

# h<sub>2</sub>ow low

*...can you go?*

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*collect, compete, conserve*



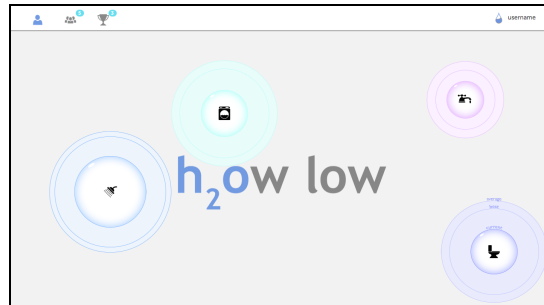
*"Moisture is the essence of wetness, and wetness is the essence of beauty." - Derek Zoolander*

## PROBLEM AND SOLUTION OVERVIEW

Currently, very few people have systems in place to track water usage. At this time, there is no easy or convenient way to collect this information. As a consequence of this, most people have no concept of how much water they use, or where it is used, and therefore have no motivation to track or reduce use. Even for those who are interested in saving water, there are no concrete implementations to feasibly and easily facilitate this, because people cannot even definitively determine their main source of water use.

To combat this void in available technology, our group proposes a vision of a comprehensive, in-residence system that automatically tracks water use and sends data to our app, which then allows

- 1) set personal performance goals and receive tips to help reach achievement
- 2) analyze trends in past water usage, and
- 3) engage with other users via conservation competitions (by location or demographic), which would ideally create a competitive backdrop for conservation motivation that may even encourage those who might not have cared without these added incentives.



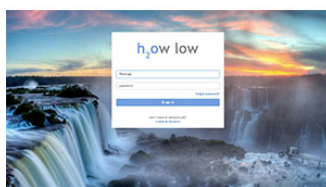
Video Demo can be viewed here (also linked on our class site):  
<http://youtu.be/FonGPuWPWQs>

Demo our hi-fi prototype here (also linked on our class site):  
[http://stanford.edu/class/cs147/projects/behavior/h2o\\_low/how-low\\_hi-fi\\_demo/Theme/](http://stanford.edu/class/cs147/projects/behavior/h2o_low/how-low_hi-fi_demo/Theme/)

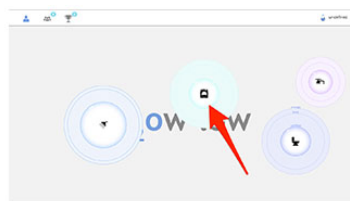
## TASK AND FINAL INTERFACE SCENARIOS

### Check personal water usage data · *simple*

We recognized the void in accessibility to personal water usage, and that is why making interaction with one's usage data and doing so in a visually engaging way is one of the primary goals of our application. A user can see his usage simply by logging in; the "my usage" page is loaded immediately from login. This design creates an immediate assessment of performance; one can grasp a sense of consumption simply by noting the size of the bubbles on the home page.



Login



Personal Usage



Appliance Data

### Compare water usage with friends · *medium*

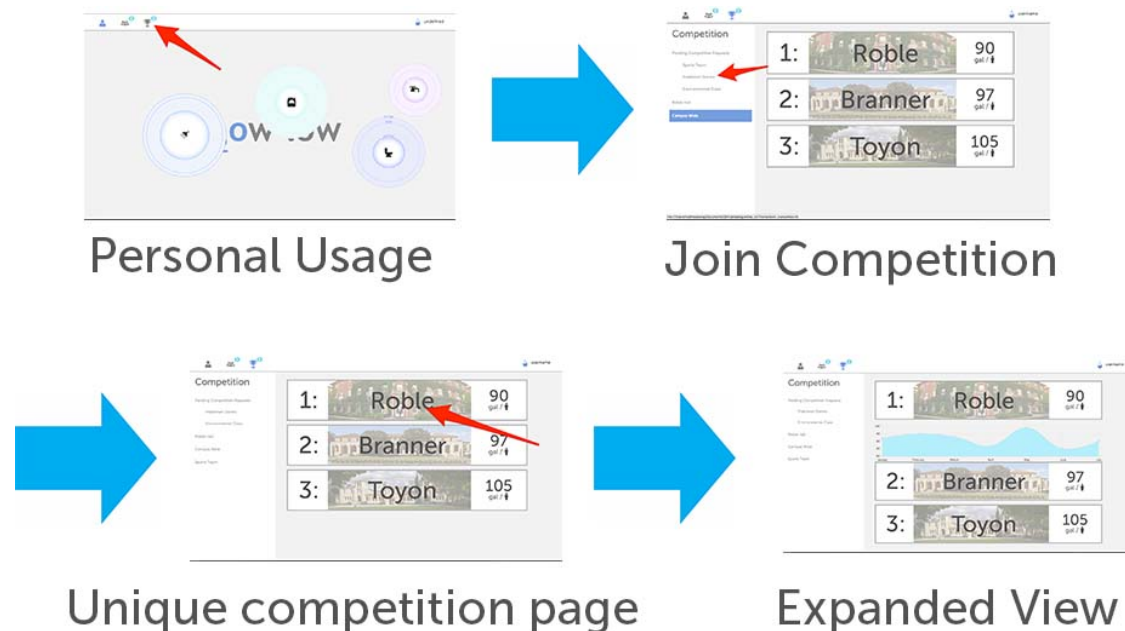
The desire to increase accountability for resource consumption drove the choice to include a social aspect in our application. People can be more motivated and more responsible if other people know how they're doing. Allowing users to check their levels compared to

