



Coast Cleanup Crusier

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Why we're doing this

Cost of Not Cleaning Beach

Health risk to human:

Exposure to polluted water can cause an uptick in gastrointestinal issues, respiratory ailments, and many types of infections

Economic impacts:

Americans spend around **\$44 billion** on trips to coastal areas every year. Economies dependent on tourism will take a hit if beaches are polluted and unappealing

Impact on animals:

Beach is connected to the ocean. More than **800 species** of wildlife are affected by pollution.

Trash Type and Feasibility

One of the dominant trash types collected in specific areas are **1 cm - 50 cm** pieces of plastic

Our robot can cover large size trash

References

1. Hu, S. (2020, May 28). Beach pollution 101. NRDC. Retrieved November 22, 2022, from <https://www.nrdc.org/stories/beach-pollution-101>
2. Watts, A. J., Porter, A., Hembrow, N., Sharpe, J., Galloway, T. S., & Lewis, C. (2017). Through the sands of time: beach litter trends from nine cleaned North Cornish beaches. *Environmental Pollution*, 228, 416-424
3. Cruz, C. J., Muñoz-Perez, J. J., Carrasco-Braganza, M. I., Pouillet, P., Lopez-Garcia, P., Contreras, A., & Silva, R. (2020). Beach cleaning costs. *Ocean & Coastal Management*, 188, 105118.

Cost of Cleaning Beach Via Human Labor

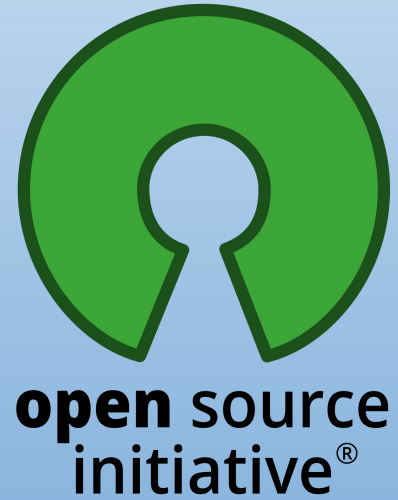
High cost:

Some teams spend **20,000 € per month** to clean a beach

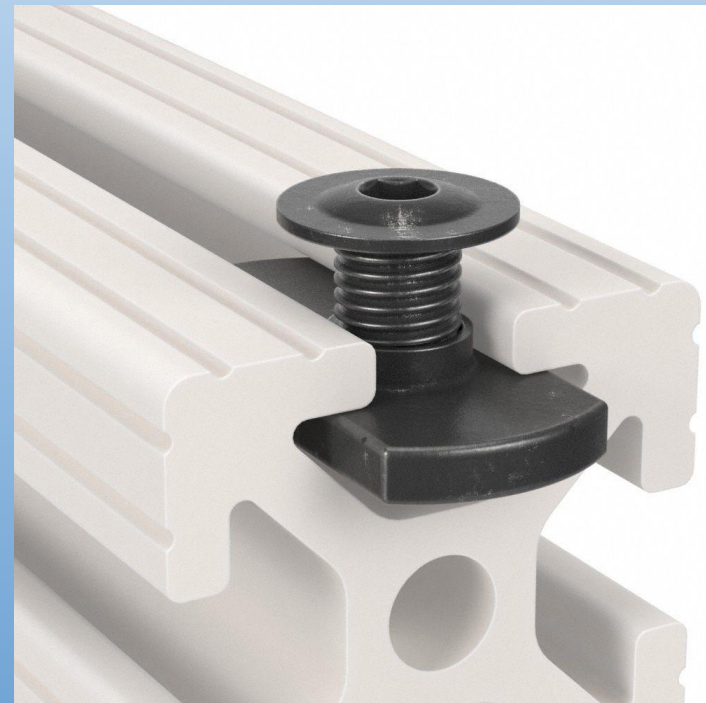
Limitation for human:

Humans normally clean during the day

Resulting Deliverable



Aluminum Extrusions

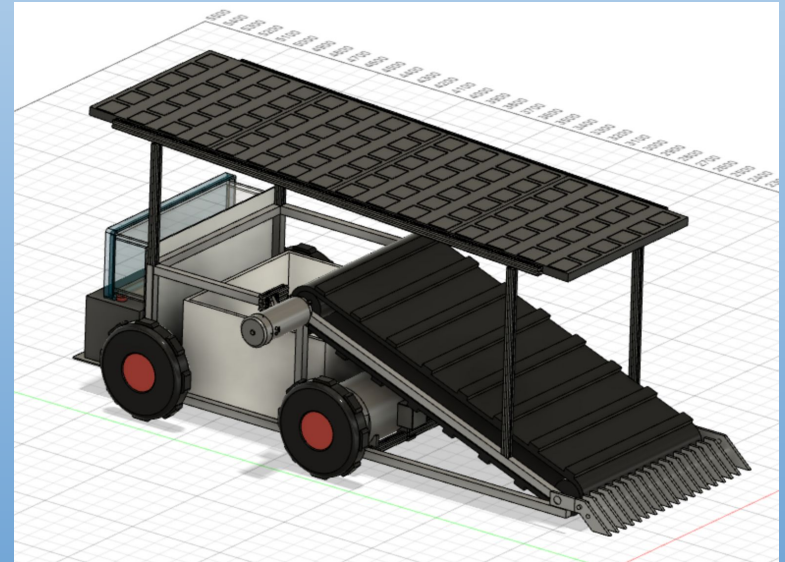
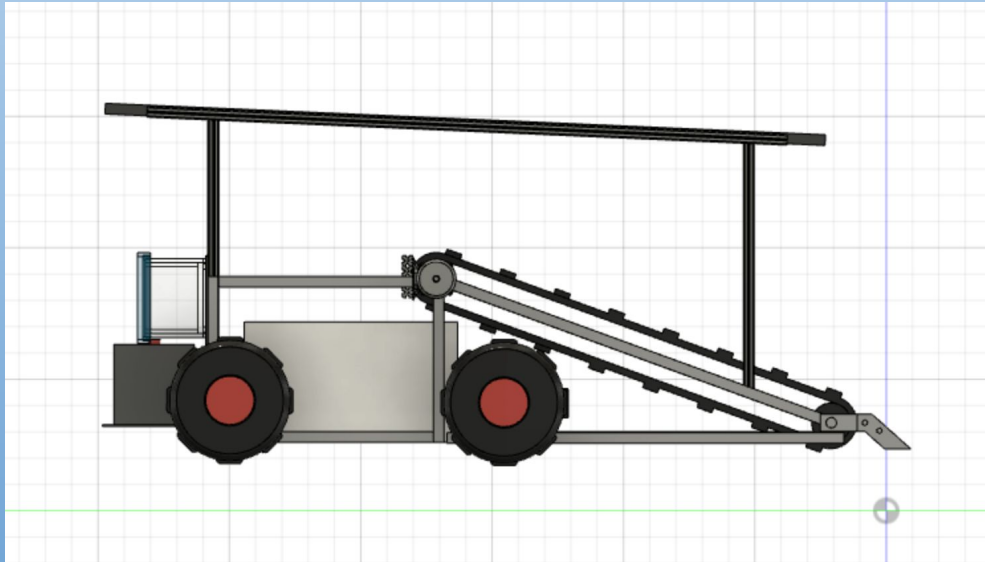


