H_2Flow

Water where you want it

Prepared For

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Executive Summary

Problem and Project

Those who do not have to access to full-sized kitchen sinks, like college students and apartment residents, cannot fill up oversized items like water filters and pots. Our design team sought to manufacture a solution to this problem.

Purpose and Scope

Our objective is to design a product that allows our users to fill up any item, regardless of size, in any sink, through the use of a universal faucet adapter and a flexible hose.

Methodology

We began by generating design constraints from group discussion and user observation and testing. Three design alternatives were generated. Through an iterative process of user and performance testing we selected a final design.

Design

H_2Fl●w is a universal faucet adapter that works by encompassing the entire faucet head and forming a watertight seal. The resulting water system exits through a flexible hose allowing users to manipulate water to desired exit. See *Figure 1.*

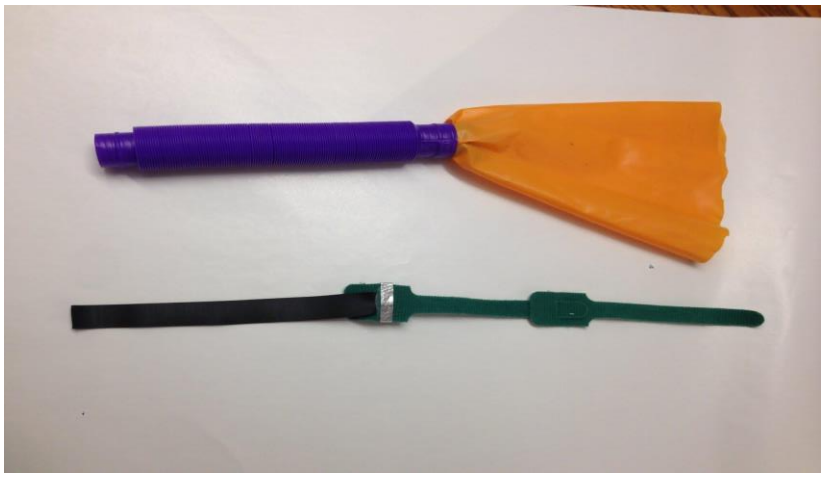

Figure 1: H_2Flow Final Prototype

Component	**Benefit**
Silicone Adapter	Flexible silicone cone wraps around faucet heads of any shape to form a universal watertight seal
Flexible Hose	Allows the path of the water to be manipulated
Expanding Hose	Allows H_2Fl●w to be compressed when not in use, saving space

Table 1: Components and Benefits

Introduction

Design Problem

On any given day a college student will have to fill up items like Brita water filters, water bottles and pasta pots. The average sink in a college dorm is 5 - 8” inches deep and 12”- 15” inches wide. A common Brita water filter is over 12” inches deep. The Brita along with most pasta pots, and many water bottles, is simply too big to fill up in dorm sinks. *Figure 2* and *Figure 3* show two different styles of Brita filter not fitting properly in two different sinks. Our design team manufactured *H_2Fl◆w*, the water transportation system that puts ‘Water Where You Want It” to combat this daily struggle.

Figure 2: Brita Filter I

Figure 3: Brita Filter II

Design Goal

Working with Design Lab Home, DLH, and Professor Walter Herbst, our design team was tasked to explore the market whitespace surrounding everyday household activities, like filling up a water filter. Our team decided to primarily explore the whitespace in the activities that the average college dorm resident experienced.

Dorm sinks, primarily those in the bathrooms, tend to be shallower than sinks in a true kitchen. The clearance between the lip of the sink and the faucet itself was found to have a measurement of only about 1” inch. This makes it very difficult to properly fill oversized items like pasta bowls and water filters. *Figure 4* shows a large water bottle being filled with *H_2Fl◆w.*

Figure 4: Prototype with Water Bottle

The standard dorm sink is simply not big enough to easily and quickly fill up the everyday items a college students uses. Therefore our team focused on a design solution that would allow a simple attachment to be used with all shapes and sizes of faucets, a universal faucet adapter.

Existing Solutions

There currently exists a numerous amount of products that do adapt to faucets and attempt to relocate the water stream. The problem with these products is that they are not universal to all sinks. Our product is aimed at all college students and our one design is capable of adapting to any and all faucet sinks. *Figure 5 and Figure 6* demonstrate the current existing solutions on the market.

Figure 5: Rinse Ace Pet Faucet Sprayer

Figure 6: Aqueduck Original Faucet Extender

Table 2 highlights the different flaws and benefits to existing solutions on the market. The main problem is that most solutions and faucet adapters are not universal. Most are designed to fit 1” inch aerator threads but not all sinks have this design. Our main design goal was to research and manufacture a true universal faucet adapter.

	Rinse Ace Pet Faucet Sprayer	*Aqueduck Original Faucet Extender*
Flaws	Leaks, not universal	Not universal, only fits larger sinks
Benefits	Relocates water well	Relocates water well

Table 2: Existing Solutions Analysis

Our Design

H_2Fl◆w is a universal faucet adapter that allows users to fill oversized items in almost all sinks by relocating the path of the water. The design consists of a hose and faucet adapter. The adapter works by swallowing the entire head of the faucet and a fastener is applied to create a watertight seal. The hose is used to direct the flow of the water to the desired location. *Figure 7 and Figure 8* demonstrates the final prototype in use.