their friends' levels is included in our application, with the hope that this will create extra incentive to save water.



**Find motivation to conserve · complex**

Our application employs one further tool for increasing motivation to conserve: competition. We provide aggregate statistics and the competition leaderboard that allow users to see how his group is doing, compared to other groups in the competition. Our high-fi prototype shows results for a dorm competition.



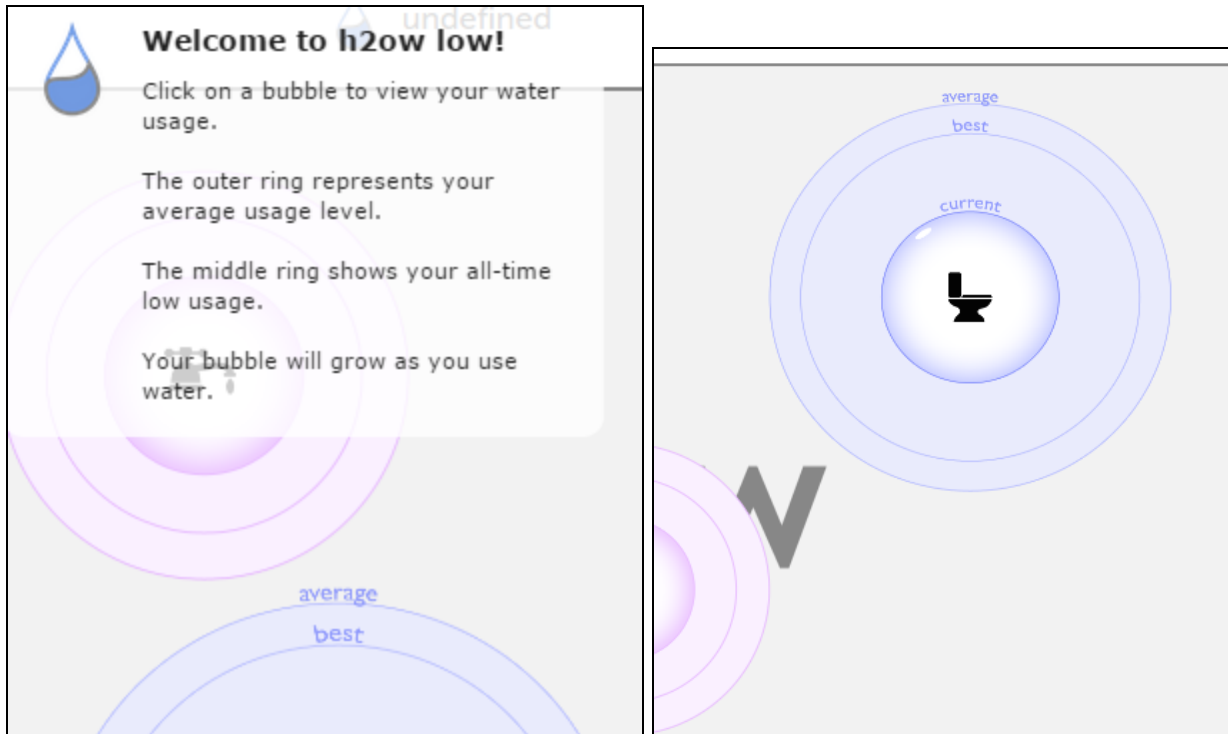
**MAJOR USABILITY PROBLEMS RESOLVED**

The heuristic evaluation report our group received based on our medium-fi prototype had nine level 3/4 violations. The violations are listed below, as well as our solution or justification for not resolving.

