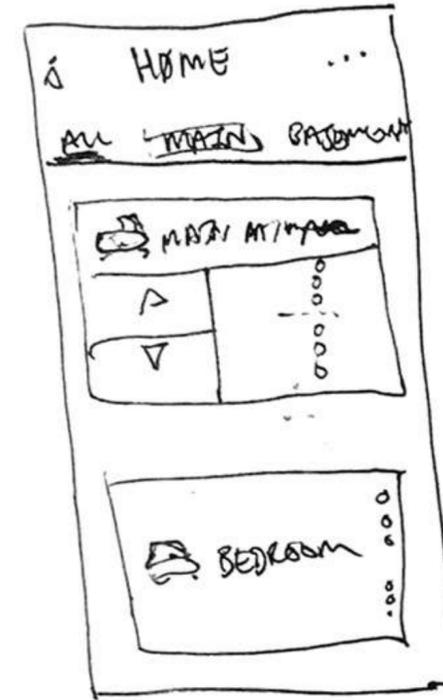
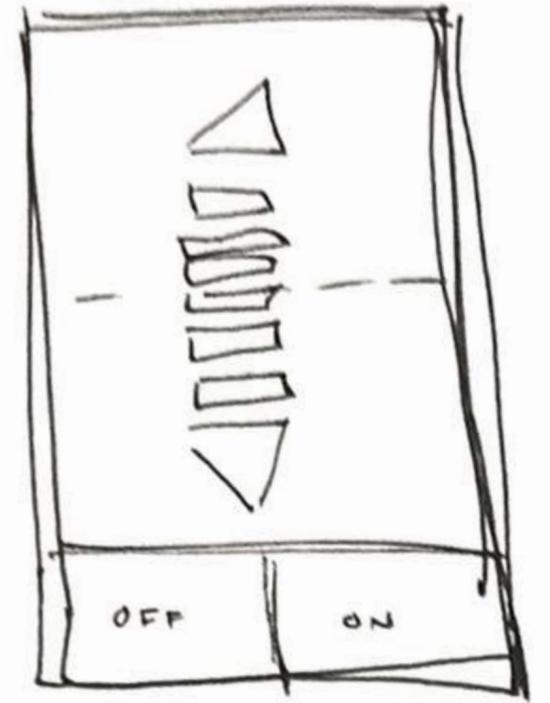
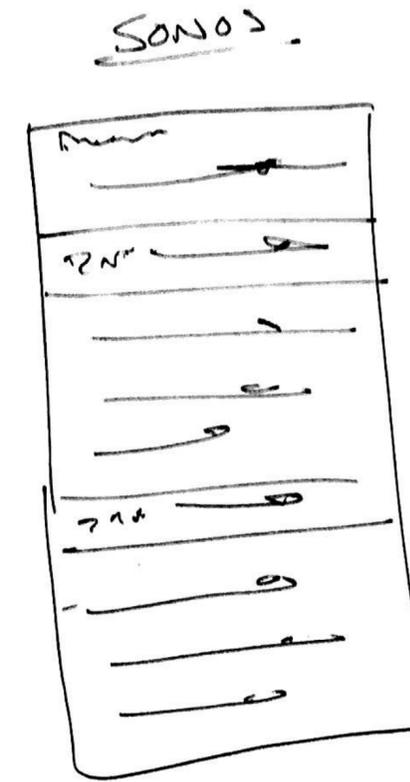
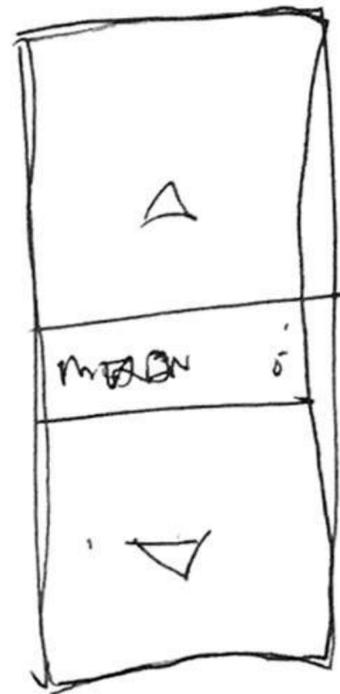
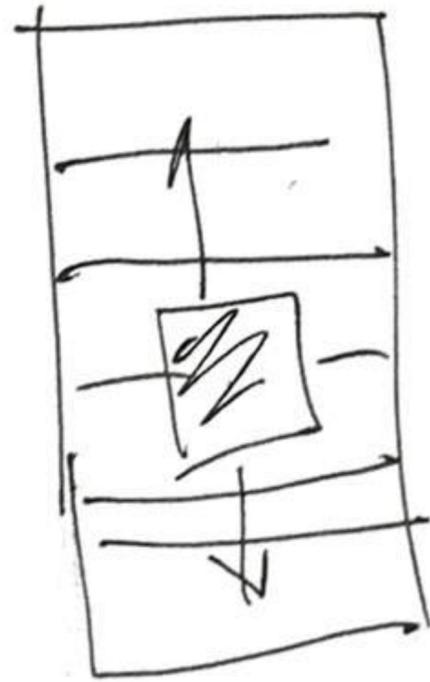
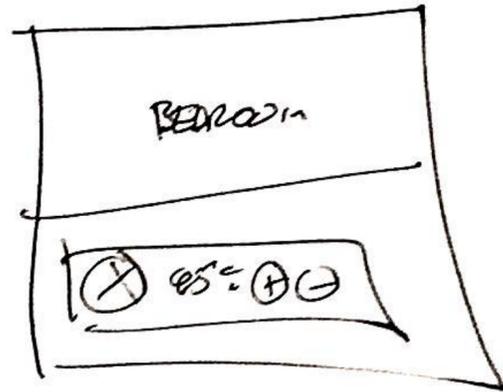
Schedule graphs

This is a collection of a selection from the number of graph styles I created while trying to decide on inter-page navigation and an overall app aesthetic.



Misc. controllers

This a collection of some different ways I imagined to control the temperature or air flow in rooms. Whether these are the most valid approaches or simply the most neatly sketch remains to be seen.

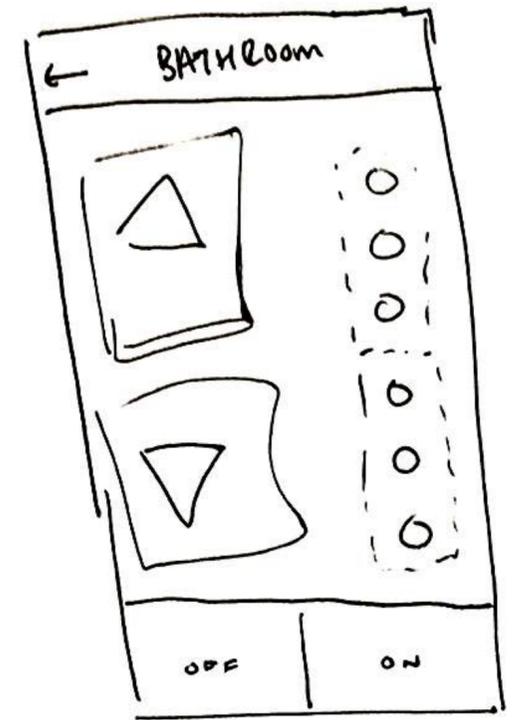
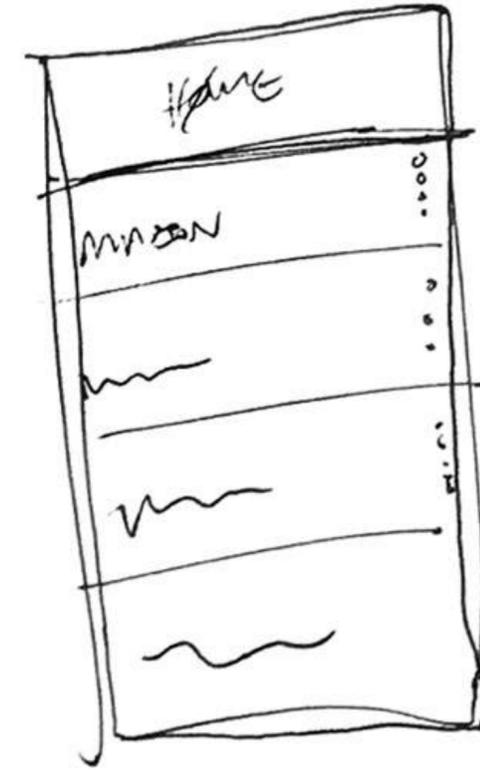


