



Final Presentation

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Problem

Picking coffee cherries by hand is a physically demanding process that requires someone to continuously extend their arm and use a stool to reach cherries at the top of a tree, while machine picking is harmful to the coffee plant and is expensive for small farm owners to afford.



Source: <https://perfectdailygrind.com/2017/07/hand-picked-vs-mechanized-coffee-harvesting/>

(Anticipated) Results

Prototype goals:

- Linearly extend around 5 inches (including the length of the actuator)
- Gripper should be able to hold onto a coffee cherry
 - Dimensions (mm):
L = 15.4, W = 13.0, T = 13.03



Stretch goal:

- Twisting gripper (full 360 degrees)



We will measure our success if our prototype can do the above.

Source: https://www.myfoodresearch.com/uploads/8/4/8/5/84855864/_31_fr-2022-498_bizimungu.pdf

Approach

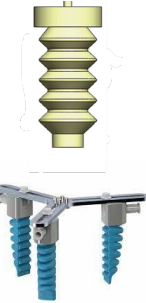
End function: linear extension of collector arm

Use a 3D printed linear actuator that will be pneumatically powered to ensure the linear extension of the collector arm.



End function: securely gripping onto a coffee cherry

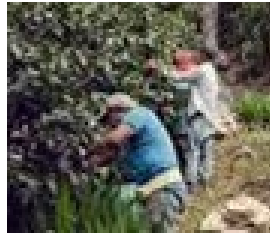
Design a 3D printable gripping actuator that is also pneumatically powered capable of grabbing coffee cherries with minimal risk of slipping and damaging the cherries.



Impact

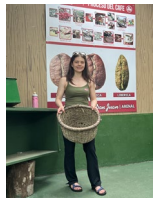
Building a device like this would do the following:

- Reduce physical strain
- Reduce time but increase quantity picked
- Reduce damage done by machinery to the plants
- Ensure ready to pick cherries are harvested



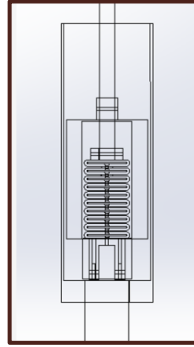
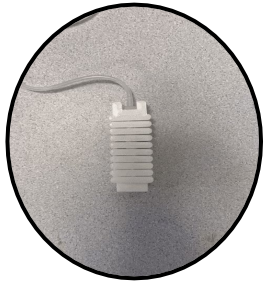
Coffee cherry collectors would benefit from our device.

Parallel Applications: medical assistive device

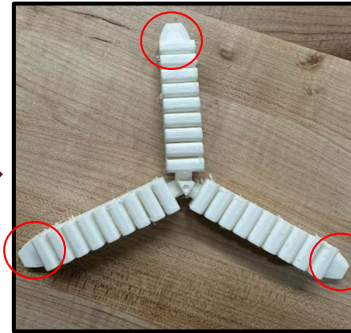
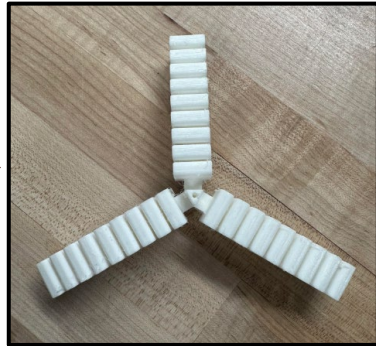
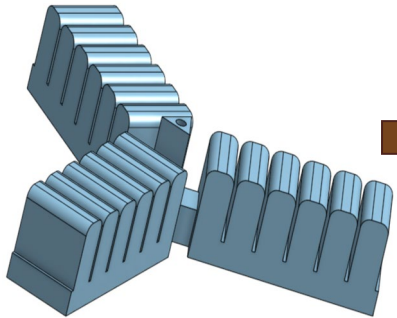


Project Journey of Individual Components

Handle: 1st Prototype → 2nd Prototype (same actuator)

