**Week 3: Brainstorming & Design Decisions**

**Lab Deliverable**

You will need to turn in your INDIVIDUAL lab report worksheet (this document) with all tables and questions completed by the due date listed on Canvas. Some of the tasks will be done as you go through the process, while some questions must be answered at the end of an activity. While your procedures will look identical to your team members, make sure that your answers are your own and you are able to explain every detail in this lab worksheet. DO NOT COPY your team members’ reports. If you are absent during the lab, you will be responsible for completing all of the work in this report yourself.

**Activity Description**

This lab is a continuation of the Developing Value and Innovating Limitless Solutions (DeVILS) project. In this week, you and your team will be researching, brainstorming, and deciding on a single solution to design based on your problem statement.

**Generative AI is not allowed to be used during the completion of this worksheet.**

**Part 1: DeVILS Research**

**Lab Procedure**

The first step in the brainstorming process is to research current approaches and potential technologies that already are available to improve upon what you find. Take some time **as a team** to research your problem statement to find current solutions or learn more about your problem. Pay attention to features and reviews of existing products so you can identify current pain points or success stories in what has already been developed. If there isn’t an exact solution to your problem (hopefully there isn’t), make sure to research the processes or products that are available that are causing the problem your team is solving. Please try to **identify at least 4 sources** of background research to better familiarize yourself with your problem.

| **Background Research** | |
| --- | --- |
| **Sources (at least 4):** | **Research Learned:** |
| ~edu-faqs.com  ~uhospitals.com  [CDC.gov](https://www.cdc.gov/healthywater/drinking/home-water-treatment/water-filters/step3.html#:~:text=Filters%20commonly%20found%20in%20homes,and%20whole%2Dhouse%20treatment%20units.)  ~freshwatersystems.com | ~Many students question if it is worth it to bring a brita to college.  ~Colleges get water from the same sources as the rest of their community  ~College students often use Brita and filtering water bottles  ~The choice between using city tap water or other methods of drinking water  ~The EPA (environmental protection agency makes sure all tap water is safe to drink  ~Many choose to use filters to improve the taste, or to kill bacteria in the water  ~The quality of the tap water will depend on the area it is in  ~Some places are known for having high contaminants in their water supply  ~ Describes the many different forms of water filtration along with  ~Different water filters will purify the water in different ways. Certain filters remove certain impurities  ~Different systems range in price from $20 to hundreds of dollars  ~Different filters work at different speeds  ~There are different treatments such as Activated Carbon Filter, or an Ion Exchange Unit  A softener exchanges the calcium and magnesium found in tap water for sodium or potassium. Having a water softener to treat the hard water to become clean drinkable water can be crucial. A softener can be one of the cheapest ways to have drinkable water. |
| **Individual Summary:** | |
| 1. What was the most important thing you learned from your research efforts? How do you feel this new knowledge will impact and affect your design solution?  I learned that the water is not the best quality and that many students use their own money for systems such as Brita, however there is still bacteria in the water and other contaminants from the water which can be taken out through many different methods of filtration  2. Has your background research created any new requirements for your potential solution that you didn’t include before? What are they?  Yes, We added extra methods of filtration to make the system run more smoothly and to also the durability of the product.  3. Based on your research, what type of customer archetypes or point-of-views were the focus of current products/trends/solutions to your problem statement? Do you feel these customers are the same customers that you will focus on during development, or do you feel you have a better understanding of your customer?  I do feel we have a better understanding of our target consumer because of all the research and just talking to people we know that it is in need and that our market is proven as a need for many individuals around the world. Our consumers will be the same ones we will be focusing on during the creation of our product. Ourn archetypes are students and people in need of freshwater or filtered water. | |

**Part 2: DeVILS Brainstorming**

**Lab Procedure**

Now that you and your team are more educated on your problem statement, it’s time to start brainstorming. **As a team**, you need to use multiple different forms of brainstorming techniques that you’ve learned to help create a wide variety of possible design options. There are multiple types of brainstorming techniques available to help you access more innovative ideas such as, *SCAMPER, random stimulus, brainwriting, word combination, design heuristics, “How Might We”, etc*. Please devote time to **at least 2 forms** of brainstorming to come up with potential solutions. Document your brainstorm evidence within the table below in any form you wish (writing/drawing directly on worksheet, link to Google Drive, screenshot of Slack discussion, picture of notecards, etc.)

| **Team Brainstorming** |
| --- |
| **Technique #1 (circle one): SCAMPER Random Stimulus Brainwriting**  **Word Combo Design Heuristics How Might We?**  **Concept Combo Functional Decomposition HCD** |
| Design Heuristics: Card-Layer  Have multiple filtering layers in our design to make the water more satisfying for the dorm students  Card-Recycle  Reduce water waste by finding a way to recycle water. Take dirty water and filter it back to being drinkable. Filter beer to water, wine to water, alcohol to water. |
|  |
| **Technique #2 (circle one): SCAMPER Random Stimulus Brainwriting**  **Word Combo Design Heuristics How Might We?**  **Concept Combo Functional Decomposition HCD** |
| Random Object: Heat Lamp:  ~Have a self-cleaning features by using the process of heat and condensation to filter the water  ~Have a very small opening so we can engineer the water pressure to be optimal  ~Water bottle holder, clips  ~Filter water through a cone shaped object with multi layer filtration.  ~Have a lock feature to protect the water from being stolen or messed with  ~camera added  ~face if render  ~Three different water spouts, multi load  ~spin feature  ~ People could pour their unwanted water in a collection tray to refilter and recycle |