SOLUTION

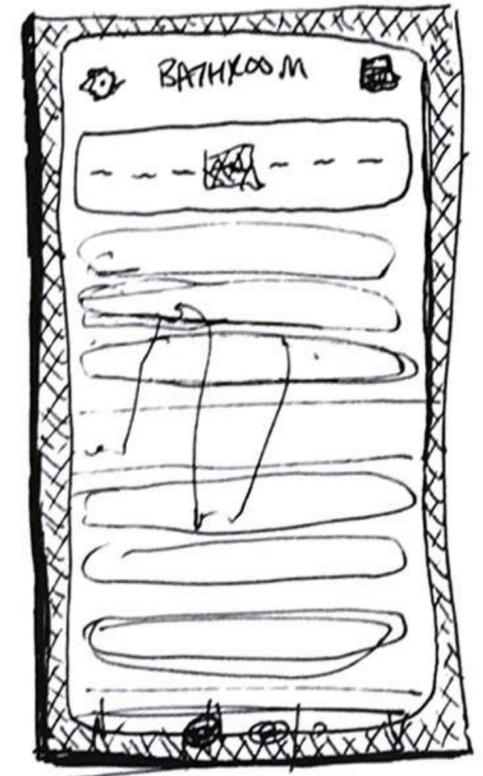
SOLUTION 1

Sketching

I made another serious pass on a list after exhausting my exploration of other avenues. These are some early sketches of ideas that made their way into the delivered solution.



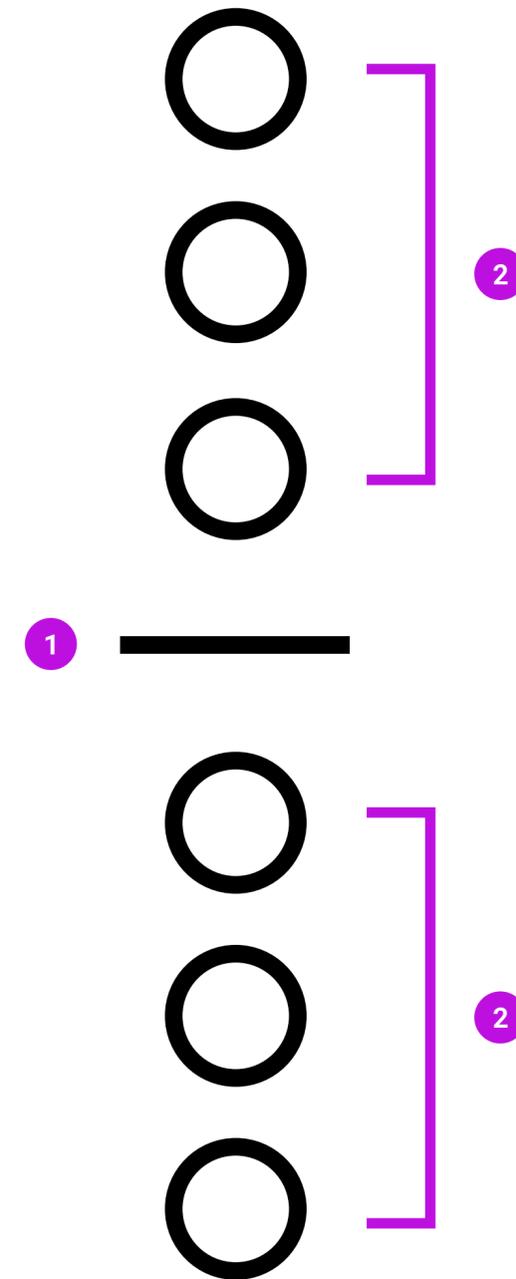
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How it works

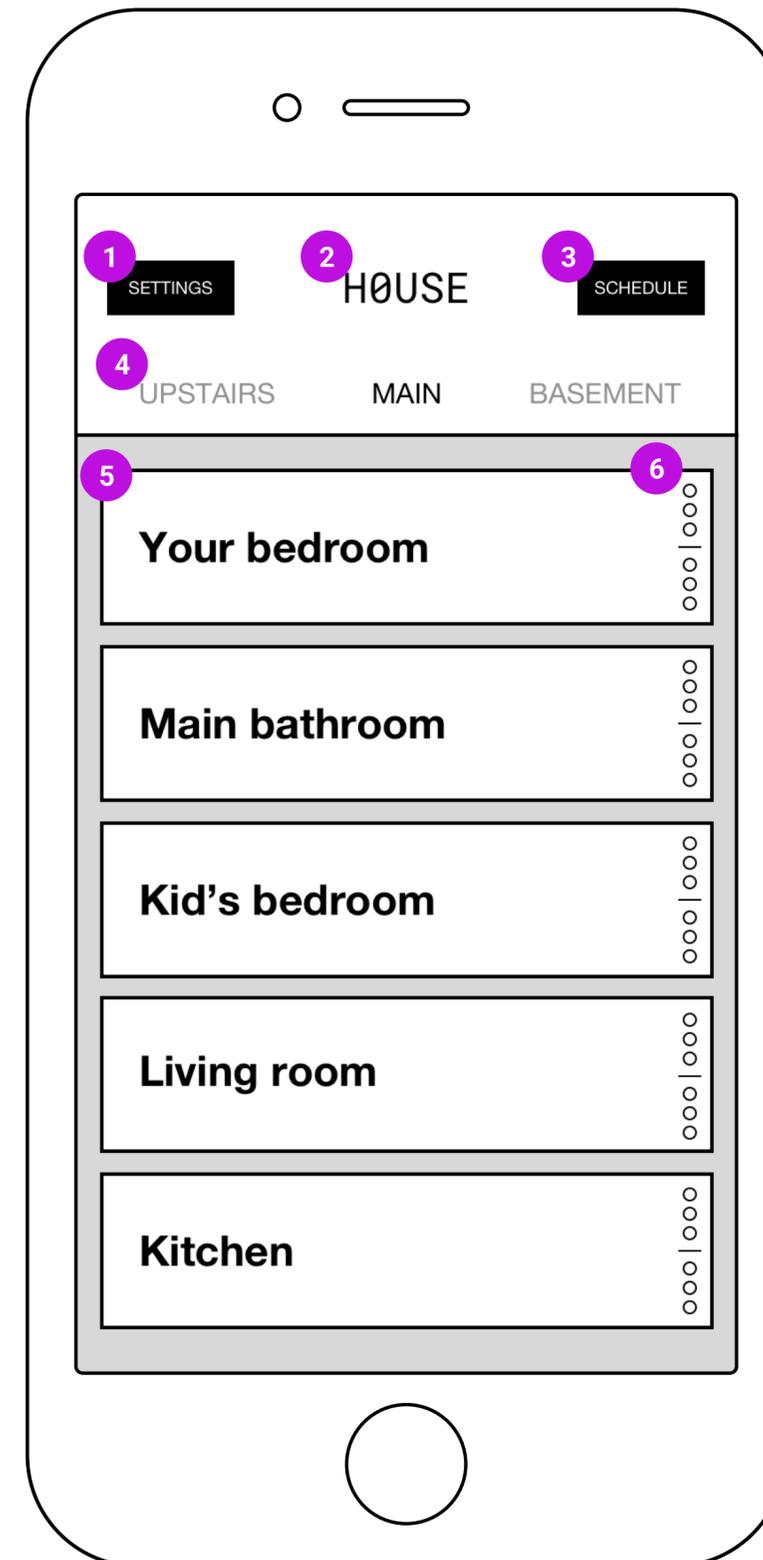
This is an explanation of the underlying concept for adjusting temperature relative to how you feel in the room instead of what number the thermostat reads.

- 1 The line in the middle represents the users desired temperature of the room. The system is working to get all of the rooms in the house to this state.
- 2 The spaces above (hot) and below (cold) represent how far the room is from actually being the desired temperature set by the user. As the room gets closer to reaching the correct state, the spaces become vacant in order towards the middle line.