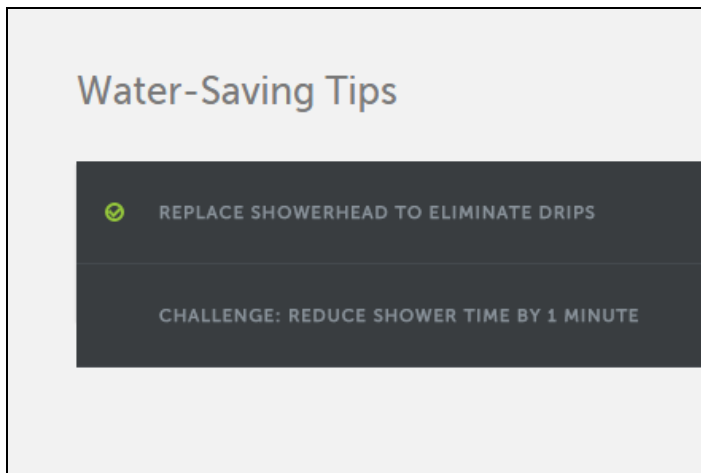
**[H2-1: Visibility of Status] [Severity 4]: Bubble homescreen non-intuitive**

We combated this problem with two things: First, we added a pop-up on the homescreen that appears immediately after login that explains the bubbles (below, left). Second, we

annotated one of the homescreen bubbles with labels of 'current,' 'average,' and 'best' to denote the different fields of each bubble-graph (below, right).



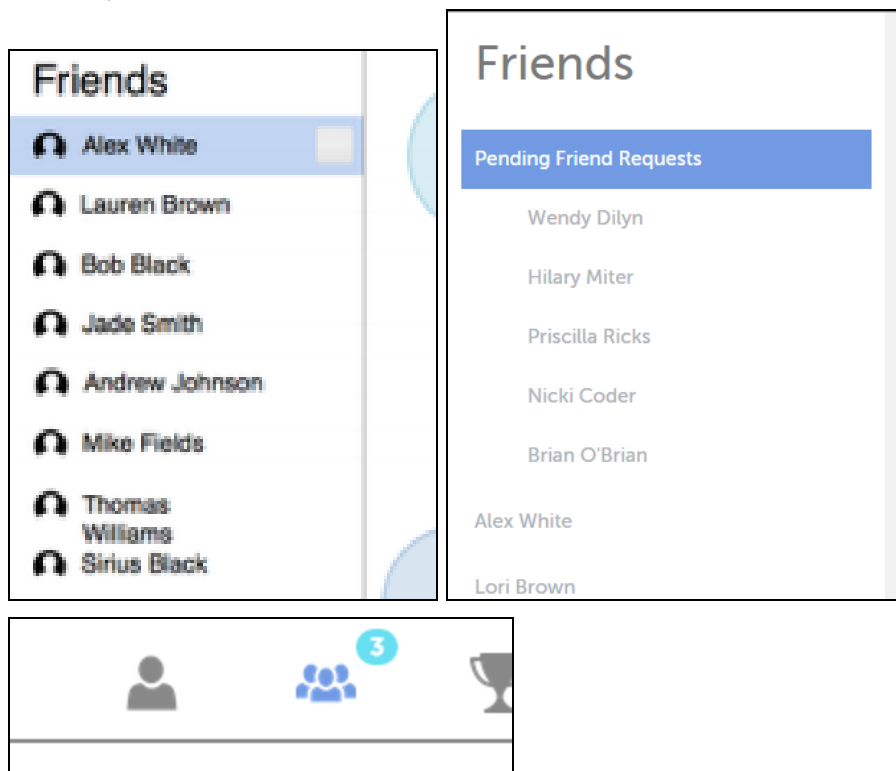
**[H2-5: Error Prevention] [Severity 3]: No help for users rectifying appliance problems**  
If users have a leak in their faucet, our app alerts the user. Also, the 'tips' panel on each appliance usage page contains relative tips, personalized for the user.