Figure 7: Final prototype - Collapsed

Figure 8: Final prototype - Extended

Report Overview

This report contains the following sections:

- Users and Requirements
- Design Concept and Rationale
- Next Steps and Limitations
- Conclusion

User Requirements

To ensure the effectiveness of *H_2Flow* our team operated to a set of design constraints and user requirements. These served as guidelines to the development of our design.

Users and Stakeholders

The users and stakeholders have been determined through group discussion.

Users, Influencers (parents, universities), Purchasers and other stakeholders

Primary Users
- College Dorm Residents

Secondary Users
- Apartment Residents
- Office Workers

Stakeholders
- Segal Design Institute
- Design Lab Home
- Walter Herbst

Purchasers:
- Walmart
- CVS
- Bed Bath & Beyond

Refer to *Appendix A: Project Definition* for more details

Requirements

The following information in *Table 3* outlines our major design and user requirements which were determined from the data collected in *Appendix B: Background Research, Appendix C: User Observation and Appendix D: User Testing*

Requirements	Specifications
Universal • The design is compatible with a majority of faucets	• Design needs to fit the 5 different faucets that were chosen for testing
Compact • Design takes up the minimal amount of space	• The final design is less than 1 foot and 1 pound
Secure • Design does not fall off during use	• Fails in less than 5% of trials

Table 3: Design Requirements

Design Concept & Rationale

Overview

The *H2Flow* is a universal faucet adapter designed to allow those without access to full-sized sinks, college students, to fill up oversized items with ease. The flexible silicone funnel forms the bulk of the adapter. It wraps around any faucet and forms a watertight seal, with an elastic fastener, to create an effective universal watertight seal. The flexible hose attached to the adapter allows the water to be manipulated and placed where the user wants it. The following is an overview of the components of the design. (See *Appendix E: Dimensioned Sketches* for full parts drawings)

- Silicone Funnel
- Elastic Fastener
- Flexible Hose - Contracts from 24” inches to 8” inches

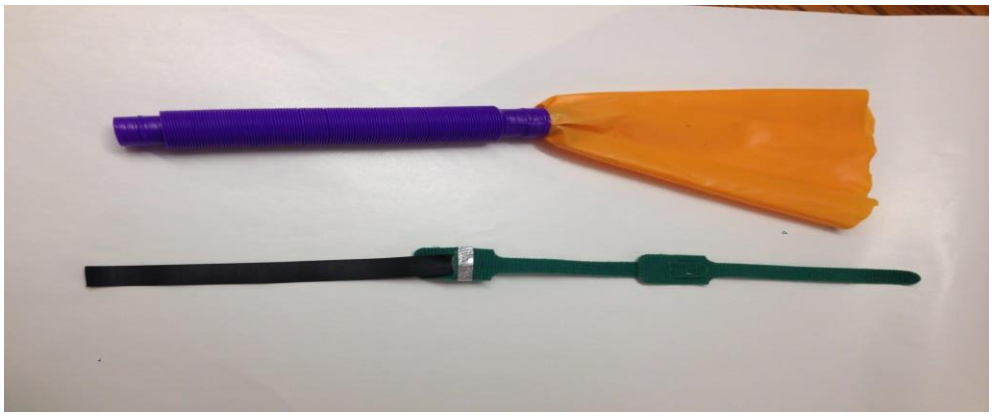

Figure 9:H2Flow Components

User Scenario

College students and those who live in apartments may not have to access to deep kitchen sinks. The average depth of a college dorm sink is only about 8” inches, while a Brita water filter is over a 12” inches deep. This makes it difficult to fill up oversized items due to the geometric constraints of fitting the object under the faucet head. With the *H2Flow,* users can overcome this obstacle and put the “Water Where They Want It”.

Details

Concept (Specifications, Features, and how it’s used) and Rationale (Benefits and evidence from testing)

<u>Silicone Funnel</u>

Concept

The flexible silicone funnel is 4” inches by 3.5” inches. It is a repurposed cone shaped pastry bag which allows different shapes and sizes of faucets to fit. The silicone bag is seamless so as

to have no holes for water to escape through. It is used to create a watertight seal around the head of any faucet.

Figure 10: Silicone Funnel

Rationale and Benefits:
The pastry bag was selected because it was seamless and flexible and can survive shearing pressure without rupturing. The silicone also forms a high-friction seal against most other materials which was an ideal quality for achieving a watertight seal. The silicone was repurposed from a pastry bag as it already had the necessary conical funnel that allows the adapter to be universal to most every faucet shape. The silicone materials is also highly water-resistant. These benefits allow it to be both durable and flexible.

Elastic Fastener

Figure 11: Elastic Fastener

Concept
The Elastic Fastener is a hybrid Velcro-rubber loop. The rubber component forms a tight seal around the silicone pastry bag while the Velcro component holds it together under pressure. It is 14.5” inches by 0.25” inches.

Rationale and Benefits:
The combined use of materials led to gaining the strengths of both with the weaknesses of neither. The rubber gives it the flexibility to form a tight seal, the Velcro helps to adhere it all together. The fastener is then used to hold the silicone funnel in place and holds the watertight system together.