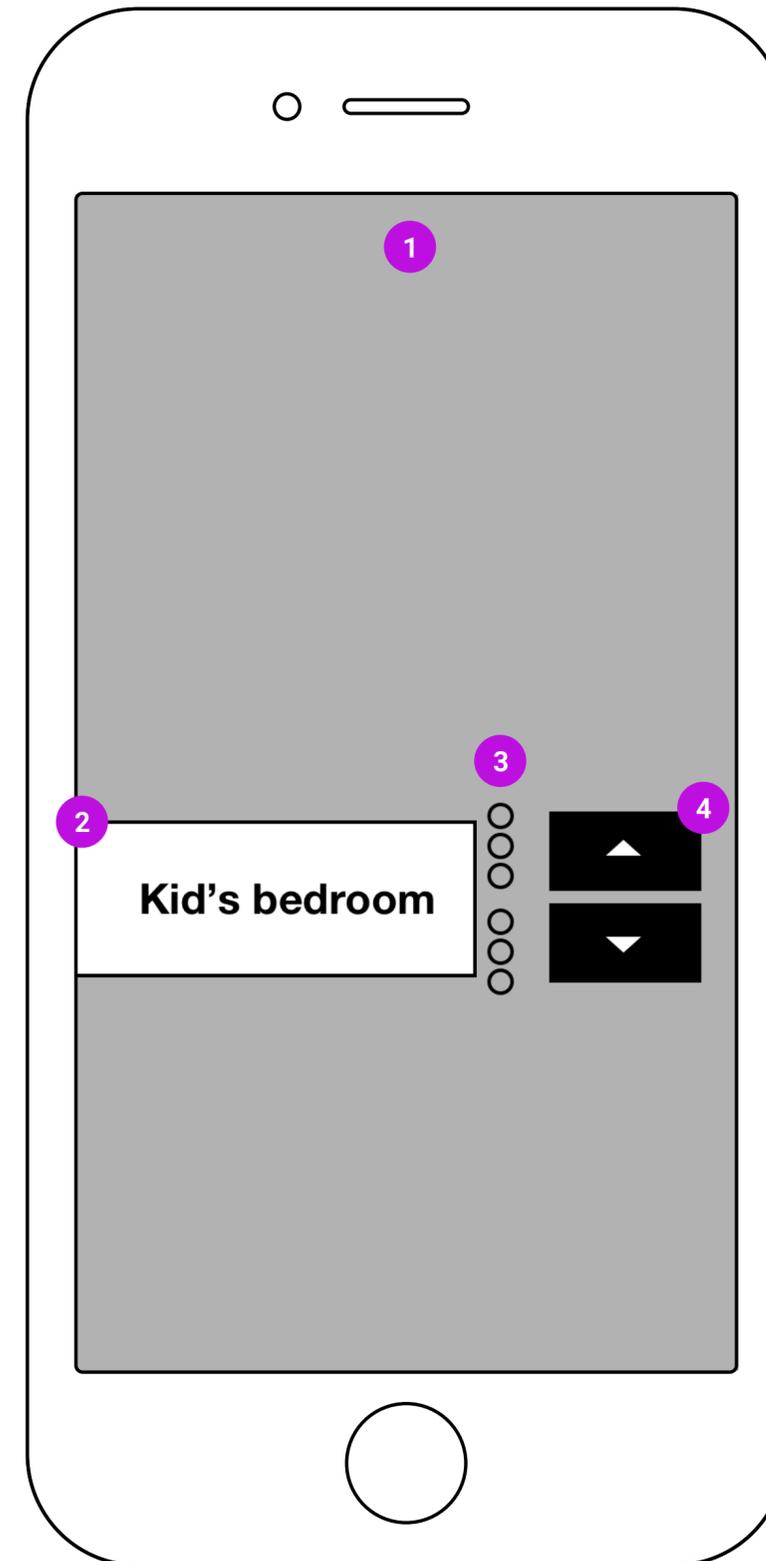
Home wireframe

- 1 Tapping this button opens the settings page
- 2 Tapping the house word/logo will select all floors from the filter menu and populate the list with all the room in the house
- 3 Tapping this button opens the entire home's schedule page
- 4 Tapping menu items will filter the list of rooms by floor. Only one floor can be selected at a time from this menu.
- 5 Cards are ordered heat-neutral-cool with most intense changes on the top and bottom edges. Tapping a card will open the room's schedule page. Swiping a card to the left will reveal the controls to adjust temperature.
- 6 Spaces to indicate the current heating/cooling state of the room. The next space that will be removed blinks.



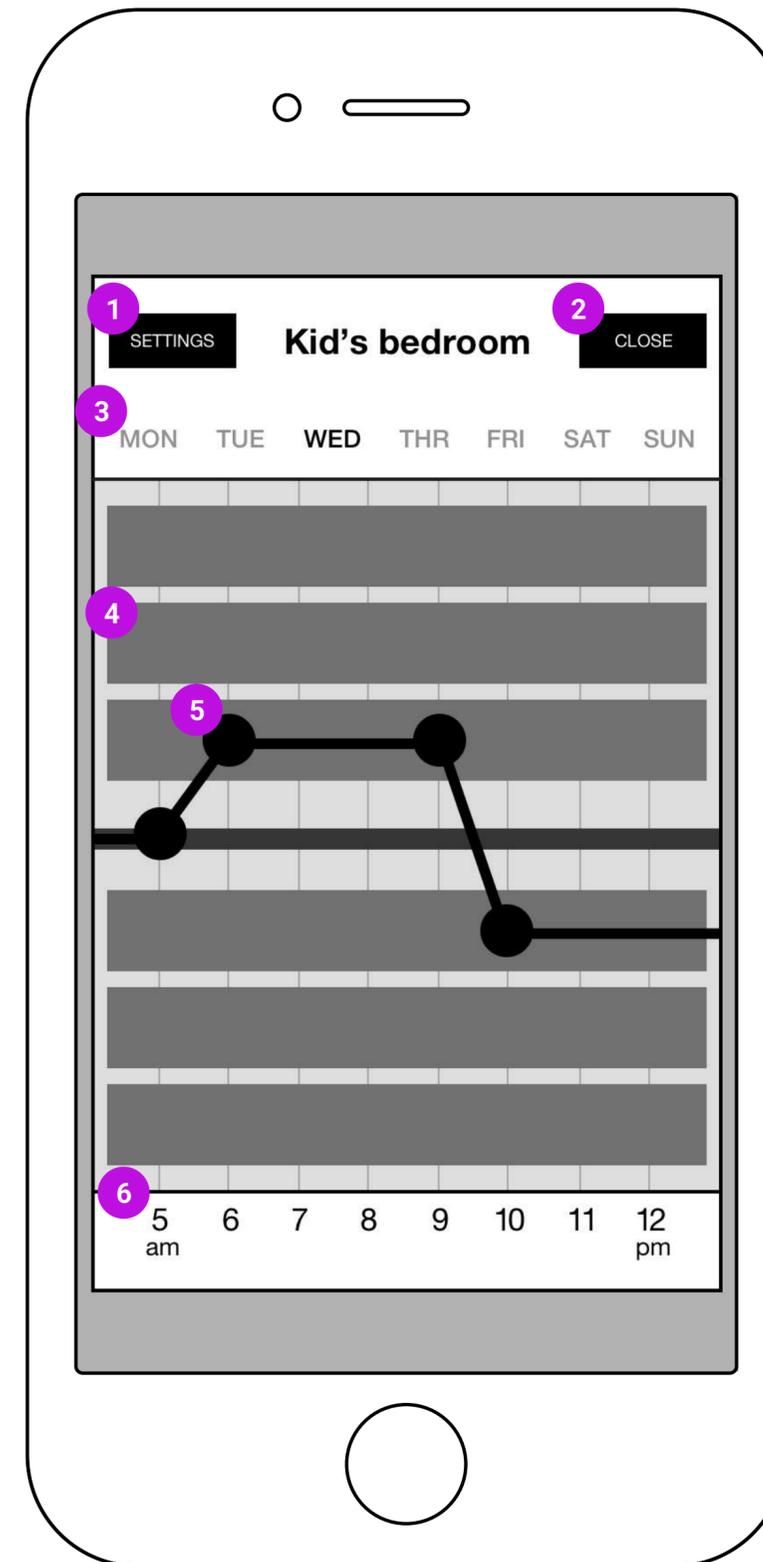
Controller wireframe

- 1 Tapping any of the background will dismiss the controller.
- 2 Shows the room currently being adjusted. Tapping on the card will open the room's schedule page.
- 3 Spaces to indicate the current heating/cooling state of the room
- 4 Buttons to adjust the desired temperature of the current room. Pushing a button will move the indicators one space in that direction.