Main Body/Solar Panels

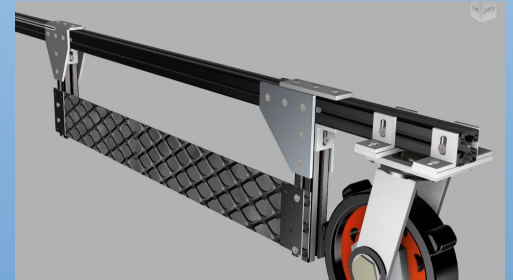
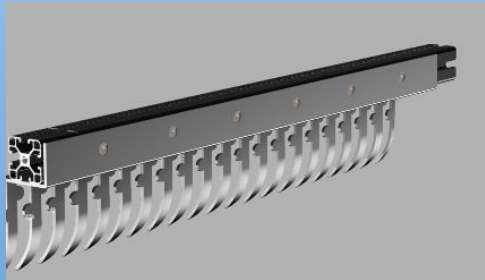
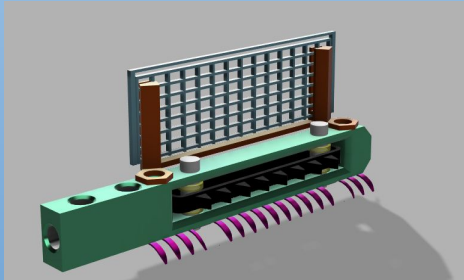
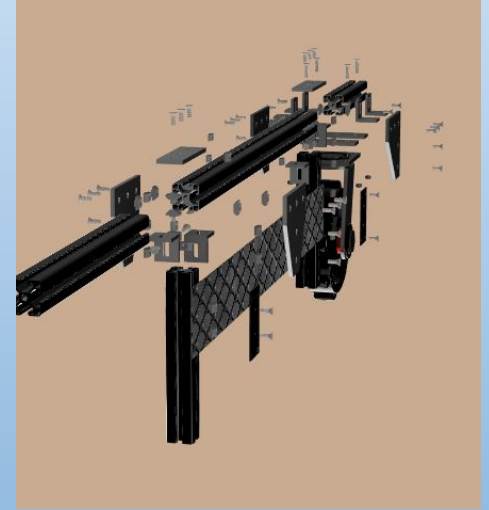
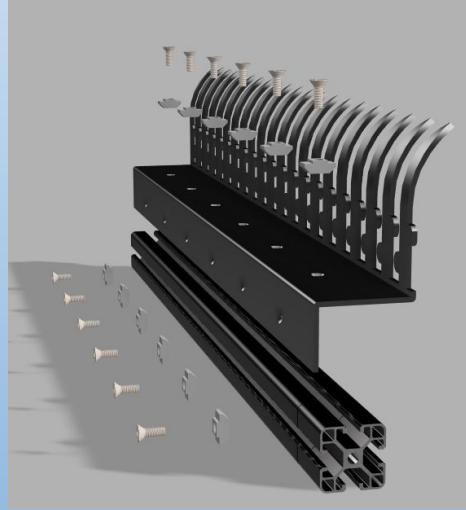
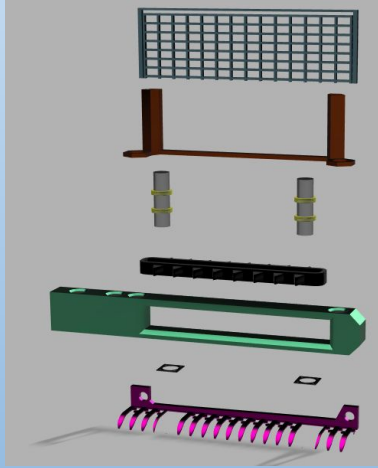
All things are waterproof

Price: ~ \$3,000

Found all things online and sorted a BOM (Bill of Materials)



Arm Designs

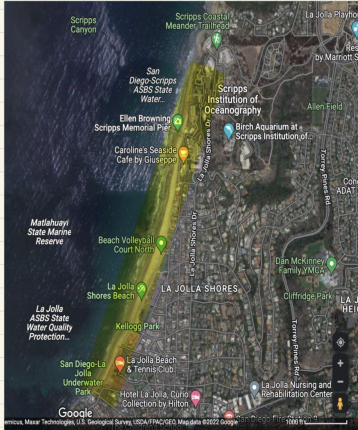


Programming Plan

- Choose a test field and approximate it into a rectangle
- Specify different parts of the rectangle: sea, sand and buildings. Sand is the area where our robot wants to operate on.
- Path when no obstacle exists
- Robot's reaction to different kinds of obstacles
- General reaction regardless of different situations