Flexible Hose

Figure 12: Hose - Collapsed

Figure 13: Hose - Extended

Concept

The hose has an outer diameter of 1” inch. It features the ability to expand from only 8” inches to 24” inches.

Rationale and Benefits:

After testing numerous types of hoses - rigid, flexible, and stretchable - it was decided that the hose diameter needed to remain rigid so that water flow would not be constricted. However, it still needed to be flexible enough for the user to direct it to the object he or she is filling. This flexible accordion hose was selected for its adaptability and ability to expand and contract with the arm of the user. This allows the water to be relocated to more locations than if a stiff hose was used. In addition the hose contracts to a small size when not in use which allows for easier packaging and storage of the hose when not in use.

See *Appendix F: Usage Instructions* and *Appendix G: Manufacturing Guide* for more info about the Final Prototype

Next Steps & Limitations

In order to further enhance our design, we have discussed possible steps that could be taken in the future with additional resources. There are several ways the H_2Flow could expand in terms of its function and design, and this section outlines potential opportunities for future development.

Bacteria and Mold Resistance
The hose may be prone to growing molds and bacteria because of the residual moisture and sediments that may remain the hose. Designing a hose with materials that have intrinsic antibacterial and anti-mold qualities would solve this problem.

Faucet Adapter
The current adapter method works well and is universal, but the material is somewhat fragile and can be ripped from repeated abuse and misuse. A next step would be to build a better membrane that is stronger and more flexible while maintaining the watertight sealing properties of the current design. Furthermore, improving the visual aspect of the bag is a possible next step, since this silicone material creases and bends easily, resulting in unpleasant lines on the silicone bag over time.

Attachment System
Another step that could be taken to enhance the quality of the H_2Flow is further easing the installation of the device, so that it can possibly be installed with one hand, giving the user greater control and ease of use.

Marketing
Moving forward, it would also be plausible to market the product to a greater audience, and possible sell the product as a bundle with large objects that don't fit in sinks such as humidifiers and buckets.

Ultimately, the biggest step for our product would be to produce each component without having to incorporate any previously existing products. By doing so, not only would we be able to have a better and more unique product, but production costs would also decrease.

Conclusion

Our design, the *H2Flow*, is a universal faucet adapter which allows users to fill oversized items in small sinks. It relocates the source of the water with a flexible hose. The *H2Flow* is composed of the following parts (*Refer to Appendix H: Bill of Materials for more information):*

- 1 Tapered Silicone Pastry Bag - 4” Inches by 3.5” Inches
- 1 1” Inch Outer Diameter Hose Expandable Hose
- 1 ½” EPDM Rubber Strap
- 1 Velcro Strap
- 1 1” Aluminum Ring

H2Flow was designed to universally attach to any hose and it allows users to quickly and efficiently apply the adapter to any faucet shape. The system is designed to be watertight when used properly and contracts to a smaller size when not in use to maximize the portability and flexibility of the design.

Appendix A: Project Definition

Project Name: Water Transportation Adapter to Fill Oversized Items

Client: Design Lab Homes and Walter Herbst

Section 15 Team 3: Irina Baek, Sam Coverdale, Jason Glass and Zachary Guritz

Mission Statement

To design a universal sink adapter which allows oversized items, too big for a standard dorm sink, to be filled above the sink while preventing spillage.

Project Deliverables

A conceptual design model which meets all design constraints.

Constraints

- Time table to finish all components of conceptual design
- Adhering to Health Code standards
- keeping price under $10

Users/Stakeholders

Primary User
- College students living in dorms
- Households with old bathrooms (small sinks)

Secondary User
- Janitors

Stakeholders
- Colleges
- Segal Design Institute
- Design Lab Homes
- Walter Herbst
- Retail stores

Table 4: Design Requirements

Requirements	Specifications
Universal • design is usable with a majority of sinks and faucets	• Design does not have to be modified for each sink
Portable • design can easily be attached/removed and carried around	• The design is not bulky or difficult to carry • It must take user only a few seconds to install the design

Watertight • design does not leak or cause spillage	• User does not have to fear of making a mess or getting wet

Appendix B: Background Research

Our team conducted market and consumer research to identify where the “white space” existed for our Water Transportation Adapter. We used ethnographic surveying tools to query potential consumers on their design preferences. We then analyzed existing model and competitive products to narrow down our design vectors.

Ethnographic Data

A total of two surveys were conducted. The first was to narrow our potential design vectors. The second was to identify what the viable design paths and price constraints for our Water Transportation Adapter are.

The surveys were distributed through social media channels such as Facebook. Each member of our team posted the links to the surveys on Facebook and invited random and anonymous potential consumers to take the surveys to provide us with our research data. We collected no demographic data on those who took our surveys.