Schedule wireframe

- 1 Tapping this buttons opens the settings page for this room
- 2 Tapping this button will close the room's schedule page and return the user to the state that they were in when they opened it
- 3 Indicates the day being shown on the graph. Tapping days will navigate the graph to them.
- 4 Spaces, including the equilibrium bar in the middle, to set the desired temperature at a given time relative to the room's current state.
- 5 Represents the schedule of the preferred temperature in the room. Dragging dots allows for the values to be manipulated. Dragging from a piece of the line will create a new dot. Dragging a dot onto another one will delete it.
- 6 Time labels for the graph that scroll with timeline as it is navigated.

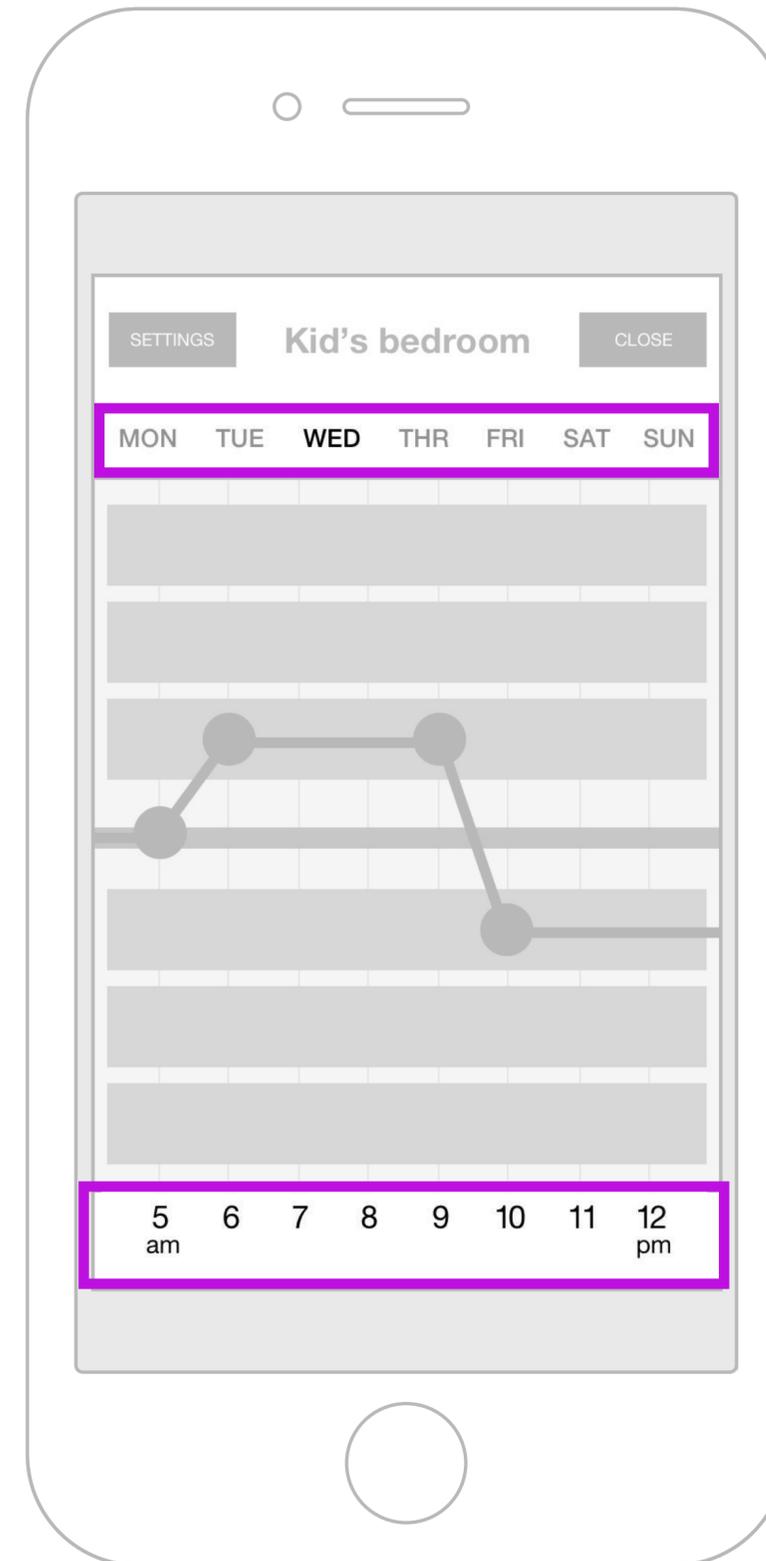


Design conflict

Placing the time labels on the bottom creates the potential for them to be covered during a time that the user needs them while they are manipulating the schedule.

Attempted designs with the time labels at the top with the weekday labels created an offset mess of labels and buttons in area of the screen that is hard to manipulate with a stretched hand.

Ultimately, it was decided that it was more important for the the weekday labels to be at the top providing context for all elements below them and lto eave plenty of space for the interactive elements at the top.