**[H2-4: Consistency] [Severity 3]: No 'pending friends' differentiation**

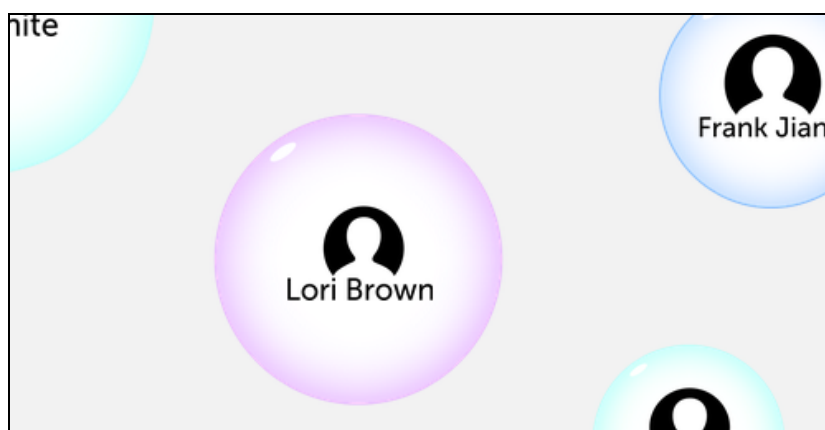
In our medium-fi design, pending friend requests were only visible upon hovering, when a checkbox would appear (below, left). Our friends page now contains a clearly labeled 'pending requests' section, which is positioned above all one's current friends, to help users see this information immediately upon navigating to the page (below, left). In addition, the

'friends' icon in the top navigation bar (which appears on every page save the homepage) contains a notification number, reminding users that they have friend requests (below, bottom).



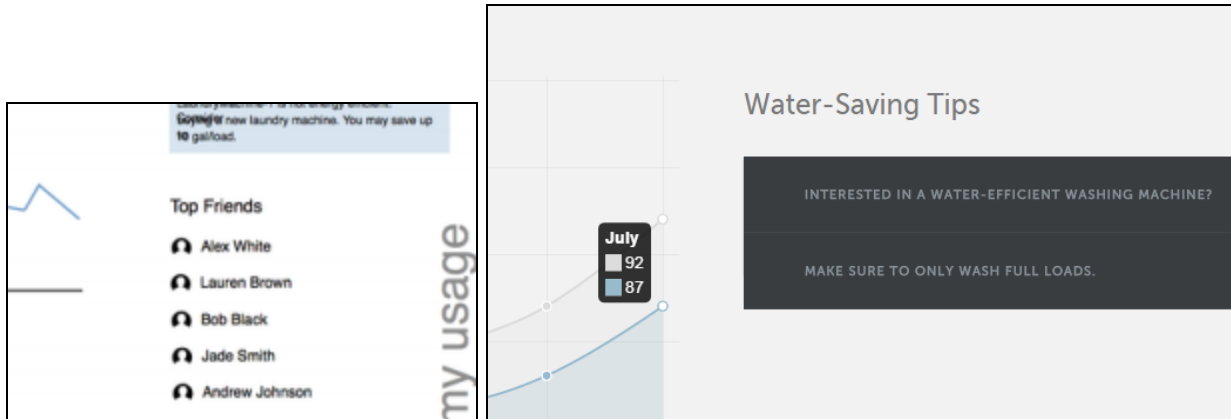
**[H2-7: Flexibility and Efficiency] [Severity 4]: Friends usage bubbles would be hard to compare (if they had concentric circle average/best/current design)**

We simplified the design of friends' usage bubbles that appear on the main friends page. Instead of including the concentric circles, each friend's bubble is only one circle, denoting current total use. That way, users can gauge at a glance which friends are using the most water, and don't get caught up in the less important facts, like what each friend's average is.



**[H2-6: Recognition not Recall] [Severity 3]: 'Top friends' section unclear**

It was unclear to our evaluators what the 'top friends' section (below, left) on each appliance page of our medium-fi prototype denoted (whether 'top' denoted most water saved, most water used, etc.). For that reason, we scrapped that element in our high-fi prototype and made a more prominent tips panel on appliance usage pages (below, right).