Survey 1 - Potential Design Vectors with Comments

82 Total Responses Recorded

Four potential design vectors were offered to our consumers:

1. Shower Head that adjusts verticality to aid tall people - 18 people selected this
2. Carrying tray that increases stability of glassware - 16 people selected this
3. Protection barrier for stoves to increase child safety - 20 people selected this
4. Water Transportation Adapter that allows easy filling of oversized items- 28 people selected this

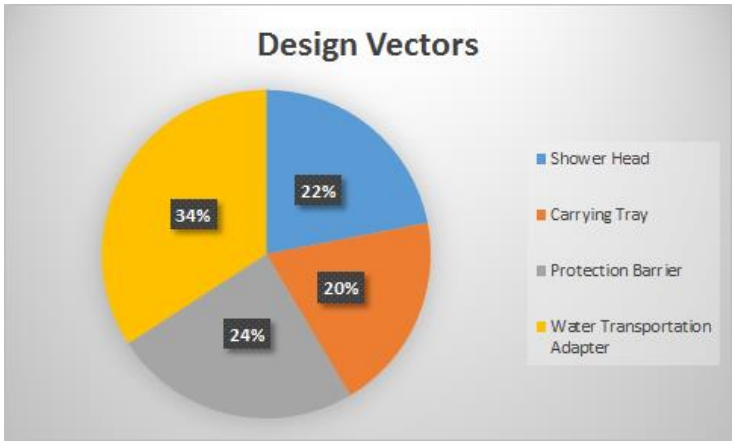

Figure 14: Design Survey

As a result of this data our design team chose to pursue the Water Transportation Adapter as our main concept.

In addition our survey provided a “Comments” section for increased consumer feedback, notable items pertaining to the Water Transportation Adapter were:

1. “to also stop water from spraying out when you fill a container”
2. “I CAN NEVER FILL UP POTS”

Survey 2 - Design and Price Constraints

27 responses were recorded

Consumers were asked to indicate how much they would be willing to pay for our Water Transportation Adapter and to indicate how they currently worked around the design problem of “How do you fill up a container too big to fit in a sink?”

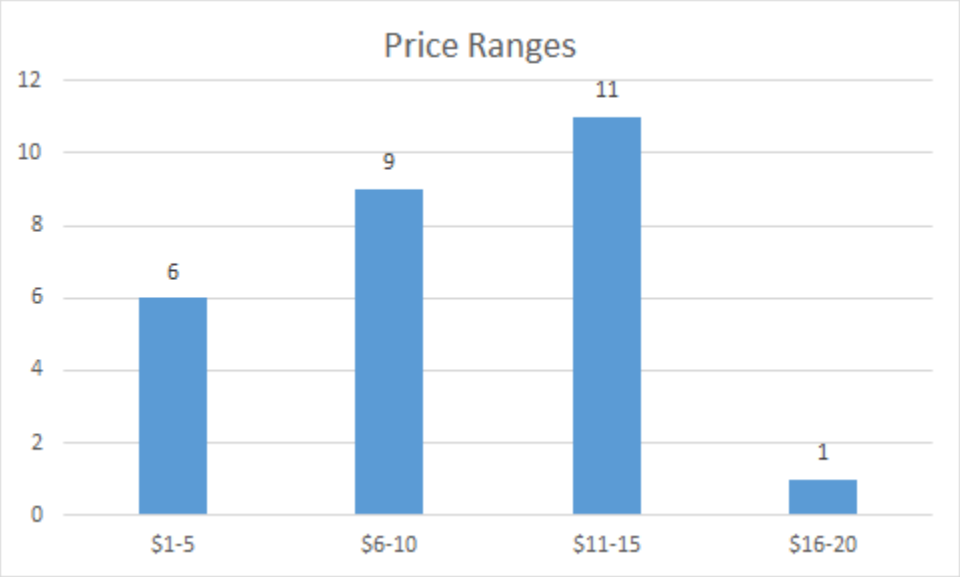

Figure 15: Price Ranges

Using this data our design team decided to focus on the $11-15 range.

The workaround comments section contained many repeat answers which have been compiled below

- Option A - Fill up smaller containers and dump them into larger one
- Option B - Use a Flexible Hose
- Option C - Try to angle the larger container
    - this method often results in unsatisfactory filling of the item
- Option D - give up and switch containers
- Option E - Use a dustpan to funnel the water
- 5 other options were not relevant to the design question

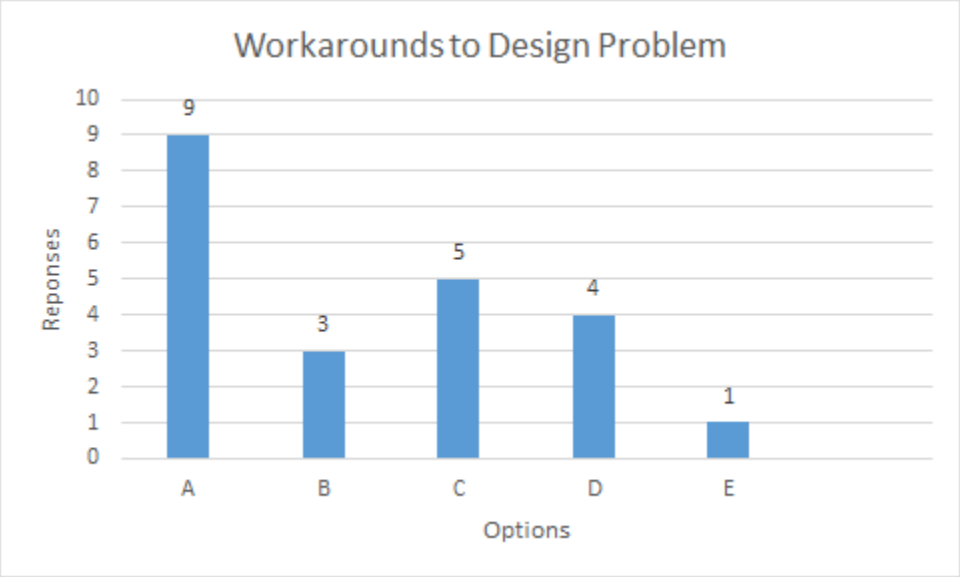

Figure 16: Workarounds

Through whitespace analysis of our market we determined that there was room for a watertight and universal adapter. The market currently has things which are only one of the two. A hose nozzle is watertight but not universal to all faucet shapes, it only fits one type of threading. We also looked at draw-string bags which use a universal method of closing their top opening, but are not watertight at all. By combining these functions we tried to make our design.

