1106 Design Project Deliverable E

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Abstract

Our chosen concept consists of three main sections. The first section is a loading system that loads the boards into our cleaner. The second section is the cleaning system that cleans the boards and passes them on to the storage system. The third section stores them until they are removed by the worker.

The loading system is comprised of a conveyer belt system with walls around it. The conveyer belt would be made of a chain and a series of paddles spaced at intervals equal to the length of the boards. The walls of the system would be the dimensions of the boards with a small missing piece in facing the cleaning system allowing only one board to enter at a time. This would allow the user to insert all the boards at once, but for the machine to only clean one at a time, which would reduce the labour expended on cleaning. It would also increase the safety of the system as the user would not need to be near it.

The cleaning system is the most complex system and consists of three main parts forming a loop. The first of these parts is a pressure washer that supplies pressure water to our cleaning system. This could be any off the shelf pressure washer. The water it receives is from the water recycling system, and it passes the pressurized water to the cleaning system. The pressure washer would be powered by the supplied power from the farm. The second part, the cleaning system comprises a loop of PVC pipe with 6 pressure washer nozzles spraying the block as it is passed through by the conveyer belt from the loading system. Our target pressure is 100 PSI. This is what will clean the blocks. The third part is the water recycling system. This consists of a box around the loop of PVC pipe that covers the system to prevent water from spraying out. The bottom will be hollow allowing the water to flow out, and the sides will have flaps allowing the boars to pass through while restricting the water. Underneath the spraying system will be a square funnel shaped collection system which will supply the water back through the pressure washer.

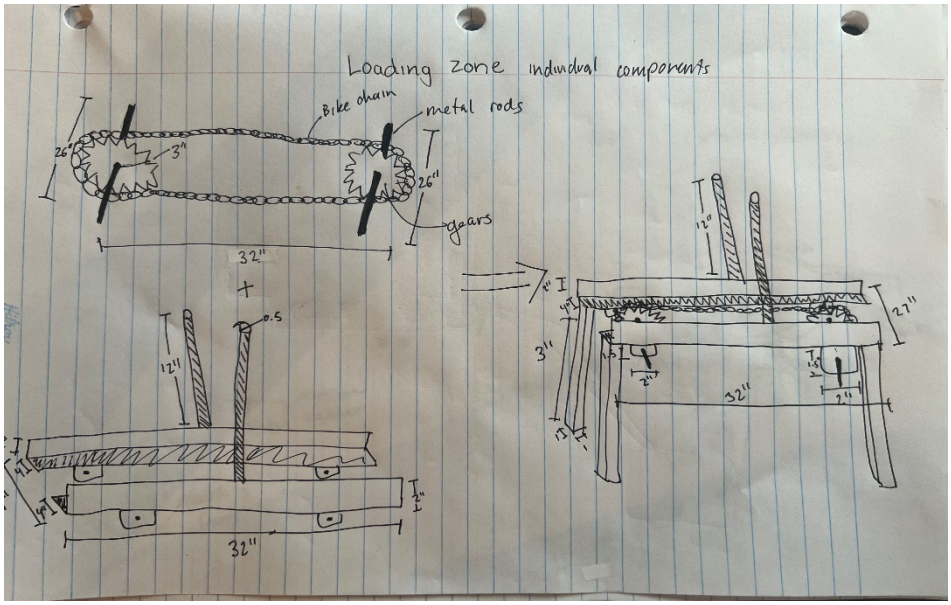
The collection system is the simplest system. This consists of a bag, made out of a heavy-duty polyester like a tarp. The boards will fall out of the cleaning system into the bag. The flexible properties of the heavy-duty polyester should cushion the fall of the boards allowing us to be able to drop them from height without concern of them breaking. We will place small holes in the bottom of the bag to allow the water to drain from the system and for the boards to dry. The main advantage of this system is its simplicity which means that it is both very cost effective and easy to repair.