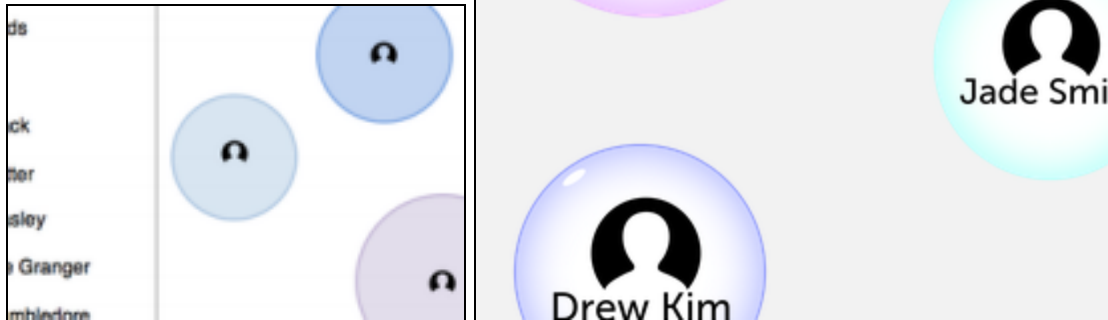
**[H2-10: Documentation] [Severity 4]: No help available**

While we did not add a comprehensive help menu to our high-fi prototype, we did introduce a tutorial-style popup on our homepage to explain the element we thought had most potential to be confusing: the bubble-graphs.



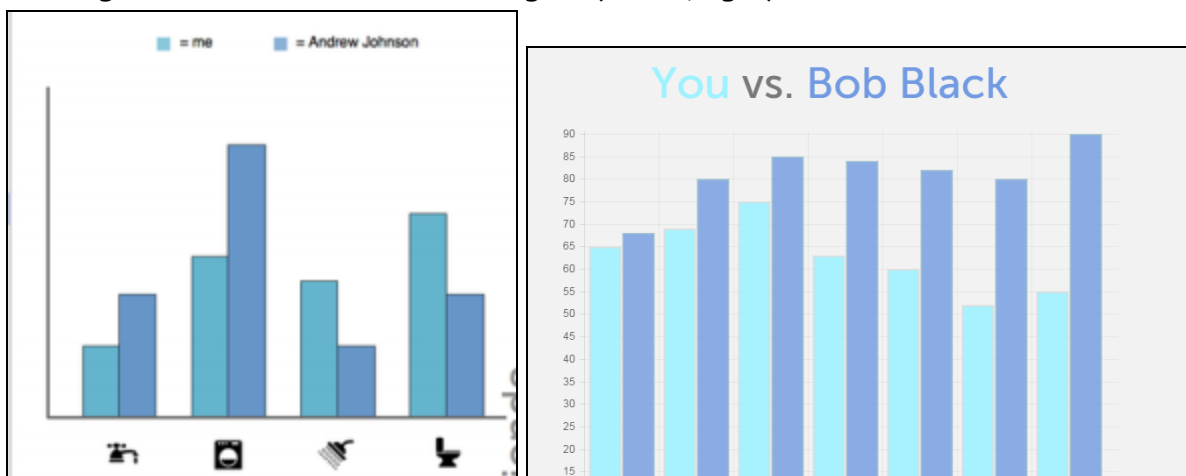
**[H2-1 Visibility of System status] [Severity 3]: No indication as to who each friend bubble belongs.**

This detail was missing in our medium-fi prototype simply because it was not fully implemented and was, in a sense, Greeked-out (below, left). Our final prototype includes friends' names on their respective bubbles (below, right).



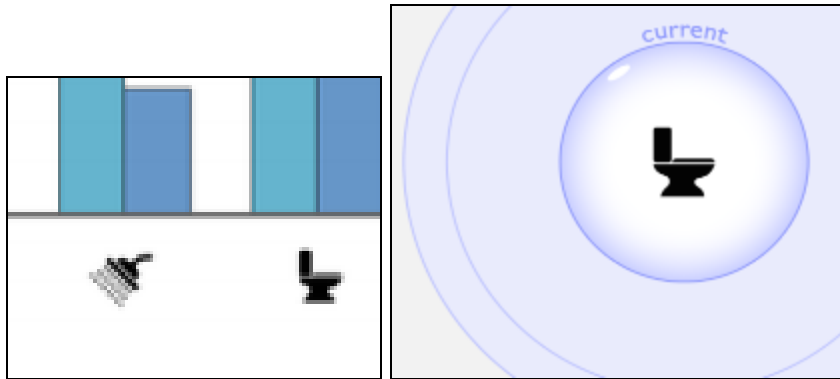
**[H2-6 Recognition rather than recall] [Severity 3]: No labels on friend comparison graphs**

We added quantitative labels to our comparison graphs, and we made the design change from bar graphs per appliance in our medium-fi prototype (below, left) to line graphs showing overall use over time in our high-fi (below, right).