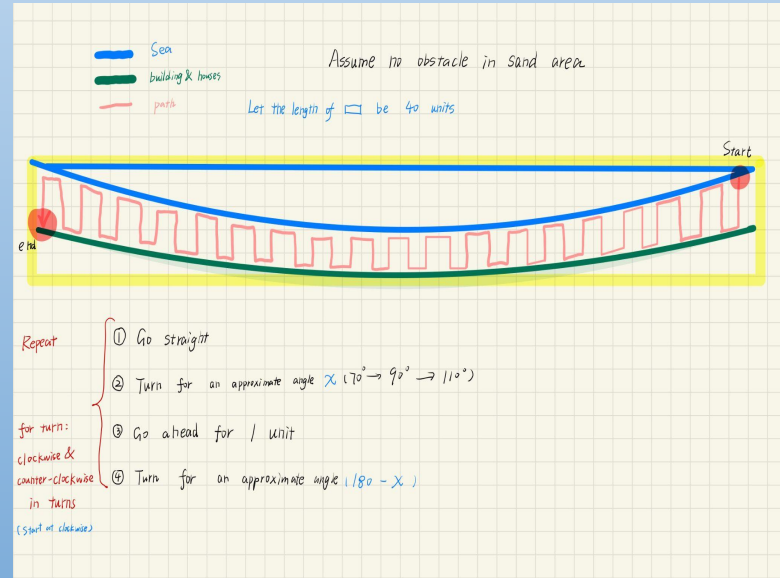
Programming Intent

Choosing a test field and approximate it into a rectangle



La Jolla Shores Beach in Google Map

Path when no obstacle exists



Simple repetition

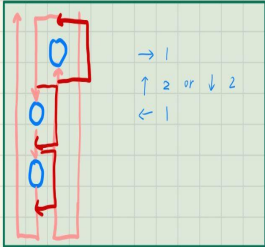
4 Obstacle Cases Covered

- Use right path
- Right path unavailable, use left path
- Big obstacles
- Long obstacles (block)

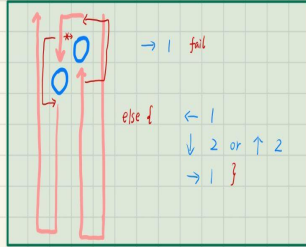
Encounter obstacles

use right path to go around the obstacle and go back to original path

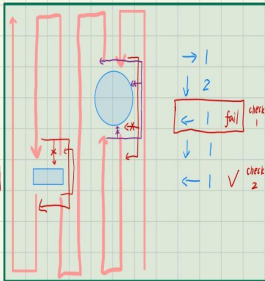
when right path is available



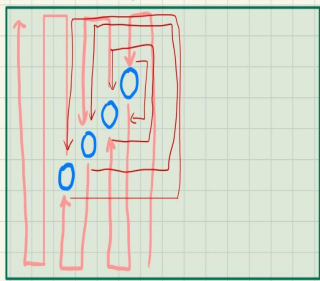
if not, use left path



big obstacles



block



General Method

Keep finding way down until fully steer by the obstacles

If Right Path Available

$\rightarrow 1$ (keep count)
if fail $\downarrow 1$

After 2 "down"

while (! \leftarrow count)

if fail $\downarrow 1$
 $\rightarrow 1$

(keep count)

if (\leftarrow V)

\leftarrow count

Else Left Path

$\leftarrow 1$ (keep count)
if fail $\downarrow 1$ (2 times)

while (! \rightarrow count)

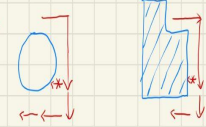
if fail $\downarrow 1$
 $\leftarrow 1$

(keep count)

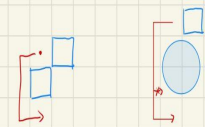
if (\rightarrow count)

