

Introduction

We have reviewed and refined our interpreted needs from our client and created a list which prioritizes these needs by which we have concluded which are the most important. The list also considers metrics and target values of all our specific design specifications. We have split the specifications into different categories which include our functional requirements, non-functional requirements and constraints. Once we came to a consensus of what our target values should be for each of our criteria, we added the target value each of these criterions should be reaching and whether we expect the values to be higher, lower or equal to the value. We also have done some technical benchmarking for other similar products and see how they compare to our specifications.

Design Specifications

Design Specifications	Prefer	Relation	Target Value	Units	Verification Method
Functional Requirements					
Clean rafts autonomously	Equal	=	yes	N/A	Observe to make sure the cleaner won't need supervision
Dries rafts	equal	=	yes	N/A	We can see whichever rafts feels drier after a given time
Clean algae off boards	equal	=	yes	Looks clean	Observe the final cleaned product
Constraints					
Size on the wall	higher	<=	48x72	in	Tape measure
Size on the table	Higher	<=	30x96	In	Tape measure
Cost	lower	<=	100	\$CAD	Receipts / Budget
Rafts to clean at once	higher	>=	1	# of rafts in cleaner	Test
Power	lower	<=	120v X 15amp	V x Amps	Multimeter
Pipe Diameter	equal	=	1/2	in	Pipe is provided
Water Pressure	high	<=	30	PSI	Water gauge
Water Drain distance	equal	=	5	ft	Tape Measure
Non-Functional Requirements					
User Friendly	lower	>=	30	mins to learn	Survey users
Easy to Maintain	lower	>=	30	Mins to fix	Survey users
Reliable on busy days	lower	<=	20	# of boards a day	Make sure the boards maintain the same amount of cleanliness for all boards
Fast to clean	lower	<=	20	Mins to clean	Time how long it takes for the board to be cleaned

Water efficient	lower	<=	20	L water wasted/ raft cleaned	Storing the wasted water and finding it's volume
Eco-Friendly	Equal	=	Yes	N/A	If it uses eco-friendly materials or not
Last a long time	Higher	>=	5	Years	Count how many years until it breaks

RYOBI 18 VOLT Power Scrubber

Design Specifications	
Functional Requirements	
Clean rafts autonomously	No. You must use the power scrubber by hand, there's no way to use this and walk away from it.
Dries rafts	No. All this product does is scrub away dirt and grime buildup, it has no drying function.
Clean algae off boards	Yes, it is ideal for cleaning grime and debris
Constraints	
Size on the wall	4.9"x7.7", it is a handheld device so you can orient it any direction you wish. Brush head has a 6" diameter.
Size on the table	
Cost	\$99CAD at Home Depot
Rafts to clean at once	1
Power	Runs on a RYOBI 18V battery for 4-amp hours.
Pipe Diameter	N/A
Water Pressure	N/A
Water Drain distance	N/A
Non-Functional Requirements	
User Friendly	One simple button to turn the scrubber on and off, lightweight design makes it more comfortable as well. The scrubber head attachment easily comes off, so it makes changing and cleaning the head very simple.
Easy to Maintain	Parts such as the scrubber head and battery pack are very simple and easy to replace. The manual for the scrubber is only 7 pages long and is easy to follow.
Reliable on busy days	N/A
Fast to clean	Based from multiple user benchmarking of this product it appears that it makes scrubbing time much faster.
Water efficient	N/A
Eco-Friendly	This product doesn't use any chemicals or pesticides
Last a long time	3 years based off its warranty

Explanation

This scrubber meets our needs for many design specifications to our own cleaning system. It is very simple to use, easy to maintain, cleans away dirt and grime, and fits our dimensions needed. It seems very well designed and functional for cleaning our rafts. We would only really use the motor and scrubber head of this because we need our system to be automated which is a major drawback to this product. There is missing information here because this product does not use water and can only be used by hand.

User Benchmarking for RYOBI 18 Volt Power Scrubber

“Got this for cleaning the bathtub and the floors, worked like a champ! The easiest way to clean the bathtub! Super-fast, efficient, and really easy to use.”(RYOBI 18V ONE+ Cordless Power Scrubber | Home Depot, n.d.)

“I was just as impressed with this one as I was the extended version. This cut cleaning times in half. I loved the control you have while using the scrubber”(RYOBI 18V ONE+ Cordless Power Scrubber | Home Depot, n.d.)

“I used this to scrub stubborn grime off my outdoor patio and stone grill area. I was blown away at how great and fast it worked! Turned a 2 hour job into a quick 15-30 mins - Highly recommend.”(RYOBI 18V ONE+ Cordless Power Scrubber | Home Depot, n.d.)

MagicWash360 touchless car wash

Clean rafts autonomously	Yes. Automatic, computer operated machine. No operator required
Dries rafts	Yes. Automatic blow drying. Using three 5.5kw and one 4kw motor embedded in washing machine. “Removes 80% water in 10 second pass”
Clean algae off boards	Superior cleaning system cleans wheels, chassis, prewash easily removes dirt, foam wash, 360 high pressure wash, wax application and blow drying.
Size on the wall	Ground mounted. Units in meters.
Size on the table	Min Installation size: L*W*H = 7.5*3.8*3.4 Max Car size: L*W*H = 5.9*3.0*2.1
Cost	15.5 lakhs = 1,550,000CAD
Rafts to clean at once	Can clean 1 car at a time ever 5-7 minutes.
Power	3 Phase, AC 380V 22KW 50-60Hz
Pipe Diameters	Not given.
Water Pressure	80 BAR = 1160 PSI water pressure
Water Drain distance	Throughout the whole car wash. Very close proximity to water.
User Friendly	Safe, comfortable easy to use wash experience. Overhead design and improved vehicle positioning system keeps floor open and unobstructed. Bright and simple customer signage and language specific audio provides clear instruction.
Easy to Maintain	Easy to use web browser interface to access all key operating functions and reports. Monitor all machine functions with any device remotely allowing flexibility and reduced need to go on site. Email messaging and other real-time connection keep staff in touch with operation. Simple part replacements and easier troubleshooting reduce on going maintenance costs. Significant reduction in sensors, swivels, valves and the use of electronic parts.
Reliable on busy days	Can run 24/7. Can clean 8-12 cars/hour depending on cleaning program chosen
Fast to clean	Takes 5-7 minutes to clean one car depending on cycle.
Water efficient	Approx. 70-80L of water per car. Doesn't talk about a water recycling system.

