Kwadropus Duster Arm

Congratulations for being chosen to be a NASA HUNCH Finalist for Design and Prototyping. Know that there were a lot of very good teams with great ideas competing for these spaces. Being a Finalist means you are already a winner. There is not a 1st, 2nd, or 3rd place—there are only Finalists. Although HUNCH would like to have all of these projects turned into flight hardware, most won't make it that far. However, some of these ideas may inspire other hardware and equipment. This is like real engineering where any of the projects or ideas in a project that are deemed valuable to NASA could be incorporated into another project. NASA has no intention of taking or stealing ideas. HUNCH has every intention to keep your names attached to those projects so that you and your team retain credit for your ideas and efforts. In general, NASA does not seek patents on space hardware unless there is a use for it on the ground that could be valuable.

Suggestions for the Final Design Review

Houston in the middle of April is warm and humid. The building is air conditioned but there will be lots of people. Rain is possible.

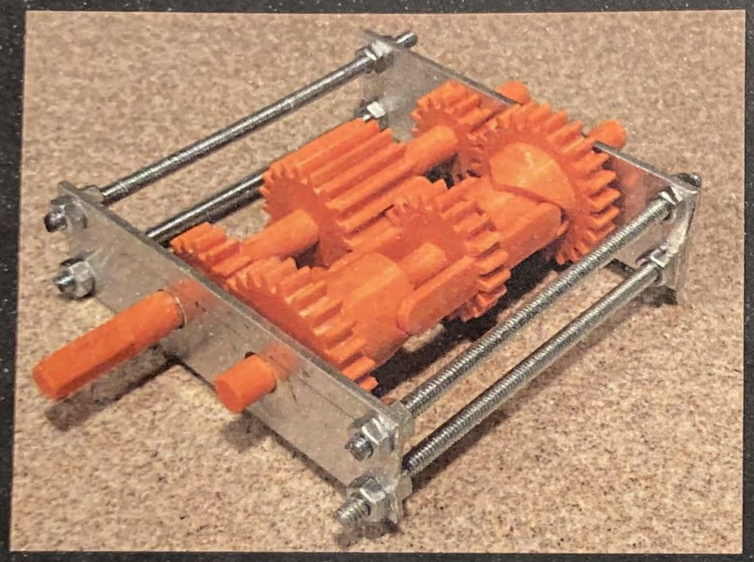
- Look professional.
- Everyone on the team should plan to talk.
- Update your brochure with you latest prototype and information.
- Make sure your QR code works for everyone.
- Update your tri-fold with your latest information—less about early concepts, more about features.
- The better your model looks, the less you have to say.
- Take a video of everything working well so if it fails when you arrive, you can still show functionality.
- You will be sharing a table with another team. Make sure your display will not take up more than half of a 6 ft x 2ft table. There will be some tables with power and some without. We will try to give priority to those who need it for the presentation—video.

Suggestions for the Kwadropus Duster Arm

- Explain why you choose the type of duster material—testing?
- Show testing data for removing real and simulated dust.
- Show testing for how much dust can be picked up and how the dust will be removed from the duster material.
- What is the life span of a duster before it is replaced?
- What kind of motion works best for your prototype?
- Provide good information on the materials (motors or other) needed to move the duster as required.
- What are your suggestions for making it smaller?

Oscilliduster

By: Noah Sisk



A Kwadropus Duster Design

akewood High School
CO

Teacher: Ashley Pederson

Problem Statement:

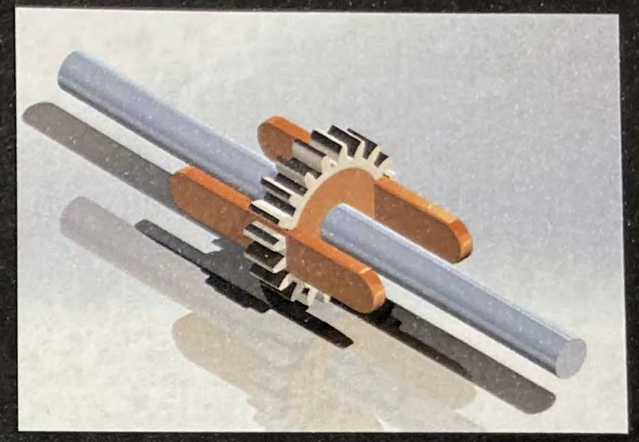
NASA is trying to remove dust from space stations using a robot which needs a robotic arm that removes and collects dust

