

Cutter Fidelity Testing

The purpose of this unit test is meant to gather information about the cutting capabilities of the end-effector subsystem. Specifically this test aims to determine repeatability of the cutting mechanism. This test should ultimately be conducted on the full end effector design, but can preliminarily be conducted cutting mechanisms:

One Page Summary

Objective	
Ensure that the cutting mechanism can repeatedly sever a peduncle under ideal conditions.	
Requirements	PR.05.2
Equipment	End-effector, table-top power supply, Raspberry Pi, green bell peppers (4-20)
Elements	Cutting mechanism unit from end-effector subsystem
Personnel	Alec Trela
Location	NSH B506
Procedure	
1. Properly connect the power supply to motors and microcontroller. 2. Place the peduncle at the approximate center of the gripping plates, within 5 cm of the top of the pepper. 3. Actuate the end-effector to ensure gripping and subsequent cutting of the peduncle. 4. Repeat steps 1-3 20 (or more) times.	
Verification Criteria	
1. The end-effector was able to cut through the entirety of all peduncle stems successfully.	

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Required Materials:

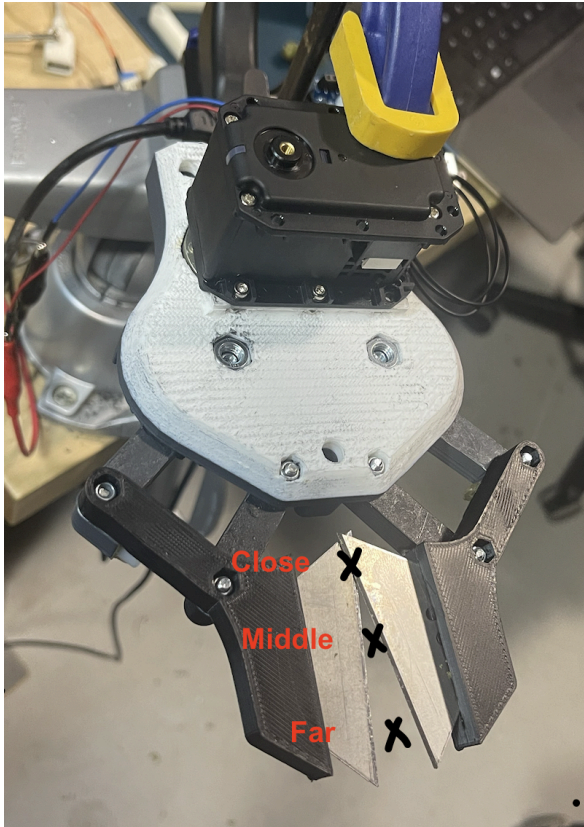
What is needed to complete the testing?

- Cutting Mechanism (integrated or standalone)
- Table-top power supply
- Arduino Uno
- Laptop and Arduino IDE

Output:

What data will be collected? Why?

- Peak Current Draw:
 - For quantitative understanding how much current is drawn for successful grips/cuts
- Peduncle cutting test:
 - To test the upper limits of the cutter
- Location of cut:
 - To understand if there is proper force distribution on the face of the blade, and to understand if this should even be a concern
 - Close, middle, and far are roughly defined as the thirds of the end-effector



- Successful Cut
 - Boolean

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Procedure:

For repeatability, what steps were taken to perform this test? Share all resources & required materials.

1. Calibrate the goal positions
2. Upload a continuously running script that operates between the two goal positions
3. Measure the diameter of the peduncle before cutting and save to the table **MAKE ALL DIAMETER ALONE THE LONGER AXIS**
4. Attempt to cut
5. Fill Table