\rightarrow count

Test Case

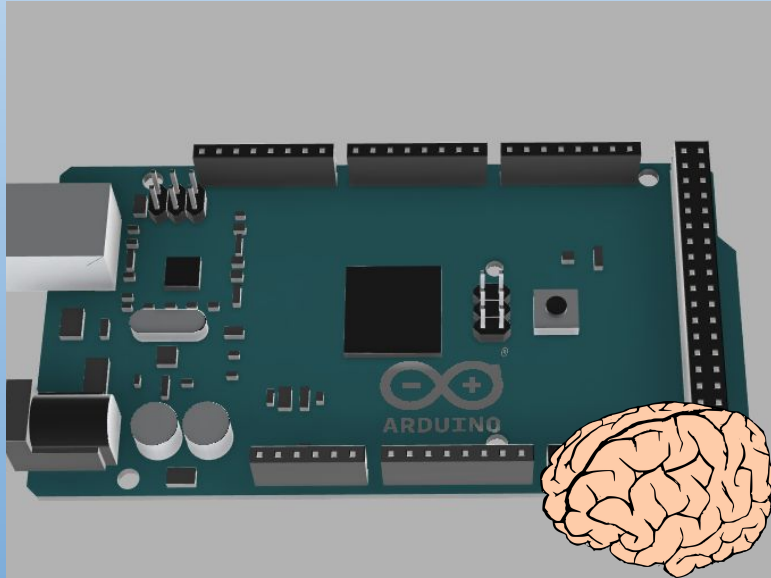


Test Case

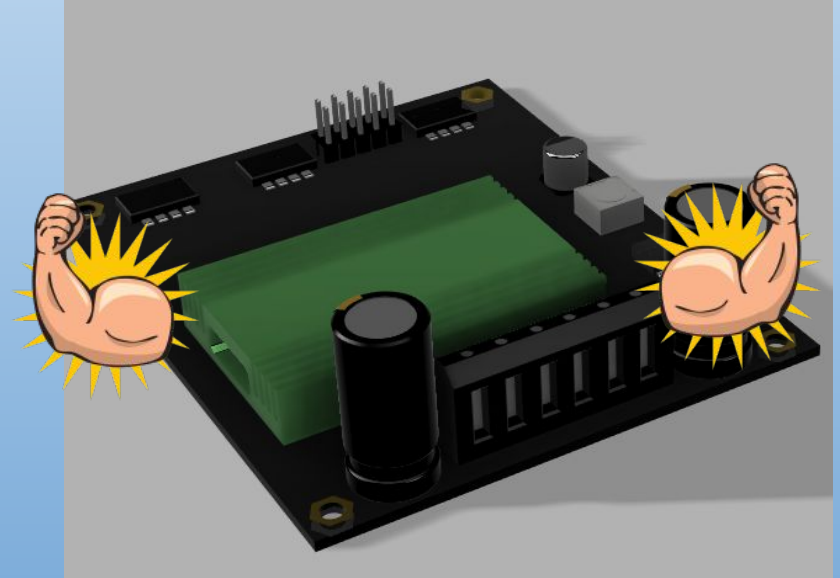


Control Setup

Microcontroller



Motor Driver



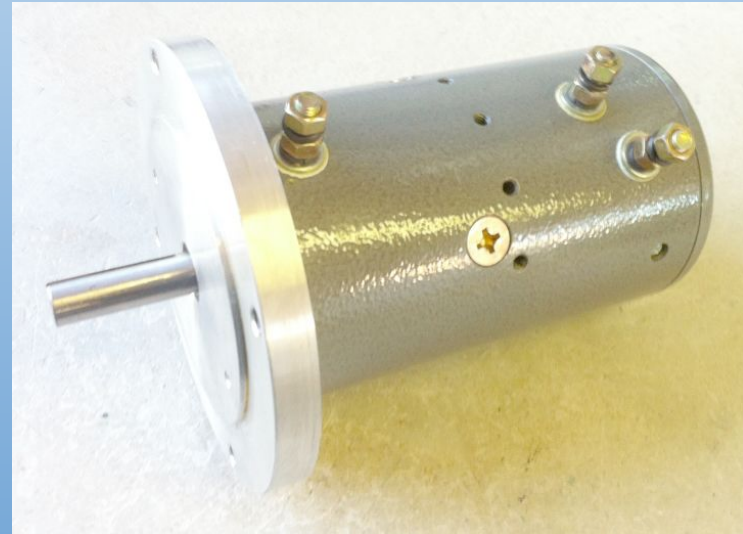
Motors Used



High Torque
and low rpm
Waterproof
motor for
Conveyor

<https://catalog.orientalmotor.com/viewitems/fpw-series-single-phase-washdown-gear-motors/40w-fpw-single-phase-washdown-gear-motors>

3hp and fully
reversible
motor for
drive train



<https://www.hydrogenappliances.com/3hpmotor.html>

A large, rectangular solar panel with a grid of black cells and white lines, mounted on a silver frame. The panel is shown from a slightly elevated angle, highlighting its thickness and the mounting brackets on the sides.