Figure 17: White Space Graph

Model Products and Workarounds

Our team looked at various products and workarounds that exist in the market already to determine how to most effectively solve the design problem while taking advantage of market white-space.

Figure 18: "Dust-pan Workaround"

Source : <http://i.stack.imgur.com/R5pZu.jpg>

This workaround allows users to funnel the water from the faucet to a container outside the limits of the sink. One drawback is that water overflow is no longer contained to the sink and thus complications can occur involving spilled water.

Figure 19: "Spray Hose for Sink"

Source: <http://www.wdrake.com/buy-spray-hose-for-sink-304035>

This model product fulfills two of the design constraints we have chosen for our Water Transportation Adapter. First, the hose claims to be universal by use of a flexible plastic ring.

Second, the hose itself transports the water in a manner which allows oversized items to be filled. However after looking at product reviews the hose was said to be leaky and consumers were not happy with the results it produced.

Figure 20: "Hose to Sink Adapter"

Source: <http://www.kmart.com/ldr-industries-sink-spray-unit/p-005W602813110001P?prdNo=2&blockNo=2&blockType=G2>

This is another products designed to universally adapt to sinks using a rink that mounts to the standard aerator present on most sinks. The hose allows the water to be manipulated and thus larger items can be filled. Reviews indicated that the universal adapter did not work as advertised and that the setup was messy and leaky.

Competitive Products

No competitive products for this exact design problem currently exist on the market. This alerted our team to the vast amounts of "white space" available in this market.

Sources

Anonymous. "LPT: Use a (clean) Dustpan to Fill a Container That Doesn't Fit in the Sink - Imgur." *Imgur*. N.p., n.d. Web. 22 Apr. 2014.

"LDR Industries Sink Spray Unit with Sprayer Hose and Universal Adapter Black." *LDR Industries Sink Spray Unit with Sprayer Hose and Universal Adapter Black*. Kmart, n.d. Web. 22 Apr. 2014.

"Spray Hose For Sink." *Detachable Sink Hose Sprayer*. Walter Drake, n.d. Web. 22 Apr. 2014.

Appendix C: User Observation

Introduction:
The purpose of these user observations to see how someone would be able to fill up a large object in a small sink without using our product. On Sunday, May 4th, four students living in the Public Affairs Residential College 4th floor men's suite were asked to fill up a Brita filter water container and a Kodiak Cold Therapy bucket in a PARC bathroom sink. We were then able to watch and observe how they were able to make their own way of filling up the container.

Procedure:
Each student was asked to fill a Brita Filter container and a Kodiak Cold Therapy bucket using the PARC sink of the 4th floor men's bathroom. Each student was able to freely fill up the containers any way necessary. After attempting to fill up the container, the user was then required to display the level of water in the container.

Observations:
Obviously the container was far too large for the sink and people would have to make their own solutions. The initial reaction was to tilt the container to the side to try and fit it horizontally. It was able to successfully be wedged into place.

However, when the user attempted to remove the container from the sink, the container being turned sideways again to take it out caused the water to flow out from the container, undermining any progress made.

Figure 21: Filling Filter

Figure 22: Losing Water I

One of the users creatively removed the top of the container off the filter. It was able to fit easier into the sink. Nevertheless, the same water was lost when trying to remove the container when he had to turn the container.

Figure 23: Filling container – No Top

Figure 24: Losing Water II

The same situation occurred when attempting to fill the bucket. It was able to fit into the sink but was not able to fill to any significant level. Even more so for the bucket, lots water was lost while trying to remove the large object out of the sink.

Figure 25: Fitting the bucket

Figure 26: Filling the bucket

Figure 27: Water Retention

The users began to become very frustrated and didn't really know what to do. Then they said what they usually would do in this type of situation, which would be to grab a cup and then fill that cup and then poured into the container. The process took a while but they were able to ultimately fill it.

Figure 28: Using a cup Part I

Figure 29: Using a cup Part II

Findings:
The tests showed that often the sink was big enough to fit an object into the sink but not able to fill it. Water would fill the object but trying to remove the object from the sink would cause water to flow out, undoing the filling of the container or bucket.

Conclusion:
From this user observation it was determined that there was a need for product to help fill up large containers in a bathroom sink where the sink is too small. In addition, it was learned that in order for this process to be considered more efficient than any sort of previous model it would have to be done faster than filling up a container while using a cup and then pouring the filled cup into the container.

Appendix D: User Testing

Introduction

The purpose of user testing to see how the same potential customers would use our product to fill up a large object in the smaller dorm sink as the ones who had to perform the user observation segment. I asked the same men from user testing of the fourth floor in PARC, my dorm suite. I observed two personally, and asked the other two questions upon their completion of the task. The purpose of diversifying the observation tools is to minimize the bias effect generated through proxy bias.