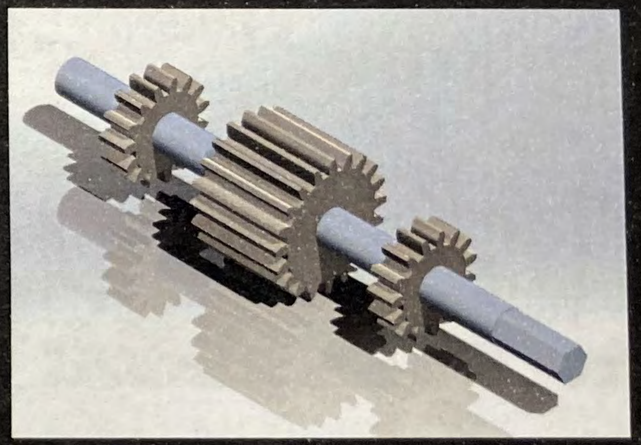
Materials

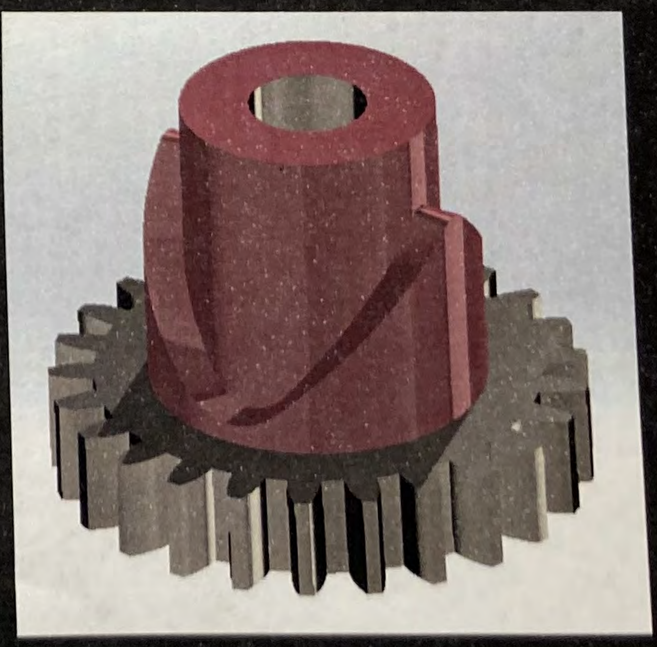
4 custom designed gears/shafts
2 aluminum plates
4 1/4" threaded rods
8 hex nuts
1 large aluminum spring
1 1/2" hex nut
Stepper Motor
Arduino Uno

