Designing a New Smart Sink for Water Usage Awareness

Mechanical Engineering Summer Undergraduate Research Institute 2019

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Abstract

The state of California is no stranger to droughts. About five months ago, the infamous seven year drought had officially come to an end as above average rain and snow hit California during the winter. Although the drought has ended, it is possible that it will come back again. To reduce the chances of another drought in California, I focused on the kitchen sink and how to reduce water waste while washing dishes. I explored different designs of smart kitchen sinks in order to have a user friendly and water conservative design, while also still having the efficient and versatile aspects a normal sink would. Through these designs, I incorporated several designs of a smart sink, containing many things like buttons, sliders, and screens, and overall sink aspects, like detachable faucet heads and smaller sink bowls.

Background

Starting in 2011, California faced a drought that would last up to seven years. The U.S. Drought Monitor started in 2000 and recorded the 376-week drought. Its measurements range from D0 – Abnormally Dry to D4 – Exceptional Drought. The most intense period of drought occurred the week of October 28, 2014 where D4 affected 58.41% of California land.

In a state of nearly 40 million residents, there were many suggestions on how the average citizen could save water in their homes. Ideas included using high-efficiency washing machines, shorter showers, not watering lawns, even using less dish soap when washing dishes to reduce the rinse process. I sought to improve the way people wash dishes with a smart kitchen sink. Throughout my research, I collected several different types of data. I searched for different sink designs that were the least efficient 5, how much water is distributed in a sink per minute 6, and what can decrease water use.

I also took another experiment done by my lab into account. The new sink would need to measure how many gallons the user has used and water flow scales to allow for more custom faucet flow.

Design Requirements

Design aspects to avoid:
- Large sink bowls that can hold more water
- Under-mounted or flush sink bowls due to leakage
- Portable and unstable

Design aspects that are needed:
- Detachable faucet head
- Sink strainer
- A way to turn on the faucet
- A way to control the faucet

Design aspects that can be added:
- Two sink bowls for drying dishes
- An aerator
- A counter to track how many gallons of water have been used
- Soap dispensers

Designs

This design has a handle to turn the faucet on and off, two sink bowls with sink strainers, a detachable faucet head, and three different types of devices with the gallon counter that was inspired by the Elkay “EZH2O” Water Bottle Filling Station. Designs 2 and 3 of the devices with the faucet head include controls for temperature and water flow. Design 2 is a touch screen devices, while Design 3 is a button device. The reset button is used to revert the counter back to zero. The user can push it every time they wash the dishes, every month, or even every year.

The final design contains all of the design aspects that are needed and can be added. Although the sink bowls have a farmhouse sink design, it is split in half in order to reduce the amount of water used. This final design also showcases the gallon counter with buttons to control custom water flow and temperature, along with a reset button to revert to standard temperature and water flow and revert the Gallons Used back to zero. The kitchen sink is the perfect place to start with water conservation because it’s used nearly every single day. The easiest way to contribute are simple things like installing an aerator into your faucet, which splits the water into multiple streams and dilutes it in air. I hope in the future more people use more water-saving sinks in order to prevent droughts and waste of resources.

Conclusion

This work was supported by the Interdisciplinary Research in Sustainable Design Lab. I appreciate the help of my mentors, Eley Ng and Ting Liao, my PI, Dr. Erin MacDonald, and the rest of the IRIS Design Lab. I thank the Mechanical Engineering Department Summer Undergraduate Research Institute (SURE) program at Stanford University for their generous grant and allowing me to participate in this opportunity with my SURI cohort. Finally, I am thankful for my friends and family for the encouragement throughout this entire program.

Acknowledgements

In this design, the faucet and the soap dispensers are automatic and motion activated. It had the same type of farmhouse sink design, but split into two to reduce water waste. The inside of the bowls are rounded to make the volume a tad bit smaller as well. This sink is also flush with the kitchen counter for easy counter cleanup.

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