Observations

User 1: Seeing as I did not instruct them, they took very little time to apply the mock up onto the faucet, official time was 10 seconds. They successfully filled up the container without any mess or trouble. As the container became full, this caused the hose to become backed up, resulting in a bit of leakage through the top of the apparatus, as seen in figure 9. I think we could easily solve this by having a tighter attachment band, IE, not Velcro. The overall feedback to our product was positive.

Figure 30: Second Prototype I

Figure 31: Second Prototype II

User 2: I gave a demonstration of how to set up the product, to simulate a slightly experienced user, and it resulted in a much shorter time of 5.5 seconds to complete the assembly. Similar problem as user 1 with the water backup, solution already discussed, see figure 9. The one comment this user had was the hose was a bit unmanageable, and would have preferred a lighter hose that was more flexible, which can be seen in figure 10. Luckily this hose is on order, so we will test that against this one to determine the most desirable product. The overall feedback was very positive towards our product.

User 3: This user was straw polled post product testing, which gave me a different perspective on the problem.

- Q1: Was this more effective than what you previously had to do? A: “Yes! I thought it was way easier to use than just my hand.”

- Q2: Is this something you would purchase for your dorm room? A: “Maybe if I had the X amount of $ to spend, it wouldn’t be something I consider “essential” to the average college student.”

User 4: This user was also straw polled, but instead asked different questions from the previous user.

- Q1: Would you have like a lighter, more flexible hose? A: “I didn’t really mind the hose you have on now, but ya, I think a more bendy hose that wouldn’t fold up would be more useful”
- Q2: How did you think the assembly and disassembly went? Was it effective? A: “I had no problem assembling or disassembling your mockup. It would have been helpful to have a demonstration or instructions so the first time isn’t so awkward.”

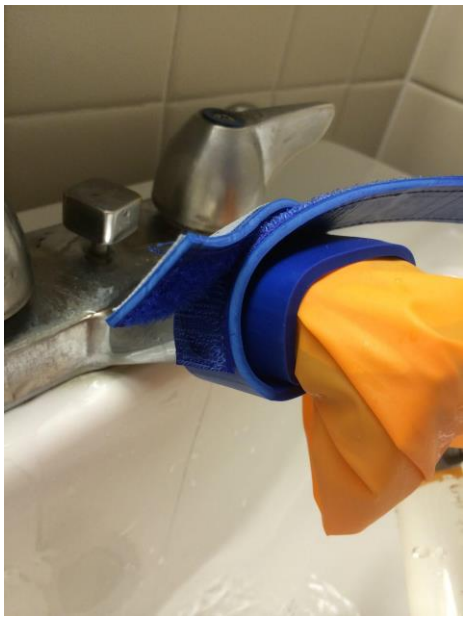

Figure 32: Prototype in Use

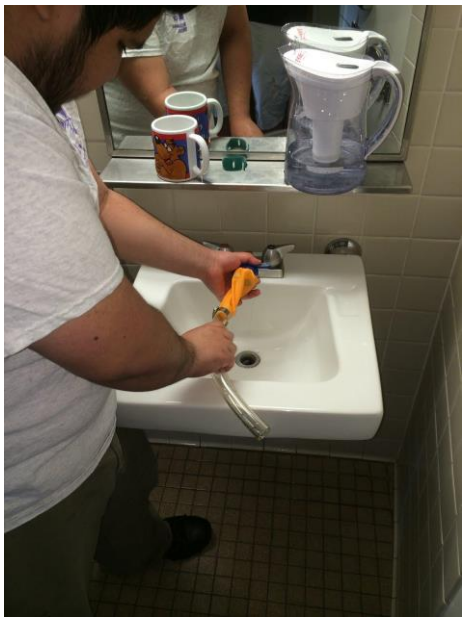

Figure 33: Prototype in Use II

Conclusion

My finding from this user testing include

- The necessity for a tighter seal around the bag and faucet (See Fig. 11)
- A clear set of instructions to accompany the final product
- A lighter hose
- A more manageable hose
- A hose that can change length to accommodate various sized “buckets”