Research/Testing

Cad files

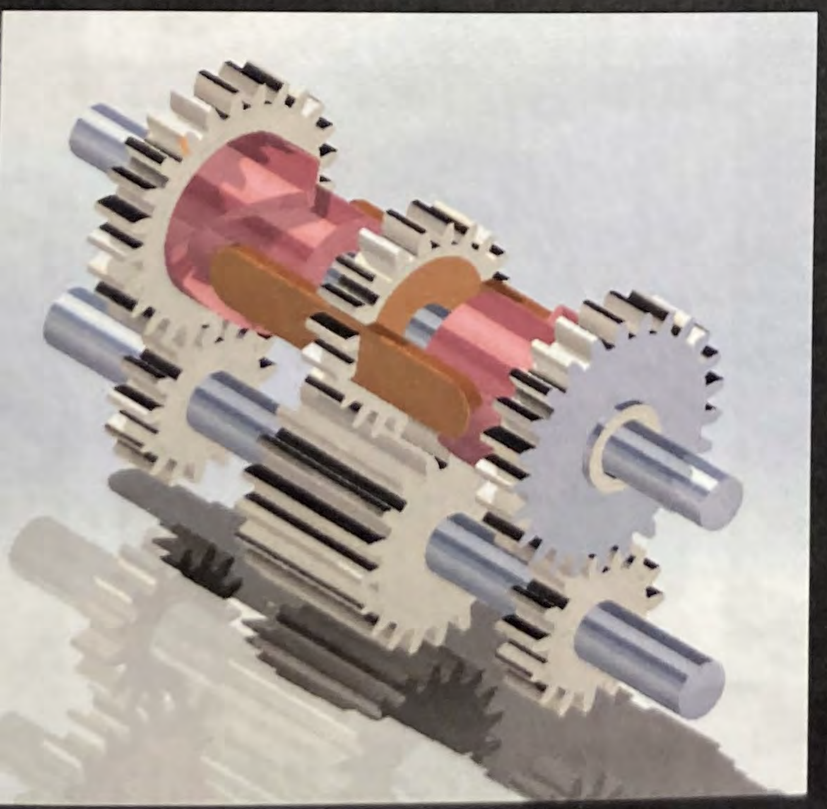






Purpose of Design

This iteration utilizes a flexible core system on a small bristle microfiber cloth for its high dust yield, universal surface compatibility, simplicity, reliability, and ease of cleaning. It attaches the flexible duster arm to a gearbox which moves the duster in a slow rotating and linear reciprocating motion, to ensure homogeneous coverage and even distribution of dust across the duster's surface.