**[H2-4 Consistency and standards] [Severity 4]: Appliances are clickable in some places, not in others**

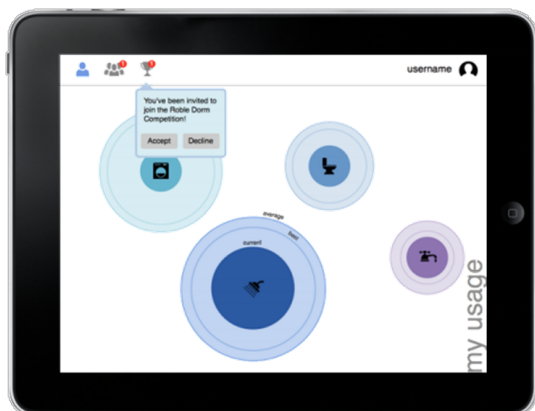
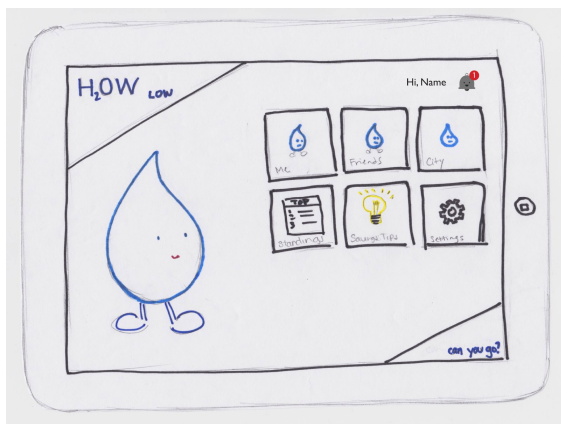
It was reported that our medium-fi design was ambiguous because our appliance symbols were clickable from some pages but not from others (below, left). We eliminated ambiguous icons in our high-fi and now only include the icons on the homepage, where each bubble *is* clickable (below, right).



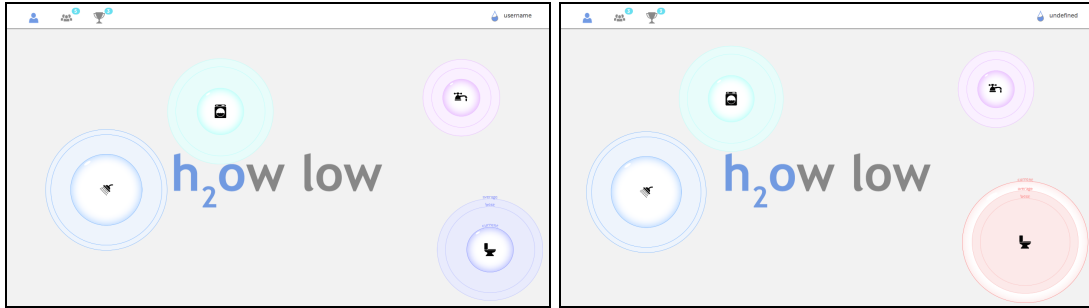
## DESIGN EVOLUTION

Below, we show the evolution of our design in three stages: low-fi, medium-fi, high-fi.

**Homepage:** the decision to make a dynamic homepage was based on initial user testing, as well as our motivation to engage users with their data immediately upon entering the app.

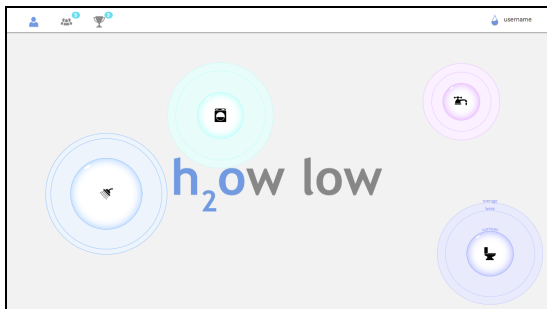
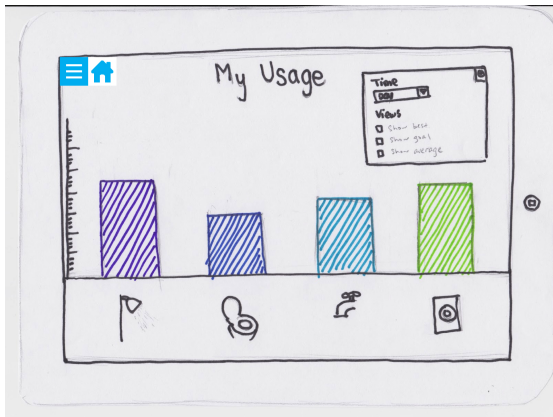