Eco-Friendly	No floor civil work required->just assemble it on flat surface. 360 rotating arm rotates within 30 seconds around the whole car saving 50% water and 60% electricity.
Lasts a long time	Hot-dip galvanized construction provides years of trouble-free service ->protects against corrosion.

Explanation

This car wash meets all the needs we would need to implement in our own cleaning system. Specifically, it is an easy to use/maintain automated solution that cleans the object (and dries it) efficiently with minimal action from the user. It seems to be a well-designed car wash that is reliable and water efficient. However, there are 2 major drawbacks: the size (car wash around 5x greater than the wall and table space in the hydroponic container) and the price of \$1,550,000CAD for the car wash vs (but this is a finished fully functional product not a prototype) the \$100CAD budget we must work with.

Countertop Dishwasher

Design Specifications	Target Value	Units	Verification Method
Clean rafts autonomously	yes	N/A	Cleans dishes automatic
Dries rafts	59	Mins to hour	It dries dishes after washing it
Clean algae off boards	yes	N/A	It removes dirt, all types of bacteria including algae, and overall, it makes the dishes be shiny
Size on the wall	16.85x18.03	in	Website
Size on the table	16.73x16.85	In	Website
Cost	489	\$CAD	That is the price of this product
Rafts to clean at once	11	N/A	Can clean 11 dishes per round
Power	1,400	watts	Most dishwashers use 1,400 watts
Pipe Diameter	63	mm	It comes with a pipe
Water Pressure	120	PSI	The water pressure for every dishwasher is between 20-120 psi
Water Drain distance	63	mm	A pipe is used to drain the water in the sink
User Friendly	20	mins to learn	Review
Easy to Maintain	1.3	hours to fix	website
Reliable on busy days	132	# of dishes per day	It can be used for a long time but it needs someone to take out the dishes and put more dishes which is why it can be used for half of the day since everyone is sleeping in the night
Fast to clean	59	Mins to clean	How long it takes for the dishes to be clean
Water efficient	5	L water wasted/ dishes cleaned	The amount of water it takes for the dishwasher to clean for one round
Eco-Friendly	Yes	N/A	It has an eco-washing program that you can use to wash dishes
Last a long time	10	Years	The maximum years it takes to for counter dishwasher to not be usable is 10

Explanation

This counter dishwasher meets most of our interpreted needs but for some parts, it doesn't. The good thing about this product is that it doesn't take that much space since its size is much smaller than wall mounted, and table mounted of the operation installment. It has an eco-friendly washing system where it doesn't cause any harm to the environment while washing dishes. It can last for about 7-10 years which is a good thing since the client want a cleaning product that can last up to 5 years. It doesn't use a lot of water instead it also used 5 L which is a great

thing since one of our interpreted needs is something that doesn't use lots of water. This cleaning product can be learned how to use within 20 minutes and most reviews said that it is amazingly simple to use and doesn't need a worker to teach them how it works. It is very reliable on busy days since it can clean up to 132 dishes for a busy day without getting broken. The downside of this dishwasher is that it doesn't clean that fast. It takes 59 minutes to clean dishes for one round. Also, it takes about 1.5 hours to fix when this dishwasher breaks which is an exceptionally long time to fix it and that is something that doesn't meet our interpreted needs. The cost of this product is expensive, and it uses lots of electricity, which isn't what our interpreted needs looking for. For one cycle it uses the same amount of electricity as a TV uses for 20 hours. It has a high water pressure which isn't something majorly consent but we are looking for a cleaning product that doesn't use high water pressure. Also, the water drain distance we are looking for is about a couple of feet long, but this dishwasher doesn't have a long pipe since it got a 63 mm pipe. Overall, this counter dishwasher cleans the dishes very well and meets some important interpreted needs such as last a long time, eco-friendly, size, and user friendly; But some important interpreted needs such as cost, power, the time it takes to fix it, and slow to clean dishes doesn't meet our interpreted needs.

Reflection

Before the first client meeting, we had very little information on the project background. After the meeting, we understood the clients needs and the aspects of the solution they find crucial. Four main categories of high importance to the client arose: ease of use, cleanability, time management and space. By prioritizing the needs in those categories as more important and focusing our design on those needs, we will deliver more value to the client. E.g. While having a dry raft (low priority) at the end of the cleaning cycle is a need our main focus is on developing an automated raft cleaner that effectively cleans the rafts. The client won't mind if the rafts are wet after the cleaning process, but he will care about the rafts being free of algae. We didn't update any needs from deliverable B since we haven't gotten any additional needs from the client. However, we have added constraints to further improve our design criteria. We added the power available (in V and aps) in the hydroponic container, the water pipe diameter and pressure as well as the minimum number of rafts in the cleaner at once.

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