Appendix E: Dimensioned Sketches

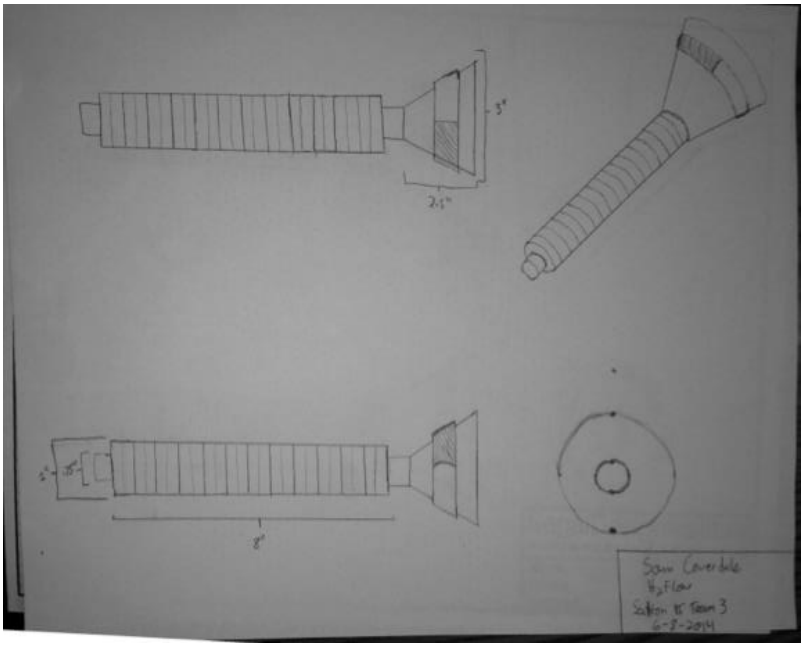

Figure 34: Sam Coverdale Sketch

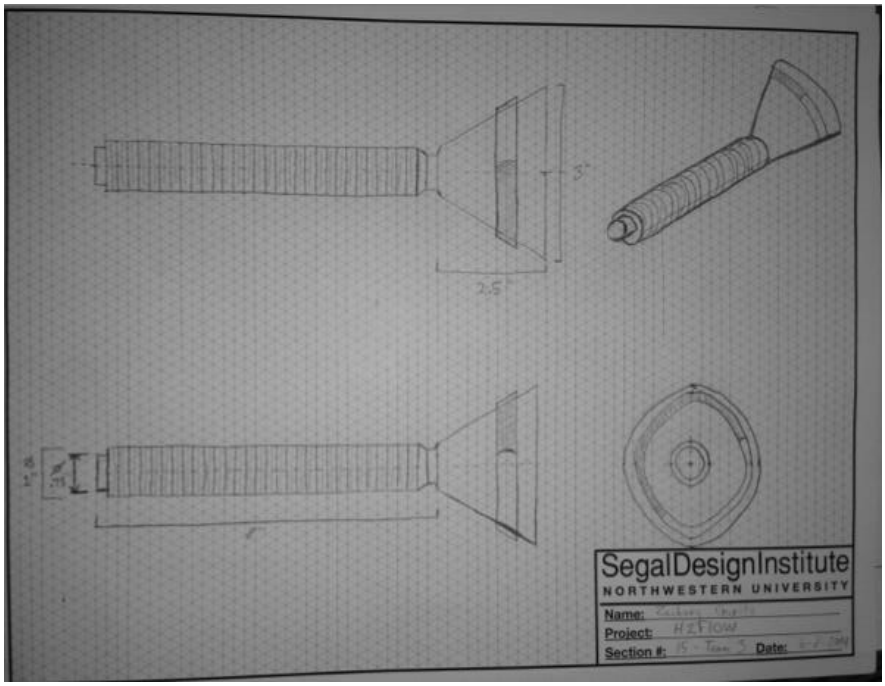

Figure 35: Zachary Guritz Sketch

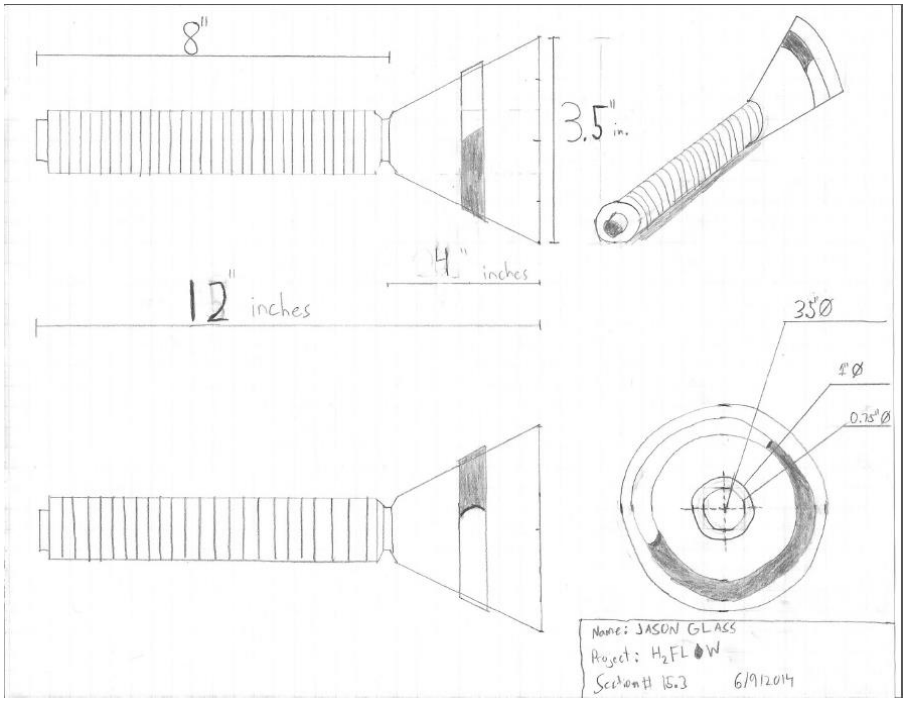

Figure 36: Jason Glass Sketch

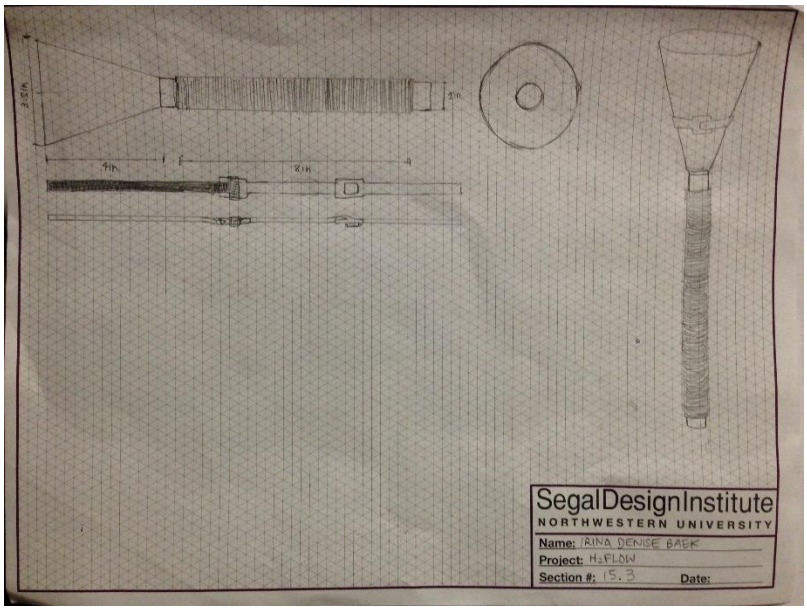

Figure 37: Irina Baek Sketch

Appendix F: Usage Instructions

This section contains information on how to properly use our design.

Step 1. Place the silicone funnel around the head of the faucet.

Figure 38: Open Faucet

Figure 39: Prototype on Faucet

Step 2. Wrap the fastener around the funnel to secure it in place

Figure 40: Open Fastener

Figure 41: Closed Fastener

Step 3. Extend the hose to the desired length and begin filling.

Figure 42: Completed Usage

Appendix G: Manufacturing Guide

This section contains instructions on how to manufacture an *H2Flow* prototype.

Materials:

- 1 Tapered Silicone Pastry Bag - 4” Inches by 3.5” Inches
- 1 1” Inch Outer Diameter Hose Expandable Hose
- 1 ½” EPDM Rubber Strap
- 1 Velcro Strap