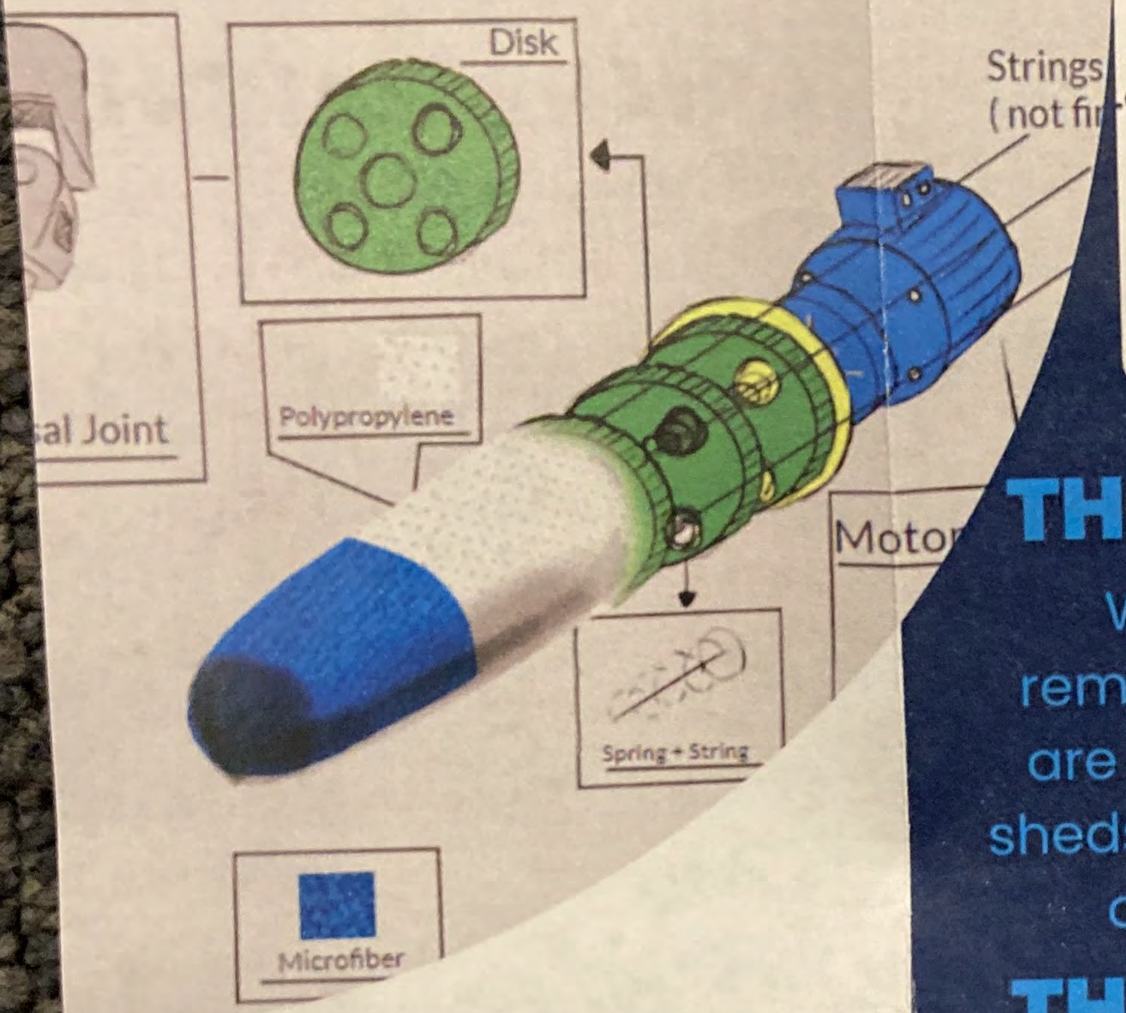
Operation

The Duster is remotely powered by the kwadropus' dedicated power supply, consisting of a single two phase motor for power. The gearbox turns the motor's constant one way rotational movement into a hybrid one way rotating and linear reciprocating output for the fiber extension. This hapens at roughly 60 rpm and allows the flexible feathers to interface with any surface

Interface with control group

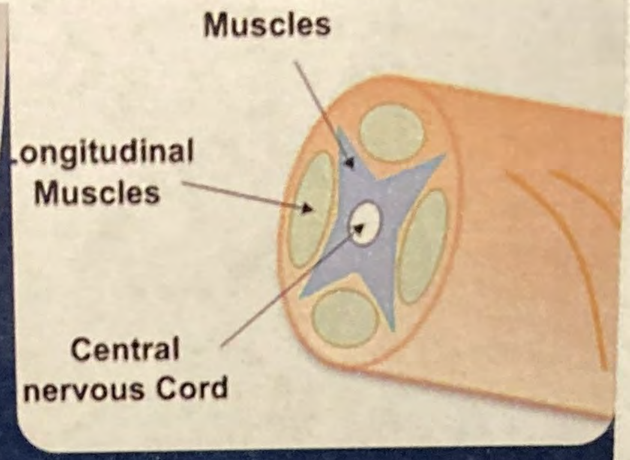
The duster in itself doesn't require much more than a steady 12V power supply when in operation so the arm simply sits idle until the arm is engaged by the control module. The other arms of the Kwadropus orient the duster arm in place, and the arm starts to slowly rotate. The flexible design allows for easy access to corners, cracks, and handrails, which tend to accumulate the most dust

Prototype



ANIMAL INSPIRATION AND TESTING

- We were inspired by the octopus and the elephant to create our soft robotic duster
- The octopus cross muscle formation allows for their complex and fluid motion
- Elephants use 4 muscles for the majority of their movement

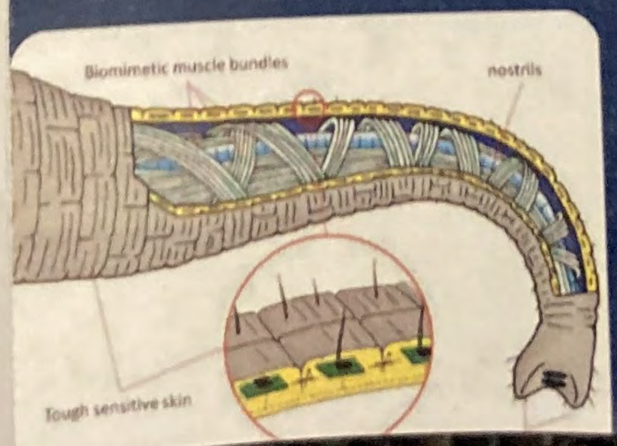


THE PROBLEM

While the ISS is remarkably clean we are not! Each person sheds 600,000 particles of skin per day.