VISUAL

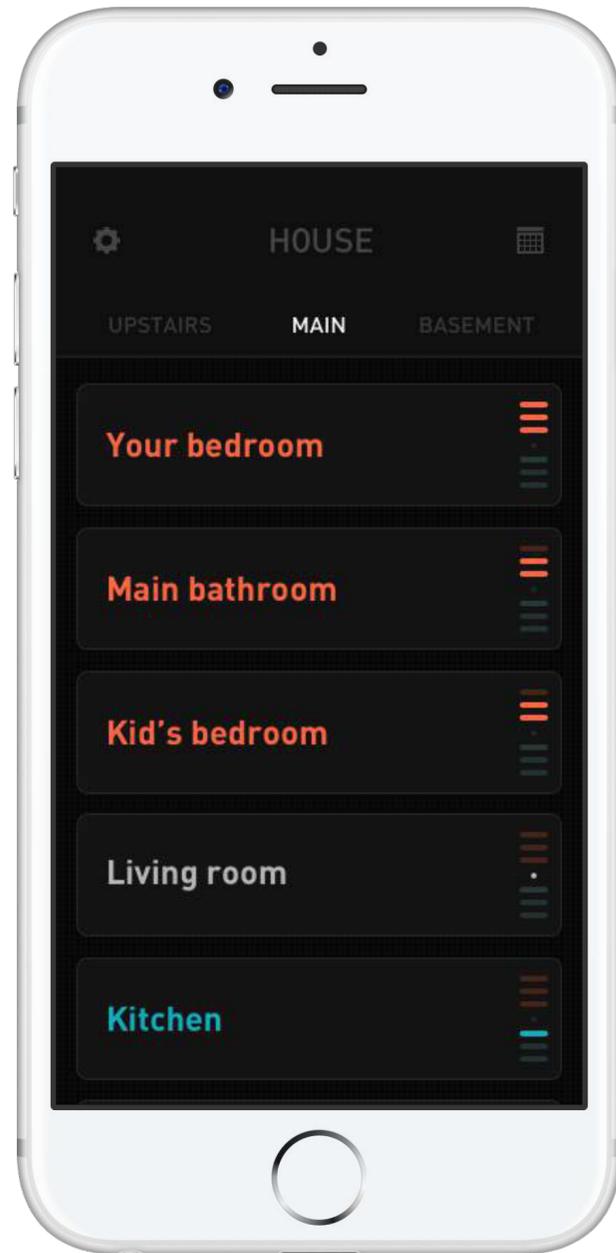
SOLUTION 3.1

Inspiration

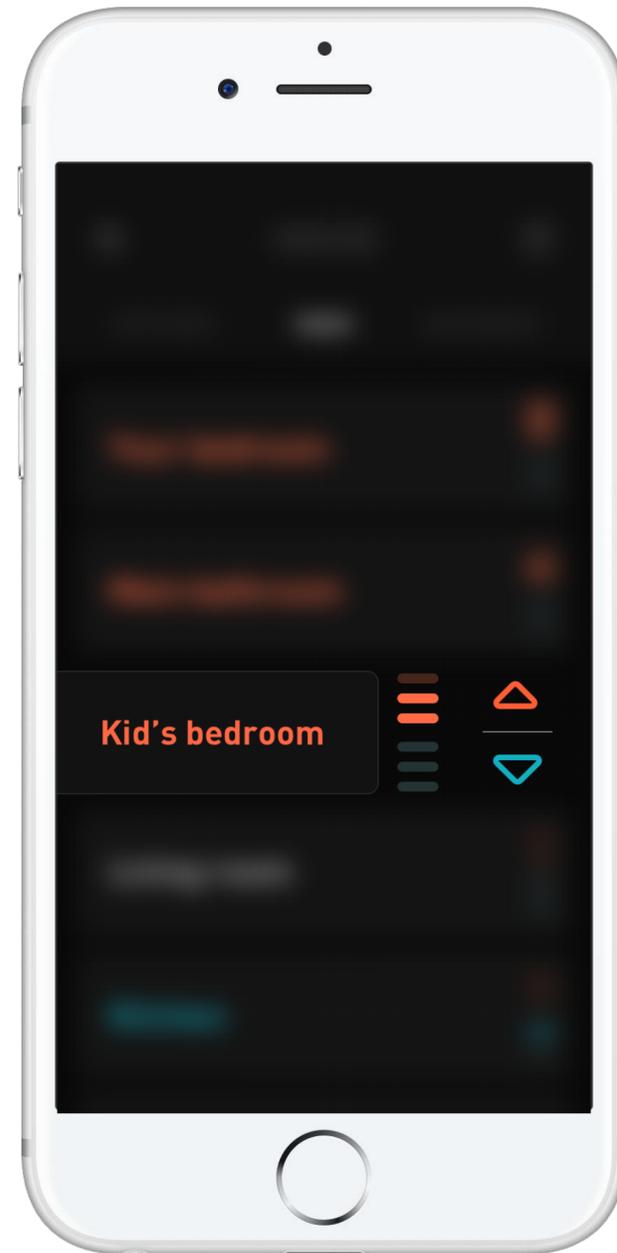


SOLUTION 3.2

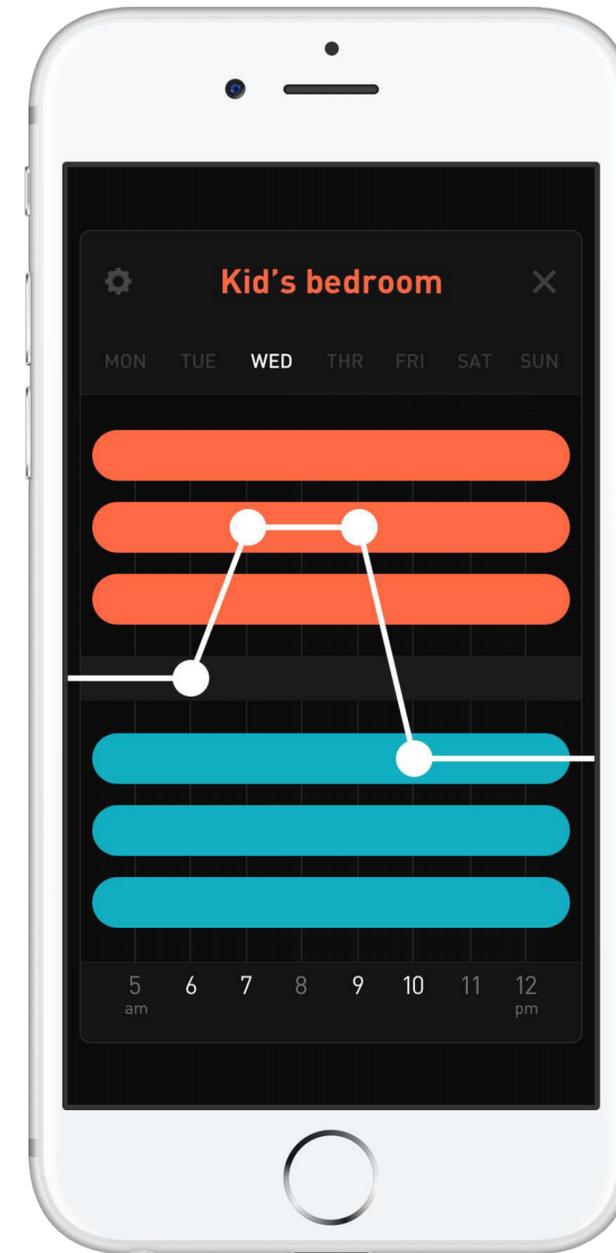
Renders



Home



Controller



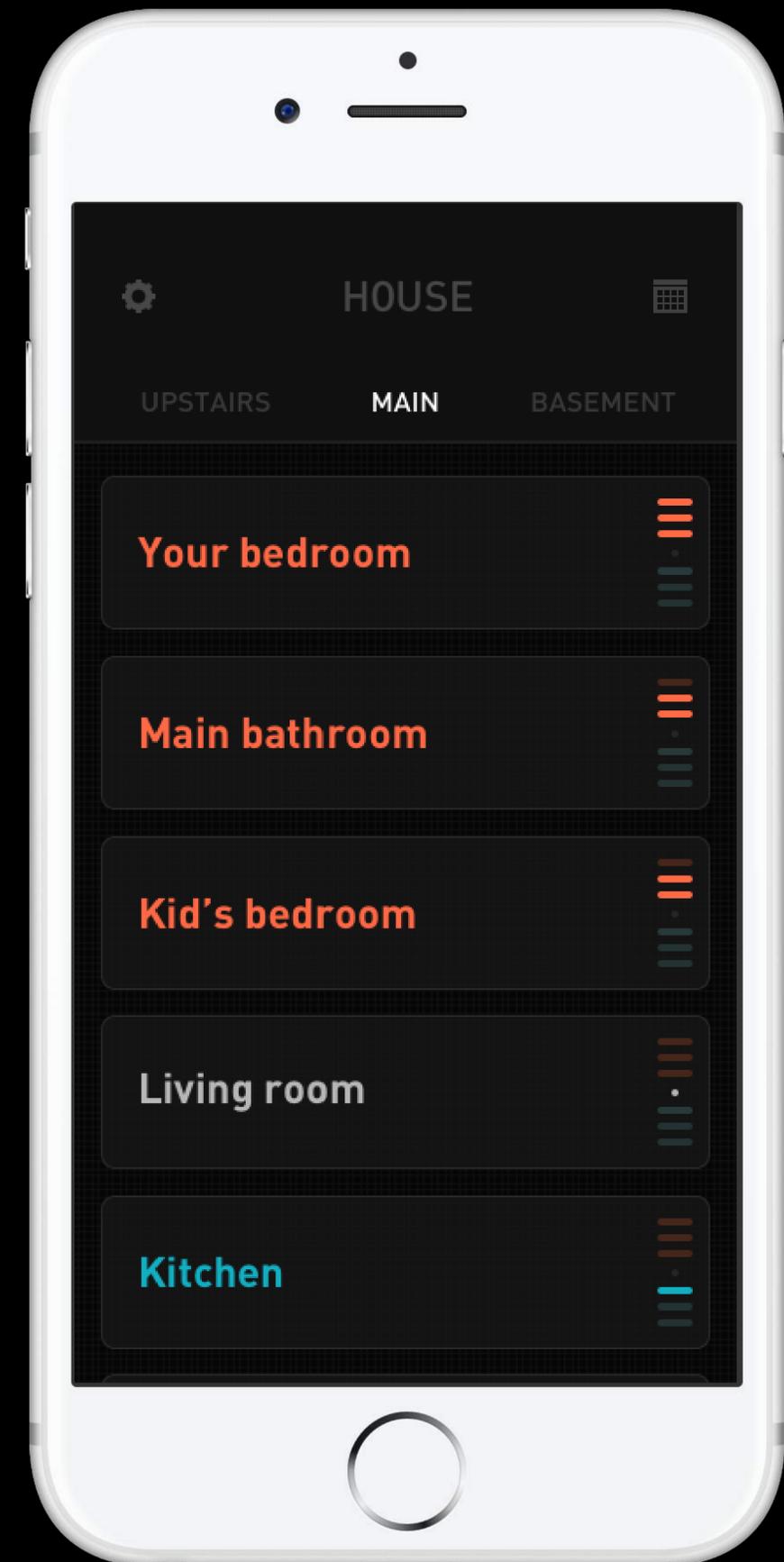
Schedule

INTERACTIONS

Adjusting temperature

To adjust the temperature, the user swipes left on the card of the room they wish to change.