**Part 3: DeVILS Design Decisions**

**Lab Procedure**

**As a team**, once you have a large quantity of ideas and features, form and select your top 3 design options as a team and provide a small summary and picture of each option. **Remember, each option MUST satisfy all of your requirements**. You must rationally identify which design option of your top 3 choices is the best solution for your customer. To do this, you will need to evaluate each option against how well it meets the criteria that was determined in the previous lab. Then using a design decision matrix, you will select which option is your optimal solution to begin designing. Refer to your AHP table from the previous lab to include the prioritized criterion into your decision matrix. Please include your decision-making scale for each criterion, indicating what would cause the design option to score low versus high per criteria. Once you have settled on a final solution, please include a final design description that you will use to begin modeling in the next lab. Explain the form (shape/app layout), function (how to use it), and finish (materials/app storyboard).

| **Design Option #1** | **Design Option #3** | **Design Option #2** |
| --- | --- | --- |
| Image:    Summary: “Ivy” is a water delivery robot that will drop fresh, yummy water off to students in their dorm rooms. It will be connected to an app that students can use to summon the robot. The robot will have a scan feature so the water can only be opened by only the person that ordered it. There will be different features like cameras, water spouts. pressurizers, a security system and more. | Image:    Summary: “Tracy” is a water vending machine that takes waste water from around campus and turns it into tasty drinking water. Students can bring their water bottles and refill them from the machine | Image:    Summary: Students could dump their leftover soda/drinks in this multilayer filtration system to be filtered and sent off to be reused at the dining hall. This will reduce waste. |
| **Decision Matrix:**   | **Criteria** | **Weights (%)** | **Design 1** | | **Design 2** | | **Design 3** | | | --- | --- | --- | --- | --- | --- | --- | --- | | Rating Factor | Weighted R.F. | Rating Factor | Weighted R.F. | Rating Factor | Weighted R.F. | | Taste | 40.9% | 4 | 16.36% | 5 | 12.27% | 3 | 20.45% | | Ice | 8.4% | 0 | 0% | 0 | 0% | 0 | 0% | | Pressure | 12.5% | 5 | 62.5% | 5 | 37.5% | 5 | 62.5% | | Cold Water | 29.4% | 4 | 11.76% | 4 | 58.8% | 4 | 11.76% | | pH | 8.8% | 5 | 44% | 5 | 44% | 3 | 44% | | **Total** | 100% | 134.62 | | 152.57 | | 138.71 | |   Description of criteria scales and methods used for rating (range of values, what values mean):  We used a scale from 0-5  For Taste, 5 refers to having specialized tastes added in, or just tasting very good and 0 referring to having an awful taste that leaves a bad taste.  For Ice, 0 refers to not even being present, and a 5 refers to having that super good restaurant style ice that is perfectly clear and doesn’t melt for hours  For pressure, 5 refers to having a quick and steady stream of water with no breaks, and a 0 refers to having an inconsistent stream of water that breaks and splatters  For Cold Water, a 5 refers to being a cold and refreshing water temperature of about 40 degrees fahrenheit, while a 0 refers to an uncomfortable hot water temperature of about 80 degrees fahrenheit  For pH, a 5 refers to a balanced water pH of 7. The water is also clean and free of contaminants, while a zero refers to a dirty water that is either too acidic or too basic and bitter | | | |
| **Final Design Description (pictures and summary of concept)** | | | |
| **A multilayer filtration system located in all the dining halls will create purifying drinkable water for all students. This will be stationed in one place (not moveable) and will filter any fluid dumped in the system, including soda and any other drinks. This will not only give students drinking water but also will reduce waste. Money will be saved in this process which ultimately makes this product worthy. This system will have layers of filtration to maximize the quality of the water to ensure the satisfaction of the students. All of the layers are removable as well to ensure that the filters and components could be replaced. The first layer of the filtration system begins with a strainer that will remove all large contaminants such as ice or large residues such as food. The next layer in the filtration system is a centrifuge like contraption that will separate the water from the rest of the liquids. The drink mixes and ingredients should settle to the bottom while the water should sit at the top. The leftover water would then be filtered through a multiplayer carbon filtration system to remove any smaller particles that still remain. The water is then put into the heat and UV chamber to kill off any remaining bacteria or pathogens. The water then is put into a collection chamber to be reused.** | | | |
| **Individual Reflection** | | | |
| 1. Summarize why the winning option in your decision matrix “won”. Explain the features and design choices that caused this option to score so high and why.  The winning option from the matrix that won is the second option. The reason it won is because it has everything needed to create a good design and also allows for extra things to be added in the future.  On taste it received a 5 because it has everything needed to make the water taste good. It got a 0 on the ice feature however, all designs didn't include an ice feature. It had a pump so it got a 5 for pressure which allows for the consumer to get their water quicker and be happier with the little to no wait. It received a 4 for coldness because it's Arizona which makes everything hot but, it has a cooling system so the water will be cold. And finally it received a 5 for ph because of the multilayers of filtration which allows for the water to be top quality.  2. Which of the following steps in the design process have you completed so far in the DeVILS project? Check all that apply.  Gather information & research  Build the final design  Test the final prototype  Define the problem  Generate alternative concepts to satisfy requirements  Evaluate & analyze alternatives  Select the most promising concept  Evaluate test results  3. What kind of security and ethical concerns do you need to consider when designing your solution in the future? How can it be misused or interfered with by people who are not your intended customers? How can you proactively design your solution to combat these fears?  Some security features in the design is the carbon fiber in the design. It is very durable and can go through a beating and still hold itself up and together. Another feature is the uv lights which are used for purifying and are also used to make sure we are not poisoning people. Our design can be misused through the collection center. people can come up with and or pour anything into it. This includes drugs, alcohol, chemicals, poison, etc… We can secure our design by having a test before it joins the other liquid for purifying. We can also scan student ids so we can keep a record and track of who is doing what with the machine. | | | |