THE SOLUTION

We have come up with a precise and maneuverable robotic dusting arm



CUSP CLEANERS

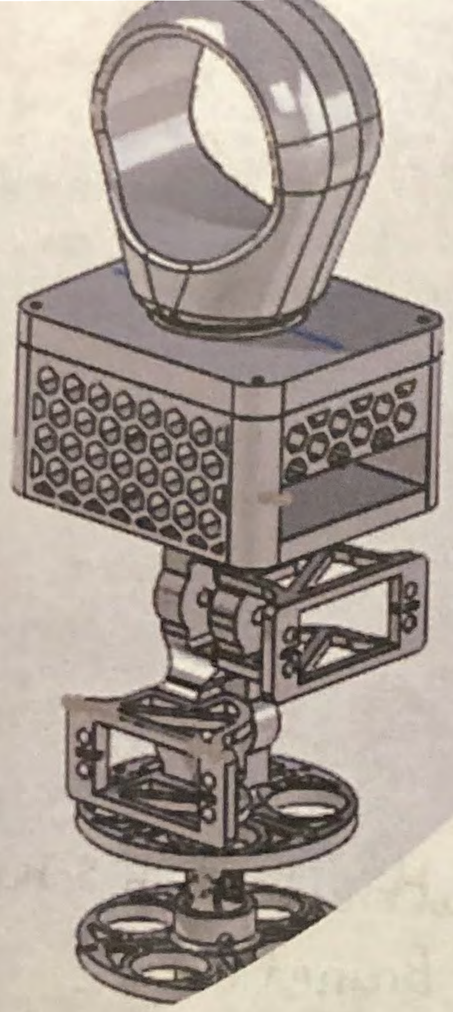
Duster Arm

Andrew Burton, Silas Cross, Jay Garcia-Olp, Aiden Lee

Our Journey through duster arm research and development

Chatfield High School
Mr. Brunetti

C.U.S.P. CLEANERS
On The Cusp Of Cleaning Technology

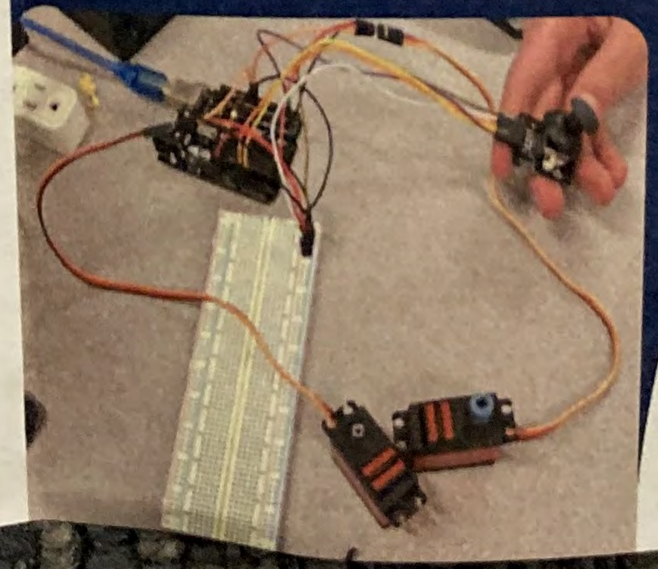


ELECTRONICS AND PROGRAMING

- using 360 degree continuous servos, we can achieve actuation in 3 axis
- Our C++ Arduino code reads coordinates from an analog joystick and converts them into servo signals
- A lithium-ion rechargeable battery powers the Arduino and servos

PROTOTYPING AND DESIGN

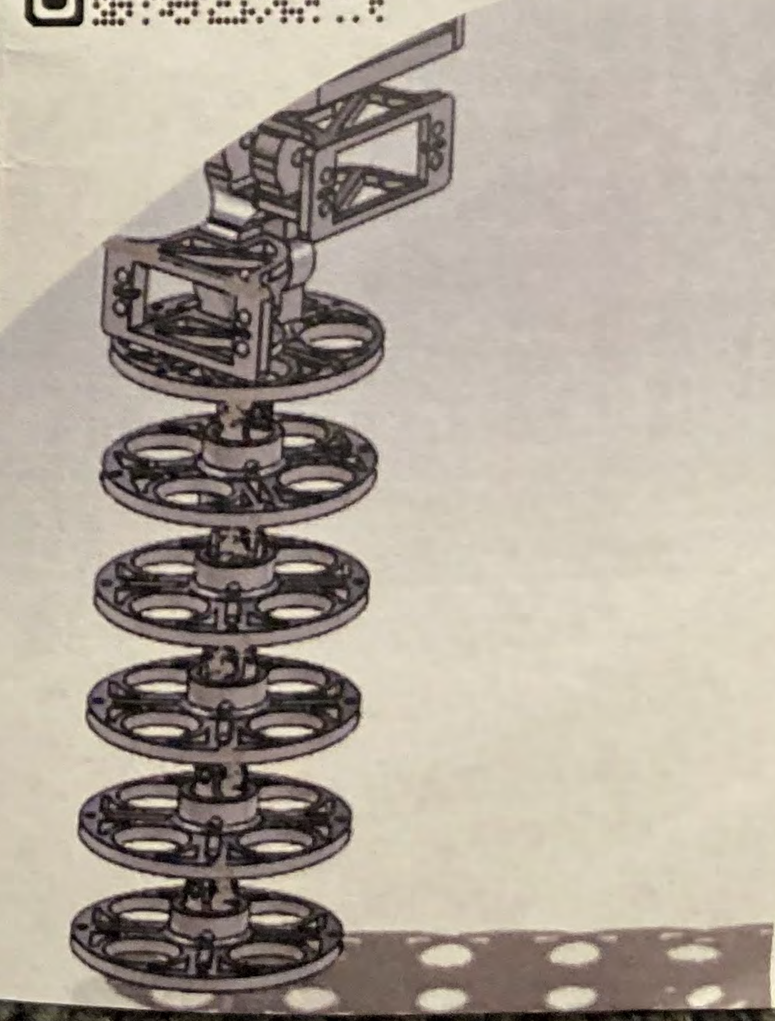
- We started making 2D design concepts to understand how continuum arms work on a small scale
- Our team created a full CAD assembly of every part of our arm
- We ran tolerance and strength tests
- Went through many design iterations
- Created a hand operated design and then added motors and electronics