- 1 1” Aluminum Ring

Step 1. Attach the Velcro and Rubber to Each Other. Put the rubber strap through the hole in the Velcro Strap.

Figure 43: Rubber and Velcro Assembly

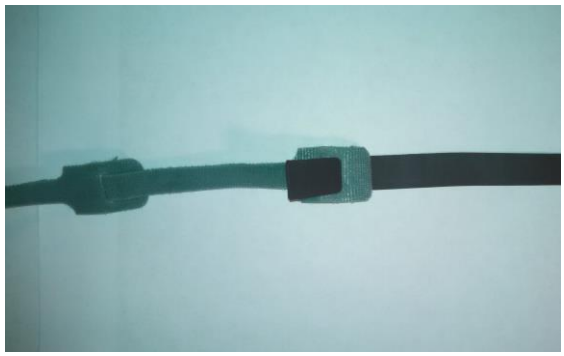

Figure 44: Completed Fastener

Step 2. Jam the aluminum ring in the hose with the silicone bag pinned between the two walls.

Figure 45: Aluminum Ring Installation

Step 3. Wrap the elastic fastener around the prototype to store all the components securely

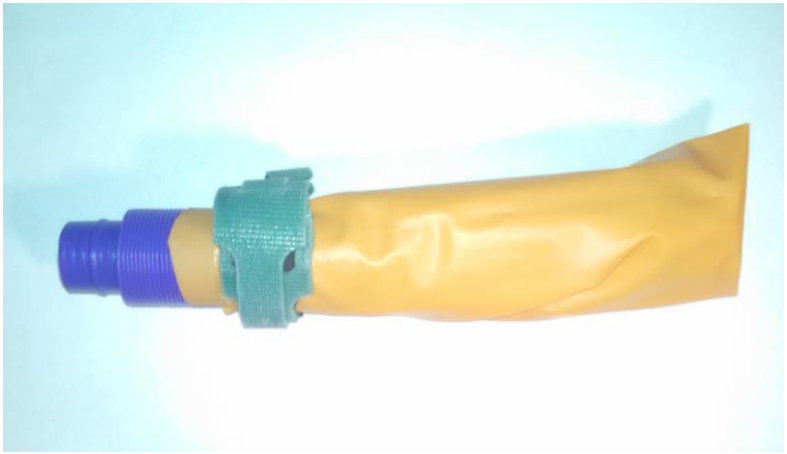

Figure 46: Completed Prototype Assembly

Appendix H: Bill of Materials

Table 5 is a summary of the materials used in our design and their overall cost.

Item	Quantity	Source	Part #	Unit Cost	Total Cost
Silicone Funnel	1	Amazon	Silicone Pastry Bag	$8.00	$8.00
Expanding Hose	1	Amazon	POOF-Slinky	$2.00	$2.00
1” aluminum ring	1	McMaster-Carr	8967K91	$12.93	$1.01
Velcro Strap	1	Amazon	Vktech Velcro Fastener	$2.00	$2.00
EPDM Rubber Strap	1	McMaster-Carr	3937T43	$0.52	$0.52

Table 5: Bill of Materials

Final Cost: $13.53