We designed our system around simplicity and price. The results of this are that the only moving part is our conveyer belt which can be powered by a small motor, and our only complex part is a pressure washer which can be purchased off the shelf at a hardware store. This means that it is both price effective as it leverages existing technology and easy to repair as it comprises very few moving parts and is

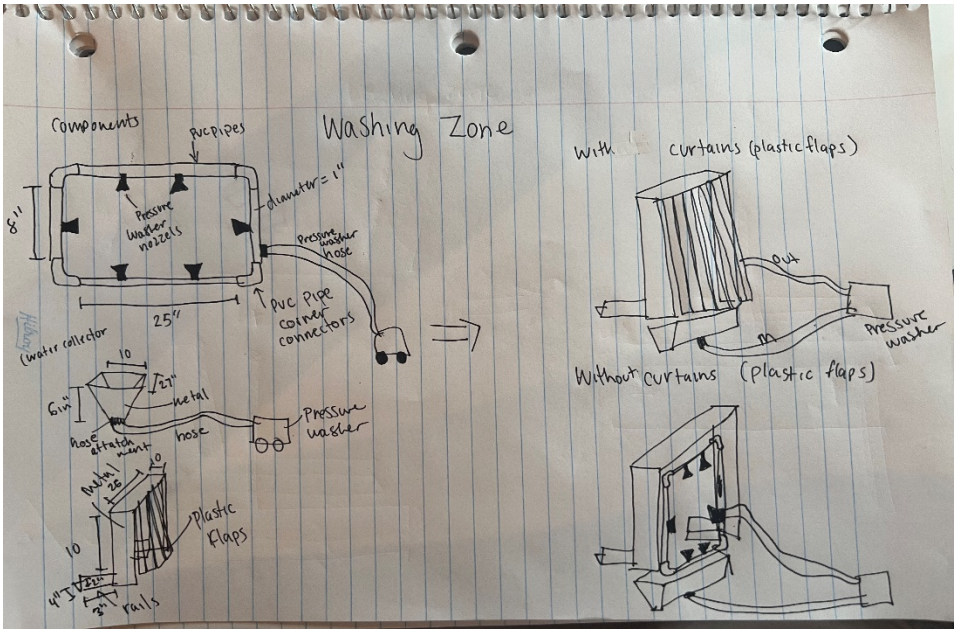
incredibly simple. We drew inspiration from both an industrial solution to clean Styrofoam boards presents at the Sorrento Tree Nursery, and a pallet dispenser. The loading system is based on a pallet dispenser, while the cleaning system is based on the industrial solution to clean Styrofoam boards, although significantly reduced in size. This approach of using designs that have already proved successful should reduce the risk of facing obstacles later in development.