ARM RESEARCH

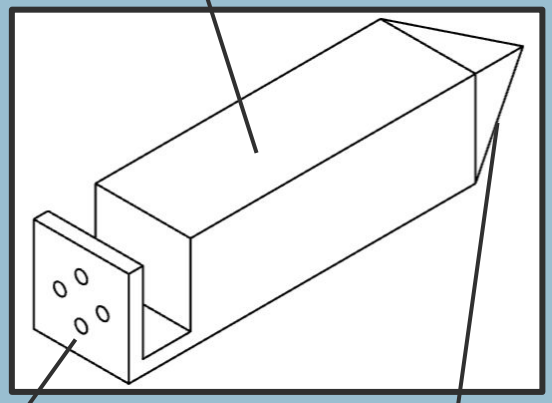
We researched multiple octopus inspired arms and materials before deciding on building our unique continuum arm design

MORE INFORMATION ON PORTFOLIO

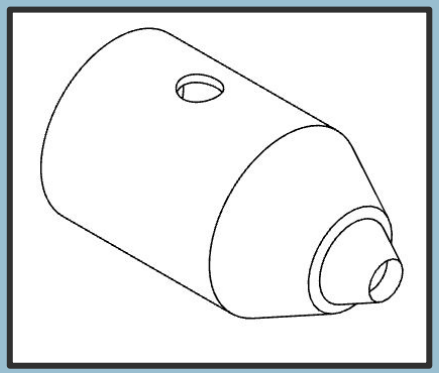


Duster Arm

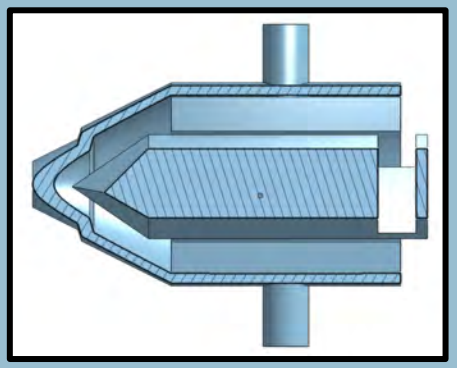
Olympia High School
Mr. Woodbridge
From left to right:
Max, Niland, Jordan, Orion



Vacuum Chamber

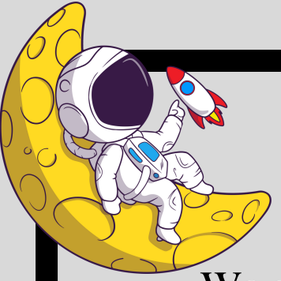


Cleaning Concept →



Our current design has 4 flat sides that rotate so it doesn't need to clean itself as often. The tip is meant for getting into things.