The diagram illustrates the electrical connections for a solar-powered system. It includes the following components and connections:

- Solar Panels:** Represented by a box on the left, connected to the Solar Charge Controller via red and black lines.
- Solar Charge Controller:** A central box that manages power flow. It has multiple output lines (red and black) connecting to the batteries and various loads.
- Batteries:** A box at the bottom that stores energy. It is connected to the controller and provides power to the AC loads via a red line.
- DC Loads:** Labeled as "(Drive Motor, Arduino, cameras)", these are connected to the controller's output lines.
- AC Loads:** Specifically a "Conveyor Motor", which is powered by the batteries through a red line.

Compared Against Existing Solutions



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Proprietary



Dependent
on human
control

Moving Forward

- Find sponsors to decrease price
- Make an instructions for building
- Find clients that need this robot



mounting plate (Middle)			
4040 outside mounting plate (Side)	2 per arm	\$999 (4pc)	Amazon
4040 flat strip mounting plate	4 per arm	\$36.87 (10pc)	Amazon
Total Costs	Approx cost per arm: \$191.25 +	Approx cost per arm with single extrusion: \$123.60 +	

Electrical Components list

Component	Number	Cost per unit	Reasoning?	link
M. Sensor	1	\$295	Necessary to detect moisture in sand if wanted to move around ocean potentially.	link
Camera	2	\$54.95	2 cameras needed to detect distance from object. Comes with lights!	link
Solar Panels	4	\$12999	Power generation (1.4 by 27 by 36.5 in)	link
Solar Charge Controller	1	\$3999	Provide 12v output (solar-> controller-> batteries-> controller-> output)	link
Battery	2	\$249	Power storage	link
Conveyor Motor	1	\$413	High torque motor to move conveyor	link
12VDC to 120VAC transformer	1	\$181.11	Needed to use conveyor motor	link

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GPS	1	\$1995	Needed if robot is using gps to move	link
GPS antenna	1	1995	Maybe needed to ensure a more accurate gps reading	link
Antenna adapter	1	\$395	For antenna	link
Arduino Mega	1	\$36.30		link
H-Bridge DC Motor Driver	1 per motor	\$779	Power and control motors	link
DT. Motor	2	\$29999	Moves robot :D	link
Total Cost				

Main Body Components

Component Name	Quantity Used	Price per unit	Purchase Link
Conveyor Belt	1	\$65	Link

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Wheels	4	\$80.63	link
Trash bins	1	\$215	link
4040 extruded aluminum	A bunch	\$1688.59	
Electronics box	1	\$285	link
Aluminum sheet	1	\$499.6	link

Components for Arms

Component Name	Quantity Used	Price Per Unit	Purchase Link
4040 Aluminum Extrusion (40cm)	2 (per arm)	\$22.99	Amazon
4040 Aluminum Extrusion (25cm)	3 (per arm)	\$14.30	Amazon
4040 Aluminum Extrusion (60cm)	1 (per arm)	\$18.00 (in pack of 4 \$71.99)	Amazon
4040 Aluminum Extrusion (1500)	Total length per arm, requires cutting	\$4099 + s&h (based on location)	Openbuilds Port Store
Off Road Casters/Wheels (8 inch)	1 (per arm)	\$23.52	Amazon
Steel wire mesh 003" thick, 22 gauge, 24x36cm	1 (for both arms)	\$83.69	McMaster-Carr
Mesh retaining brackets	4 (per arm)	\$18.99 (in pack of 10)	Amazon
4040 T Nuts (Hammerhead)	1 (pack of 50)	\$15.49 (free shipping)	Amazon
4040 outside	2 per arm	\$22.99 (4pc)	Amazon

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