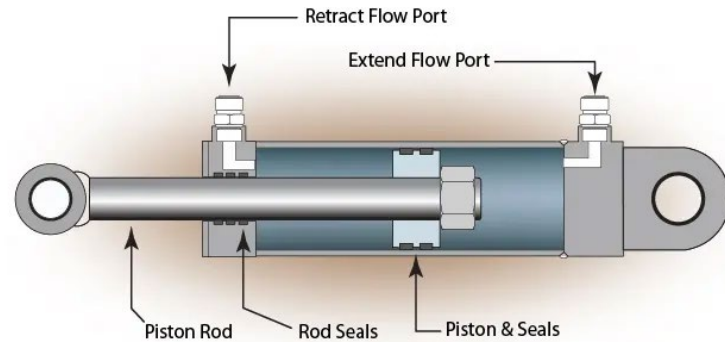
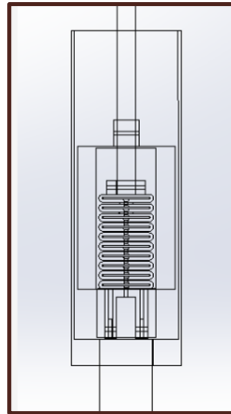


Gripper: 3-in-1 Gripper → Modular Design



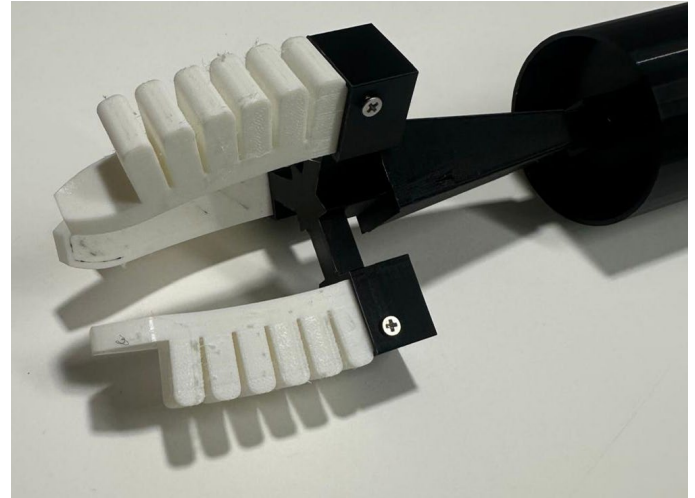
Handle Design

- Initial problems with actuator bending too much
- Second design inspiration: mechanical linear actuator
- Linear actuator is placed inside two pistons
- Pistons keep the linear actuator straight as it is pressurized



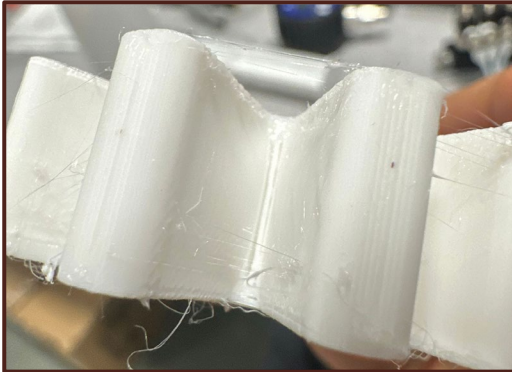
Gripper Design

- Initial design: 3-in-1 gripper
- Problems with printing
 - Print time too long: >24 hours
 - Would not bend enough
 - Would not grip the actual cherries
- Final design: Modular gripper
 - 3 grippers connected with a PLA structure



Print Failures

- Stringing motivated our decision on making a modular gripper
- Clogged nozzles
- Holes in print
- Layer separation