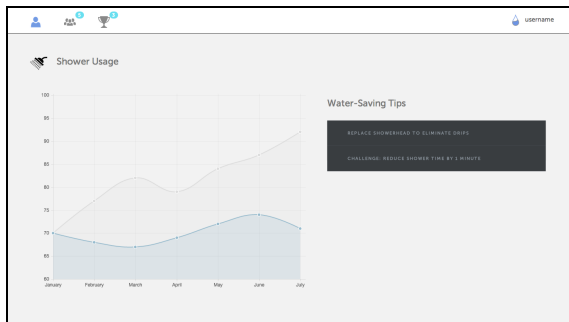
(in right image, user's current toilet water usage has exceeded his average/best and therefore has turned red to alert him)

**My usage:** As mentioned, the my usage page went from a static bar graph page to the actual homepage, which displays information in an engaging, immediate way.



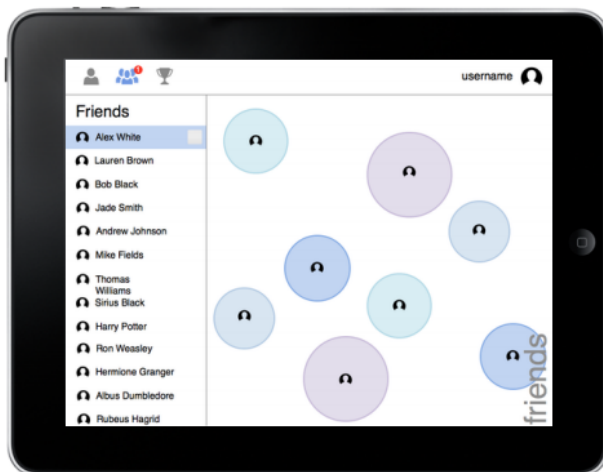
## Appliance use page:

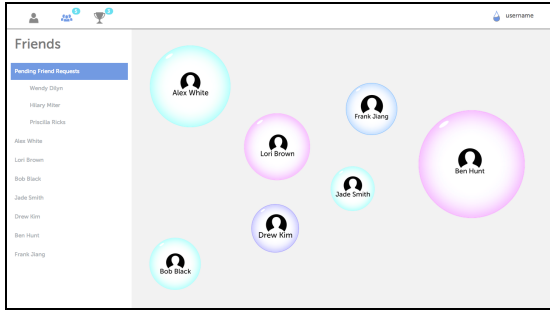
[Not present in low-fi prototype]



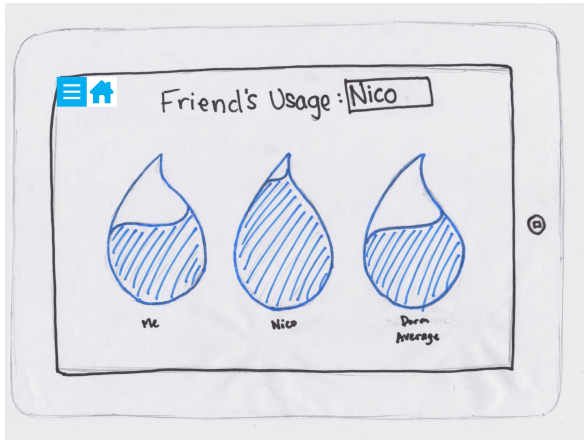
## Friends' Overview page:

[Not present in low-fi prototype]