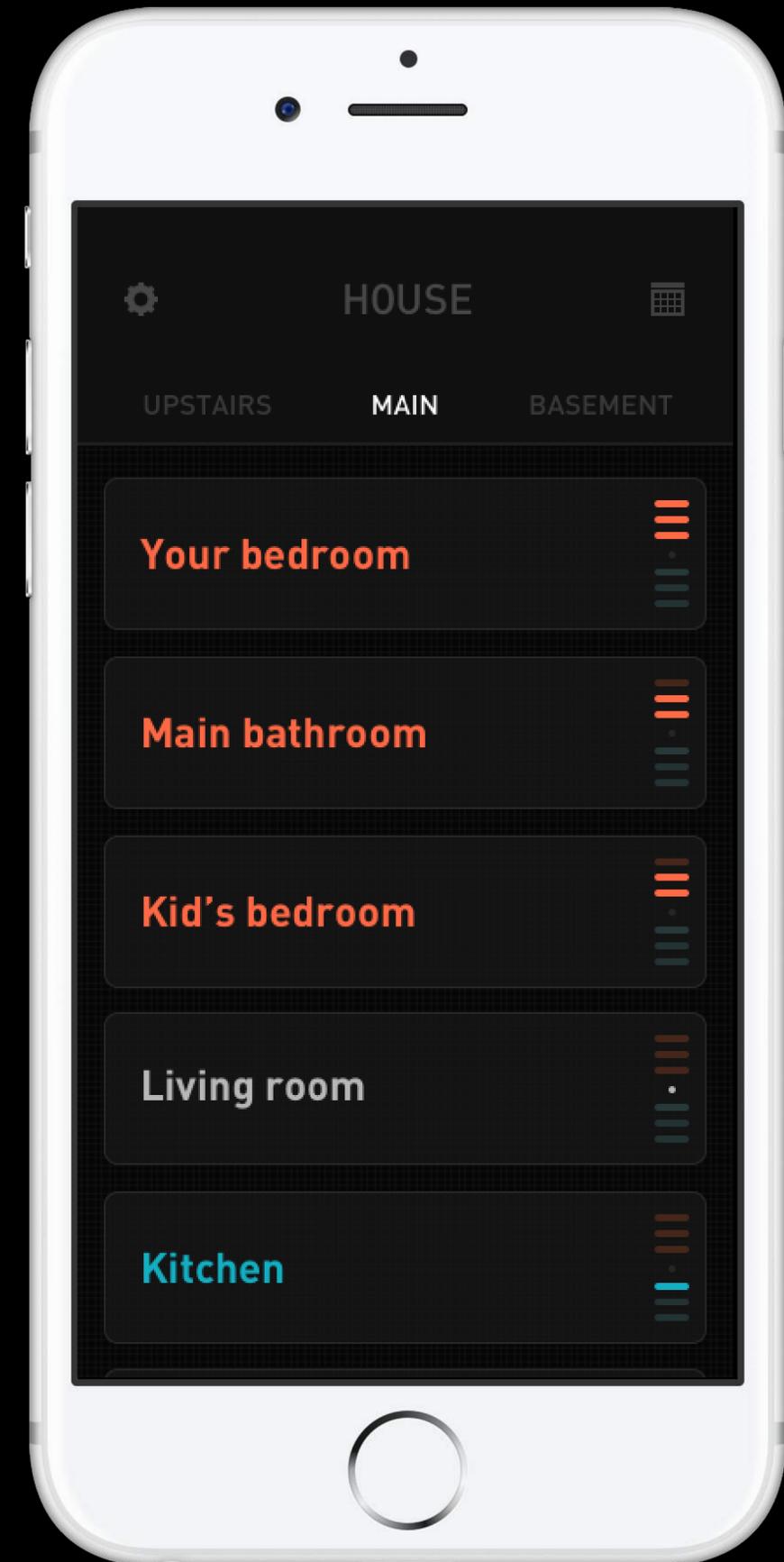
- The background fades and blurs in order to provide focus on the active controller and task at hand.
- The title remains stationary to help the user understand that they are still on the list page.
- The indicators move smoothly off the card to provide the notion that they will be going back on once the interaction is complete. Growth occurs to form a visual relationship with incoming buttons that will be manipulating them.
- The arrow jumps when tapped to provide further feedback that the desired temperature has been increased and the indicator stack has gone up.
- The controller closes quickly as the user is finished with it and needs to get onto the next task.
- The cards adjust order automatically in a way that seems systematic and untouchable while giving the user a clear indication of what is happening so that their positional awareness of the cards is not lost.



Opening room schedule

To adjust a room's schedule, the user taps anywhere on the card of that room.

- The background fades and blurs in order to provide focus on the active controller and task at hand.
- The title moves up the center like it is opening the window and showing that everything coming next will fall below it in the hierarchy.
- The icons from the header sink into the new window to provide reinforcement that they are interactive elements that the user already understands and not something new that need to investigate.
- The schedule line and the receded time lines build in from left to right to provide a clue that the graph moves and that day is flowing in that direction

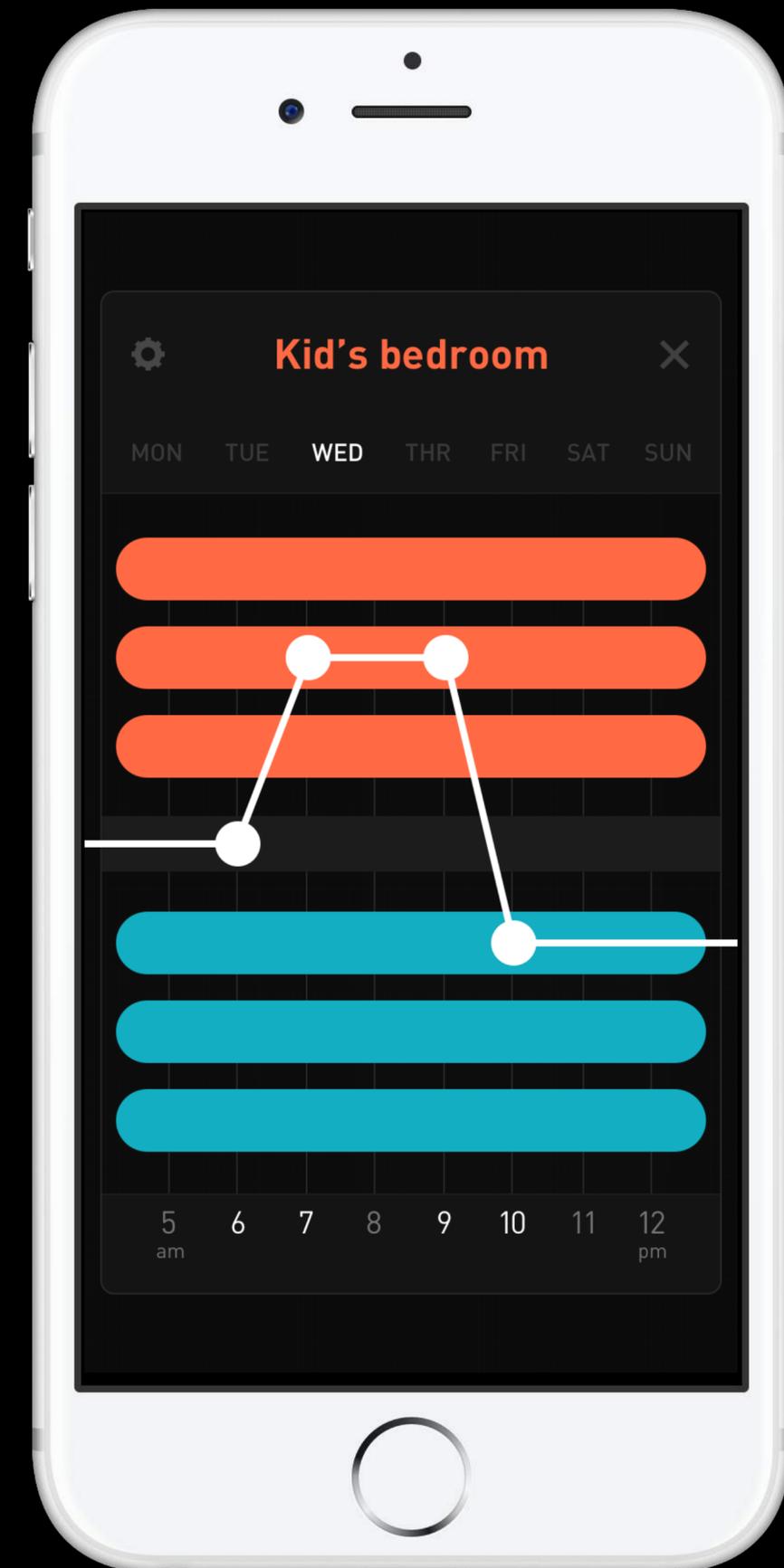


SOLUTION 4.3

Navigating schedule

To navigate the schedule, the user swipes in either direction anywhere on the graph.