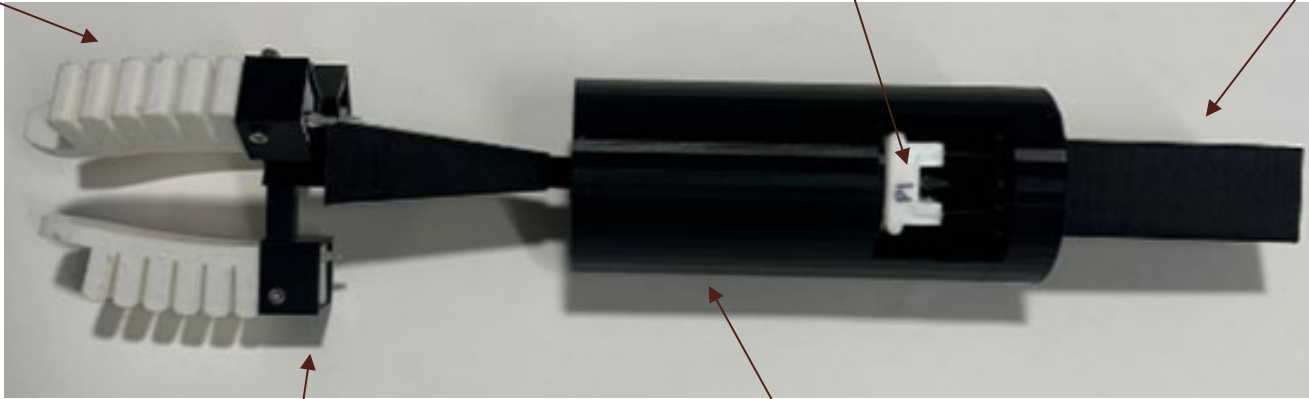


Final Prototype

3 Modular
PneuNets

10 Chambered
Linear Actuator

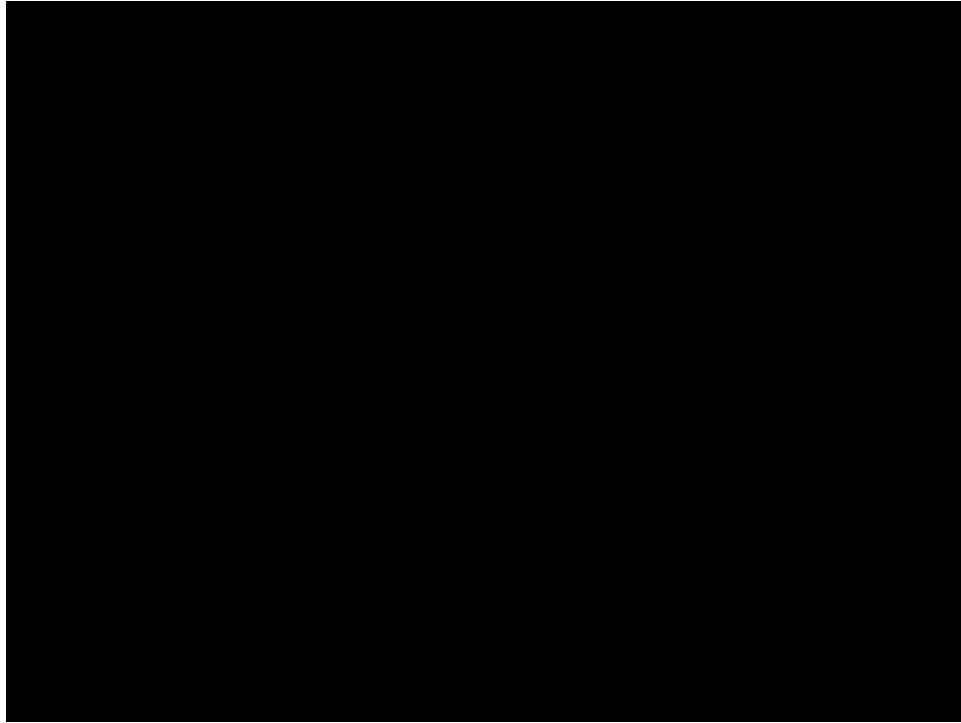
Handle



PLA Mount for
PneuNets

Piston powered
by linear
actuator

Project Demonstration



Project Takeaways

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graph TD; A[Project Takeaways] --> B[Design]; A --> C[Fabrication]; A --> D[Testing]; A --> E[Application]; B --- B1[Minimizing the number of components as much as possible made it harder to meet our objectives]; C --- C1[Reducing print times means you can test more frequently]; D --- D1[Make tubing entry points accessible so that testing is easier]; E --- E1[Having a clear application motives the project];
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Design

Minimizing the number of components as much as possible made it harder to meet our objectives

Fabrication

Reducing print times means you can test more frequently

Testing

Make tubing entry points accessible so that testing is easier

Application

Having a clear application motives the project



THANK YOU!

Questions?