Prototype Pictures

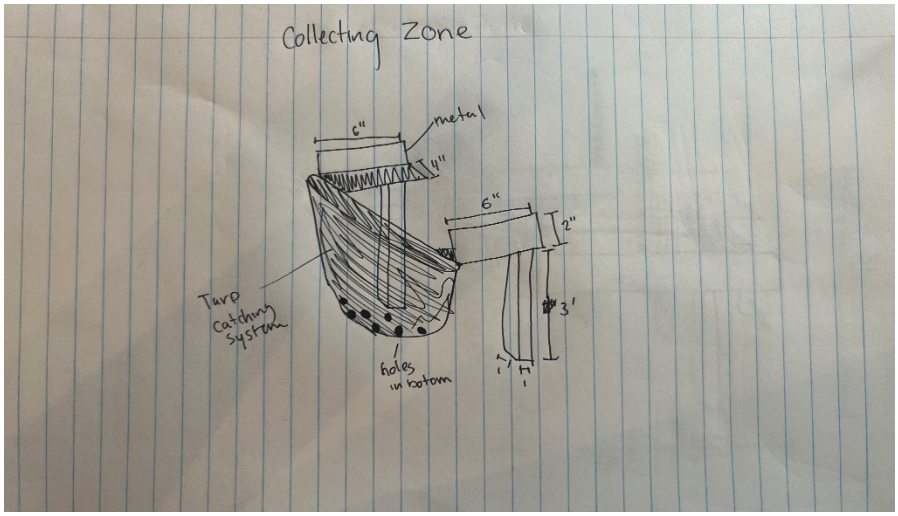
I. Loading Station



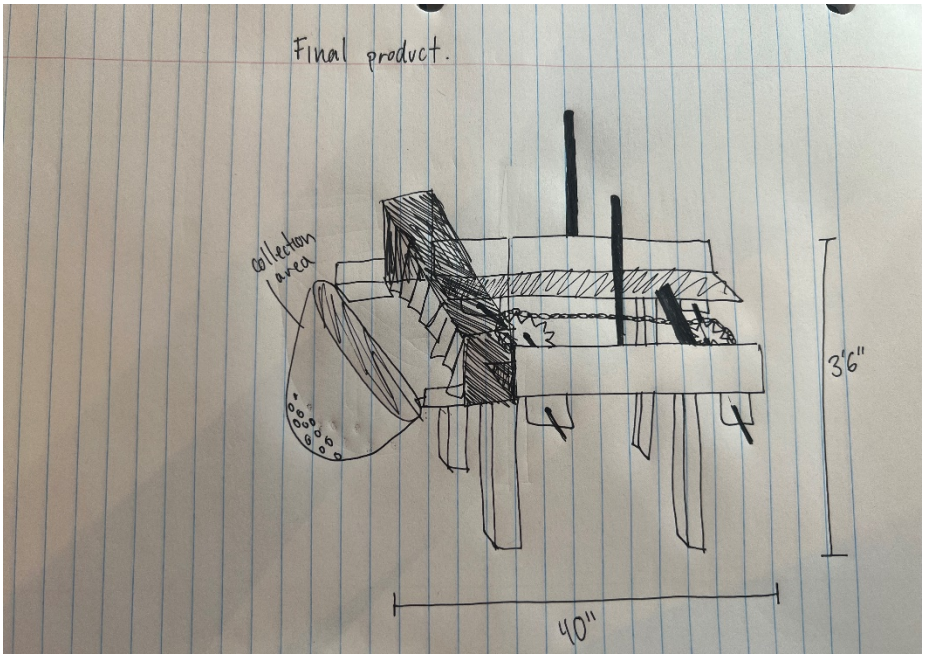
II. Washing Zone



III. Collecting Station



IV. Full Prototype



List of Materials Required

- Gears
- Screws
- Chain
- Reverse screw
- Stainless Steel Sheet metal
- Welding tools
- Welding wire
- Drill
- PVC pipes
- PVC pipe corner connectors
- 8 pressure washer nozzles
- Pressure washer
- Hose
- Motor
- Plastic Flaps

Material Specifics

Material	**Quantity/ Dimension**
Stainless Steel Sheet Metal	1200 in^2
Metal Rods x2	1 foot long 0.5 in diameter & 26 in^2 0.2 in diameter
Gears x2	Top Bike Gears
Bike Chain	68 in
Hose Connector	1
Switch	1
Small Motor	1
Plastic Flaps x28	20 in^2
PVC Pipes x2	25 in & 8 in (both 1" diameter)
PVC Pipe Corner Connector x4	1 in Diameter
Pressure Washer Nozzles	8
Square Tube(for legs) x4	3 feet
Tarp material	500in^2
Screws	10
Power Washer	1

How it will be Put Together

I. Loading Station

The loading system that we have put together is comprised mainly of stainless-steel sheet metal and a combination of gears chains and motors. The sheet metal pieces will be welded together to ensure lots of stability in the structure. The gears will be attached to the body of the system by rods that attach both sides of the loading station together. One will be located at the rear of the loading system and one at the front. The chain will be attached to the gears as it will be wrapped around it and will be able to move in a counter clockwise rotation freely. The body of the motor that will make the gears move will be attached to the siding of the system that keeps the board straight. It will be attached to the outside by welding it and will have the purpose of spinning the rod to spin the gears. The legs will be attached to the design using screws, 2 for each leg. The paddles to push the boards along will be composed of metal and will be attached to the chain with a screw. There will be 2 of these paddles and they will be an equal distance of approximately 32 inches apart.

II. Washing Station

The washing station is composed of stainless steel, PVC. pipes, hoses, a pressure washer and pressure washer nozzles. The PVC pipes are held together with the corner PVC pipe connectors. These connectors will be sealed with waterproof caulking. The pressure washer nozzles will be attached to the PVC pipes by drilling holes in them then screwing them in and sealing them with waterproof caulking. There will be one pressure washer hose that feeds into the PVC pipes which will have an attachment to make sure it does not fly off. For the metal components the PVC pipes will be attached using metal fasteners that are screwed into the metal body of the washing station. The metal portion will be approximately 10 inches high 27 inches wide and 6 inches long. Welded to the back end of the metal body will be around 3 inches of rail that the board can stay on before gravity takes affect and drops it into the collection zone.