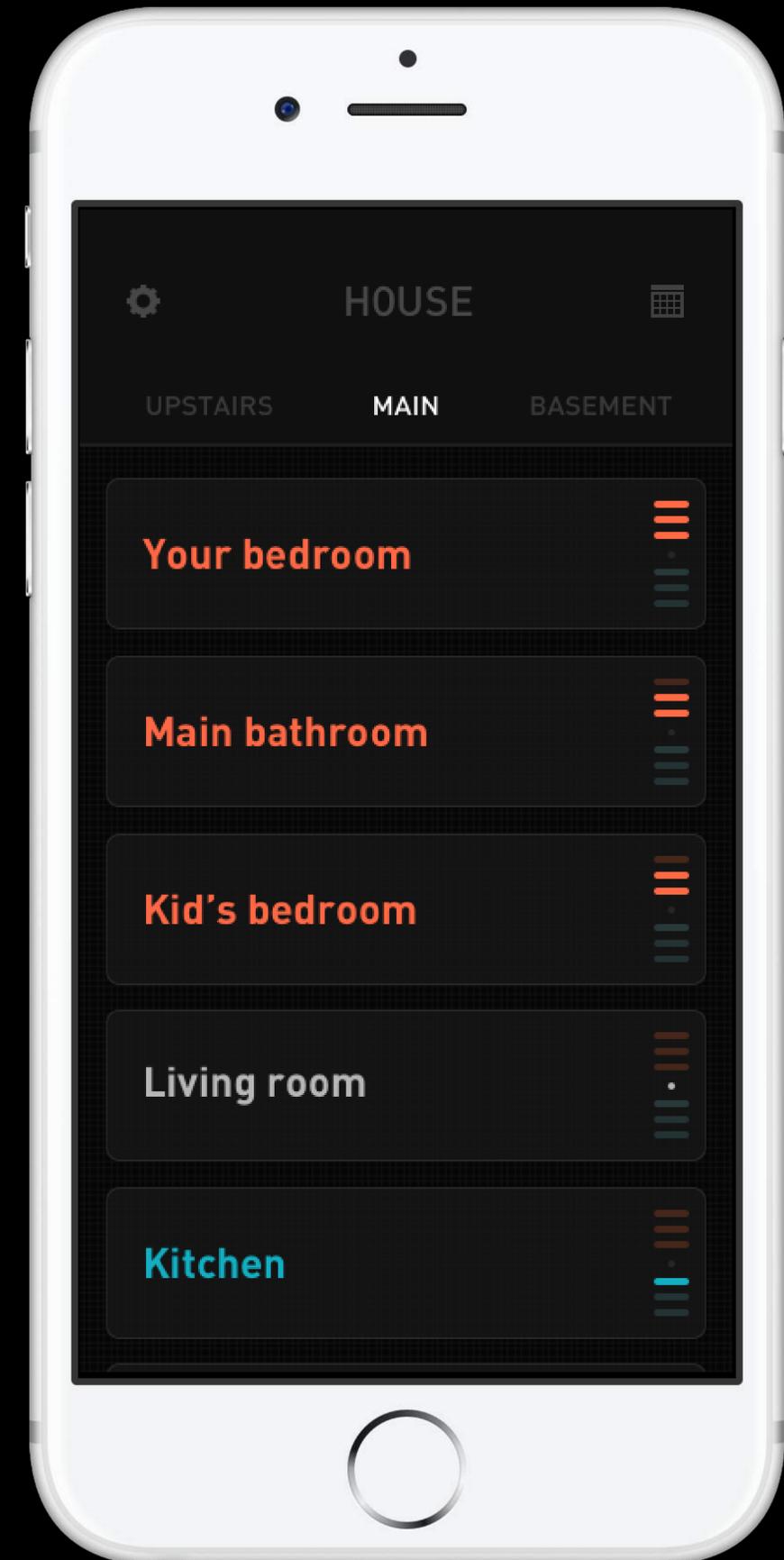
- The graph swipes between preset sections of 8 hours (morning, daytime, night)
- The time labels are replaced by the section title while the user swipes to give them a quicker and easier way of understanding where they are
- As the user navigates through the sections of entire days, the weekday navigation automatically adjusts to the new position