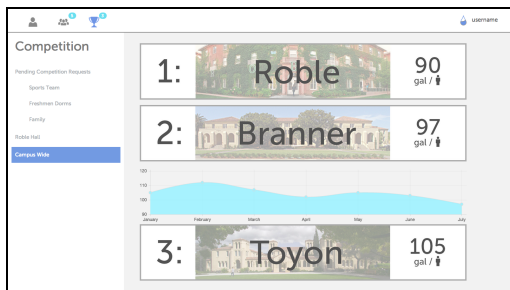
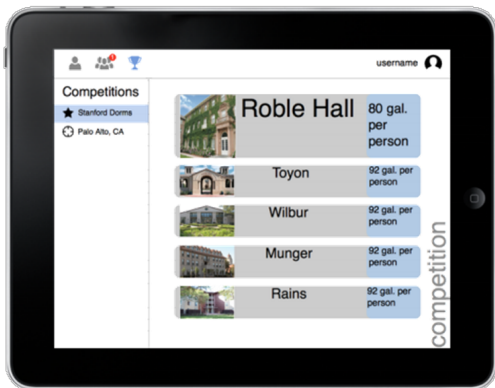
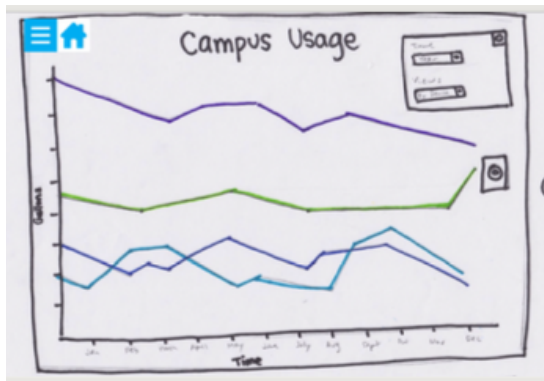




**Single friend comparison page:**

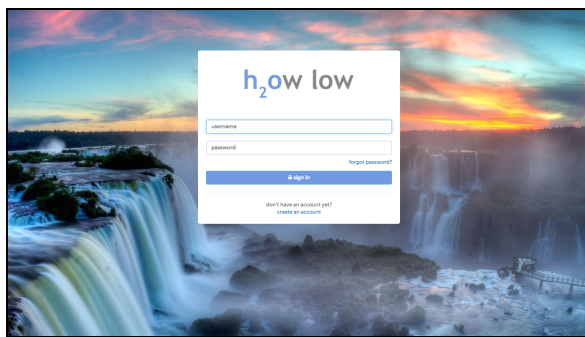


## Competition details page:



## Login:

[Not present in low-fi prototype]



## PROTOTYPE IMPLEMENTATION

### Tools

Between our medium- and hi-fi prototypes, our group decided to make a platform switch from iPad to web. There were many motivating factors for this change. The first was increased portability. Since we envision this type of system being most useful in large format (perhaps on a wall screen in a home or dorm), the design would be more similar to that of a webpage. Second, we anticipated reaching a wider audience base, as nearly everyone has used a web application, but the subset of the population that owns and has used an iPad is much smaller. This factor would contribute to a lower learning curve for users and more familiarity with the motifs and styles of a web application. Finally, a practical reason we had for switching our platform was the experience of our team. None of our members had any experience with mobile programming. Only two of our teammates really had experience to web programming, so there was still a bit of a learning curve for all of us in programming for web and getting familiar with Javascript and HTML. We were able to flesh out our vision in a web application, and every member of our team contributed to the programming aspect of our project, which would not have been possible, had we decided to code for mobile.

### Wizard of Oz

Our application does not make use of any Wizard of Oz techniques.

### **Hard-coded data**

All of our water usage data is hardcoded, because our implementation relies on the assumption that usage data is automatically collected from household appliances and imported into the application's database (using something like the Belkin Echo product). Since no technology is widely-available commercially for such data collection, our application bases graphs, trends, and other functionality on hardcoded, created data.

### **What's missing/future plans**

There are a lot of lower priority, fun features that we would wish to add in the future, if we continued work on our project.

For our current design, we would like to add the capability for the user to create a dorm competition. The dorm competition page would allow users to set the judging criteria (aggregate usage or per resident usage, all appliances or just one) and to invite competition participants.

Similarly, we would like to add the ability to add friends, and to implement a suggested friends list based on proximity. Users could then easily compare their water usage with neighbors.

We chose to focus on the competition/social aspect of motivation for this project, but an idea that we would also want to integrate is a charity motivation model. Under this proposed model, our app would contribute money to charities that provide water to impoverished people for every gallon saved by our app users. The donated money could come from an outside sponsor, such as the utility company, to incentivize reduced domestic water usage.

We also initially envisioned the app to be on a display in a dorm/house instead of being a website. Users would have a watch or some sort of wearable that was synced with the a coordinating application on your phone to make the data accessible on the go. The wearable could give you immediate feedback based on your usage. Our concept video showed it sensing that the user was showering and notifying him that he had was close to (and exceeded) his target time.