III. Collection station

The collection station is comprised of only one component. This will be a bag constructed out of a heavy-duty polyester, which we will get from a tarp. The dimensions of the bag will a rectangular prism of 30 inches vertically, and 26 inches in width and depth. We will attach the tarp to the cleaning device using screws. We will place holes in the bottom of the bag to allow for drainage. The sizes of the bag are designed to fit the boards while not being too big so the boards to hit the ground. The bag will be loosely attached to the system meaning that the side that is not attached could be pushed against the side that is attached to reduce the space when the system is not in use.

IV. Putting it all together

The three components of this system will be put together using welding. The metal edges of each of the components of the system will be welded and potentially bolted into each other if needed for extra stability. The different sets of legs on each component will make the final product balanced and stable.

Cost of Each Material

Materials	Cost (in CAD)
Stainless Steel Sheet Metal	118.65
Metal Rods	13.91
Top Bike Gears & Bike Chain	47.58
Hose Connector	7.99
Switch	1.48
Small Motor	439.26
Plastic Flaps	41.99
PVC Pipes	10.46
PVC Pipe Corner Connectors	5.96
Pressure Washer Nozzles	16.16
Square Tubes	90.56
Tarp Material	10.67
Screws	12.72
Power Washer	317.91
TOTAL:	1135.3

References

Sheet Metal - https://www.onlinemetals.com/en/buy/stainless-steel/0-018-stainless-sheet-304-annealed-2b/pid/6823

½ in x 24 in Steel Rod - https://www.homedepot.com/p/Everbilt-1-2-in-x-36-in-Plain-Steel-Round-Rod-802457/204273960

¼ in x 24 in Steel Rod - https://www.homedepot.com/p/1-4-in-x-36-in-Plain-Steel-Round-Rod-802427/204273973

Hose Connector - https://www.canadiantire.ca/en/pdp/gardena-classic-hose-accessory-adapter-0593401p.html?loc=plp

Switch - https://www.homedepot.ca/product/leviton-single-pole-toggle-switch-white/1000105587

Plastic Flaps - https://www.amazon.com/Plastic-Vinyl-Replacement-Strip-Curtain-Door/dp/B09X2XJ8GY/ref=sr_1_4?keywords=plastic+door+strips&qid=1666577768&qu=eyJxc2MiOiI1LjA2IiwicXNhIjoiNS4xMSIsInFzcCI6IjQuODYifQ%3D%3D&sr=8-4

PVC Pipes - https://www.homedepot.com/p/VPC-1-in-x-24-in-PVC-Sch-40-Pipe-2201/202300506

PVC Pipe Corner Connectors - https://www.lowes.ca/product/pvc-fittings/xirtec-pvc-1-in-pvc-sch-40-90-elbow-socket-2887429

Pressure Washer Nozzles - https://www.lowes.ca/product/pressure-washer-nozzles/kobalt-kobalt-15-quick-change-nozzle-tip-max-4500-1020694

Steel Tube - https://www.homedepot.ca/product/paulin-1-x-36-x-0-065-inch-steel-square-tube/1000126763?rrec=true

Tarp Materal - https://www.homedepot.ca/product/everbilt-9-ft-x-9-ft-drawstring-tarp-in-grey-and-black/1001528001

Pressure Washer - https://www.homedepot.com/p/Sun-Joe-48V-1196-PSI-Maximum-1-GPM-Cold-Water-Cordless-Portable-Electric-Pressure-Washer-Kit-w-2-x-4-0-Ah-Batteries-Plus-Charger-24V-X2-PW1200/315418077

Bike Chain and Gear - https://www.amazon.com/CNCMOTOK-136Links-Sprocket-Off-Road-Motorcycle/dp/B0978NMDVR

Screws - https://www.homedepot.ca/product/simpson-strong-tie-strong-drive-sd-connector-screw-9-x-1-1-2-inch-1-4-hex-drive-mech-galv-100-qty-/1000670114

Small Motor - https://www.emotorsdirect.ca/item/max-motion-mm3390fc