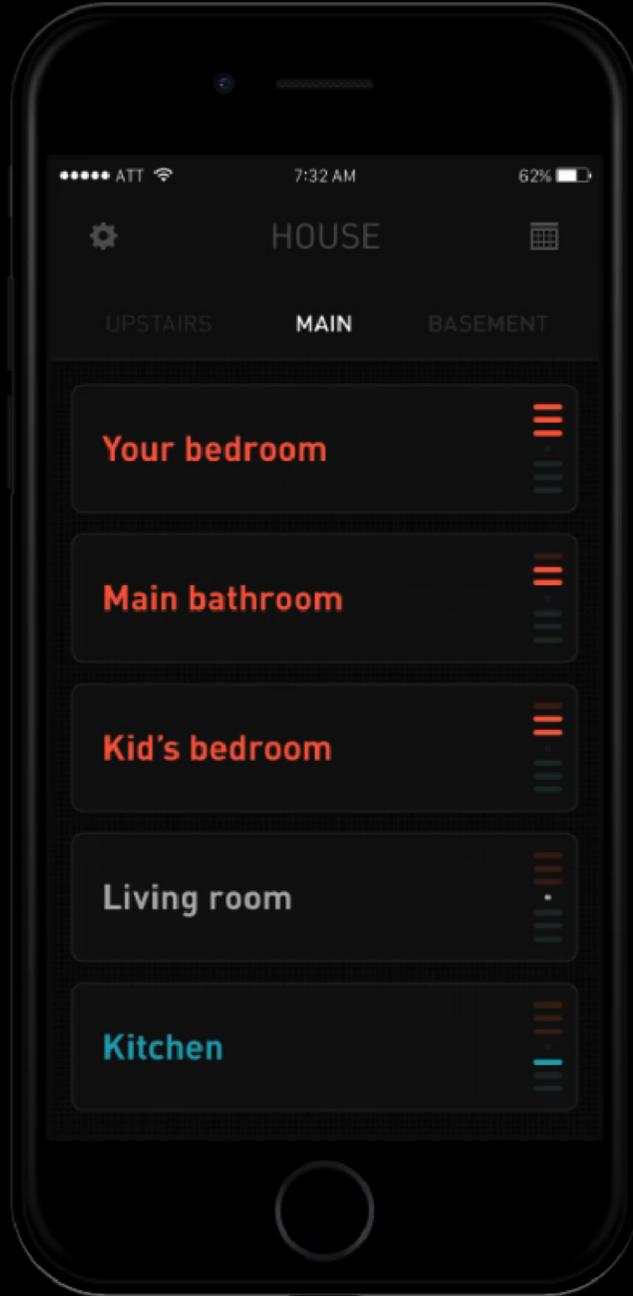


Filtering rooms

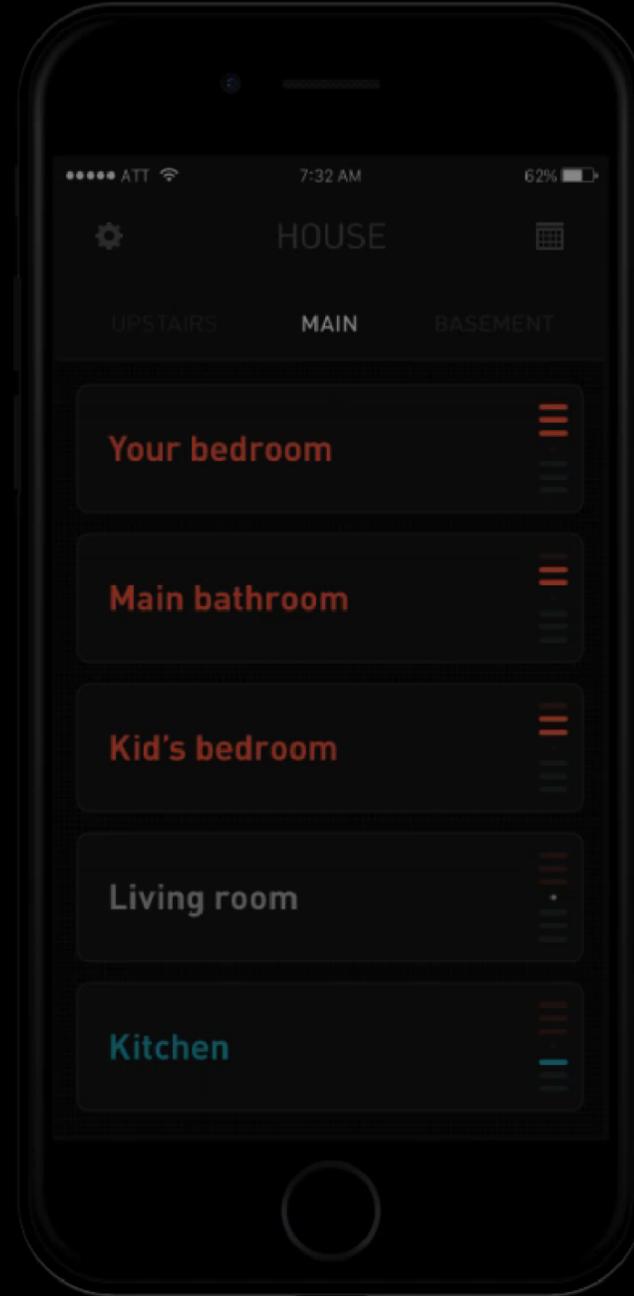
To filter the rooms list, the user taps on different floors in the menu or the “house” logo on top.

- The different floor lists exist beside each other the same way they are represented in the menu
- The lists slide across while the new selected button lights up in order to give the user reference of how the lists are oriented
- When the lists combine due to selection of the “house” button, the cards from other floors slide in from the direction of that list to give the user a hint of which floor that room is on without having to provide a label on each individual card

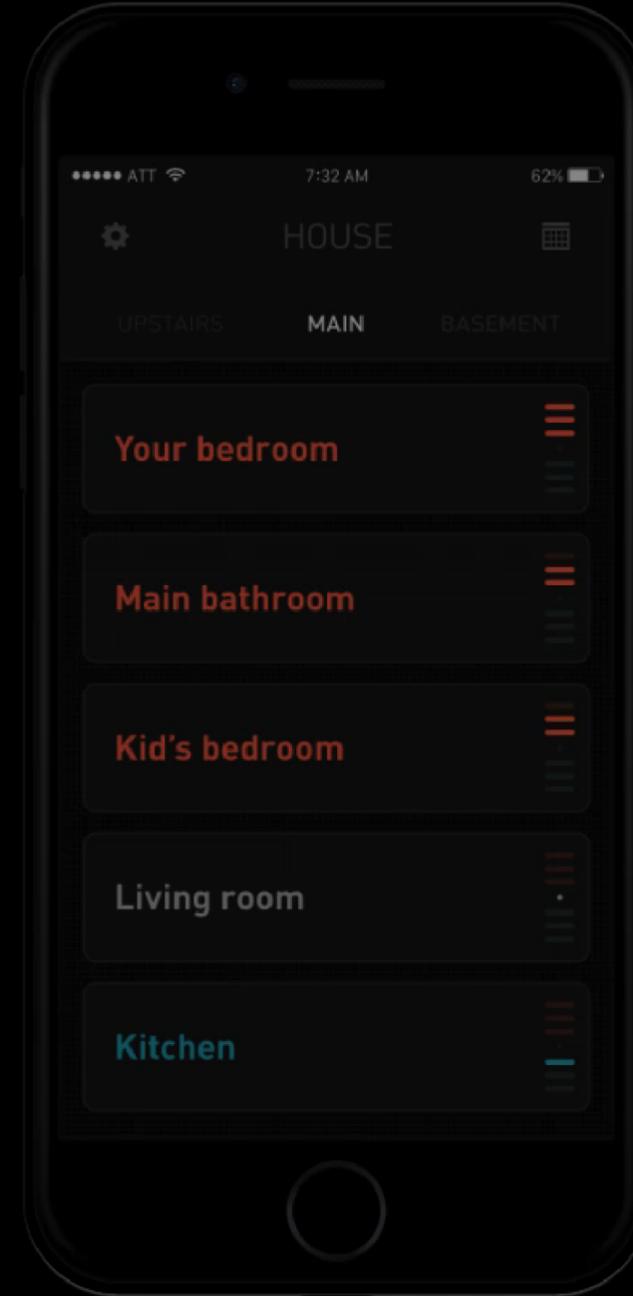




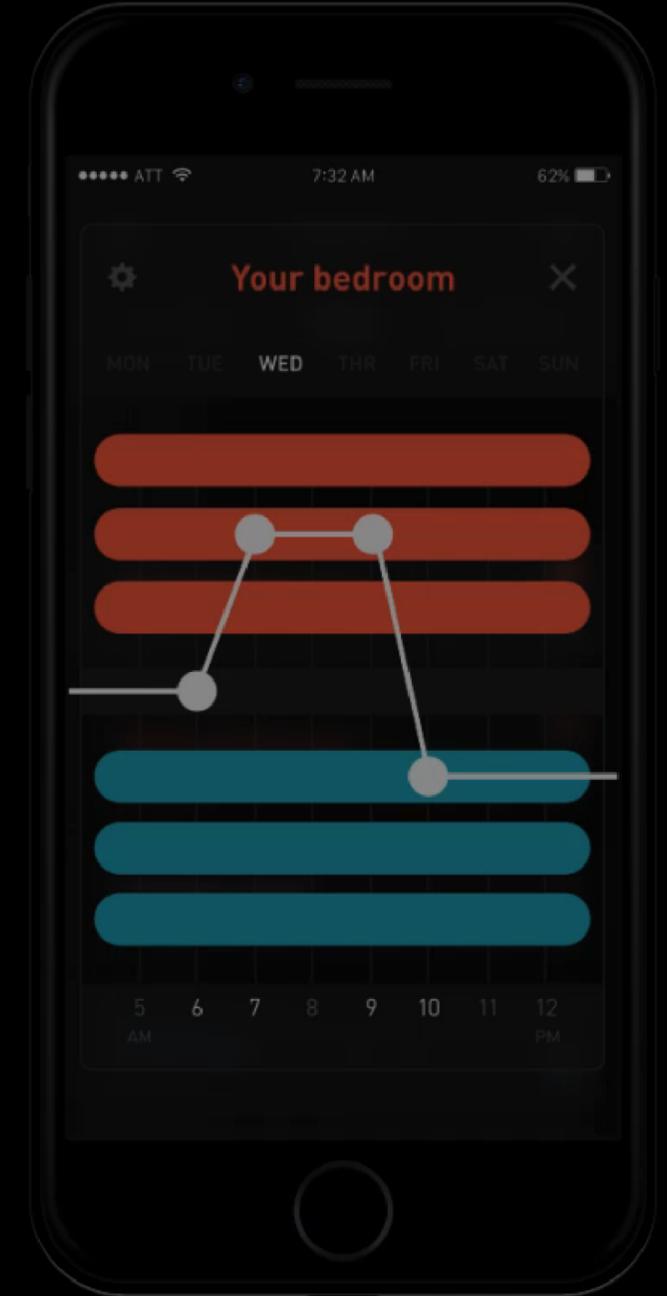
Filtering rooms



Adjusting temperature



Opening schedule



Navigating schedule



End+Thanks