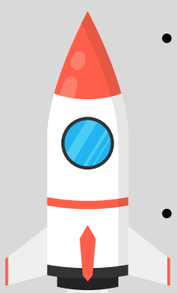
Videos Here



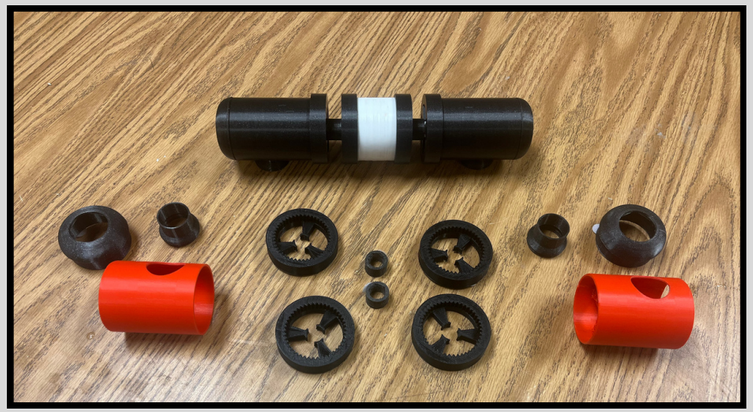
Accomplishments

We created a prototype of a duster arm that was able to complete a list of accomplishments.

- Able to pick up dust without flinging it into the air.
- Maximize dust collection while minimize material used.
- Slow and light weight so it wont push robot off wall or throw dust around.
- Easily able to be cleaned and replace able.
- Only need to use one product rather than multiple.

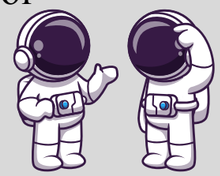


Final Prototype



Our prototype:

- Is designed to be like an octopus arm, will be able to roam freely with its own set of code and still be attached to the main robot.
- Uses a mechanism of gears to spin our lambswool.
- Is spun with a half gear so it has a stutter motion to its cleaning. (spin, drag, spin, drag).
- Lambs wool is held on with Velcro for a easy way to clean and be easy replaceable.



Kwadropus Duster arm: TAC Worm

Tyler B, Andrew Y, Christian R

Billings, Mt 59105

Eric Andersons- Aerospace Engineering

Career Center, 3723 Central Ave

Material: Lambswool

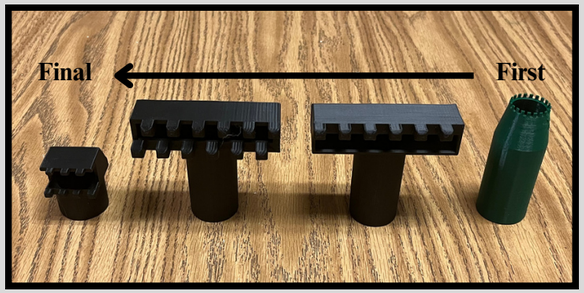
After using a decision matrix we found that lambs wool would be the best material for our project.

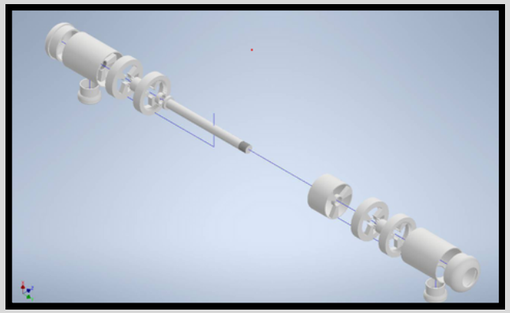
1. It does not create static electricity when used.
- Synthetic materials create static electricity when used, could cause problems on station.
2. It can be easily cleaned with a vacuum.
- With our cleaning attachment we can return our duster to good as new.
3. Collects dust easy.
- Picks up sawdust, dust, and dirt with ease.
4. Lambs wool is durable.
- It is a super strong natural material.
- It is sewn and glued into a leather backing.
- Wont get pulled out by attachment, while other synthetic will.

Vacuum Attachments

To help efficiently clean the lambs wool, we decided to use a vacuum. The problem is that to much of the duster enters the vacuum, not allowing the vacuum to pull the dust out of the lambswool. To solve this problem we created a attachment with teeth so it would act like a brush and separate the hair from the dust. We have gone through 4 original designs to end up with our final.

1. This deign the teeth are to small and would rip out the duster.
2. This one had the right shape and teeth size but wouldn't pick up as much dust as we liked.
3. More teeth to separate hair.
4. Smaller surface area, so more suction.





Not real QR code