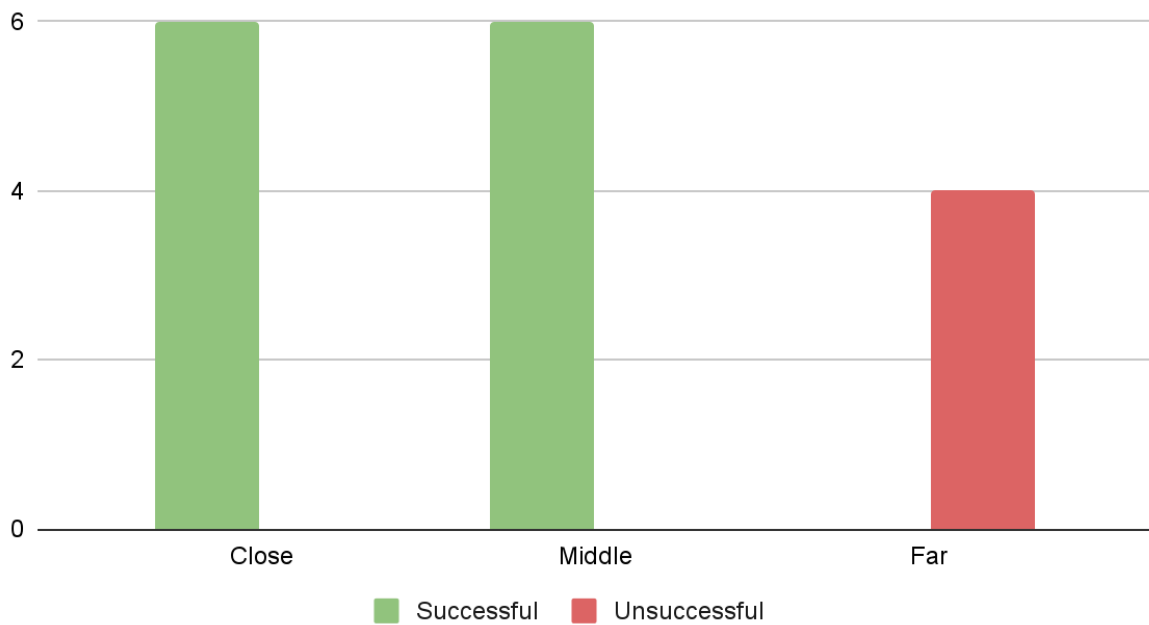
Cutter Fidelity Testing

Test 1 Results:

Test Date: 3/19/23 Calibrated Goal Positions: 110 deg, 225 deg				
Test #	Peduncle Diameter (mm)	Cut Location	Peak Current (A)	Did it Cut?
1	10.25	Near	1.17	Yes
2	10.45	Middle	1.0	Yes
3	10.77	Far	1.4	No
4	11.63	Near	1.7	Yes
5	9.06	Far	1.25	No
6	9.77	Near	1.00	Yes
7	10.03	Middle	0.90	Yes
8	10.7	Far	1.30	Yes
9	10.6	Middle	0.83	Yes
10	7.15	Middle	0.70	Yes
11	5.41	Far	0.63	No
12	6.45	Near	0.83	Yes
13	8.64	Middle	0.40	Yes
14	8.56	Near	0.6	Yes
15	7.82	Far	0.4	No
16	11.12	Near	0.83	Yes

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Successful Peduncle Extractions



Notes:

- After first cutting test at the far position, noticed that since the blades were affixed they began to pivot around peduncle, so I hot-glued them into place
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Test 2 Results:

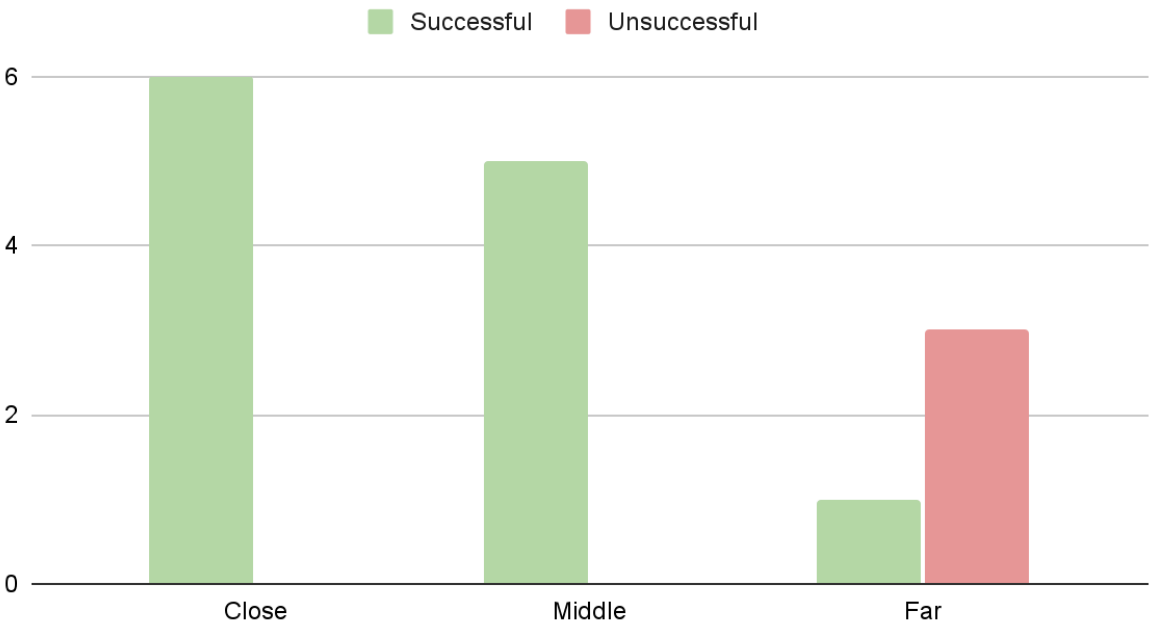
Test Date: 3/26/23 Calibrated Goal Positions: Cut 105 deg, 160->180->190 deg, Grip 205, 125 (gripper + cutter)				
Test #	Peduncle Diameter (mm)	Cut Location	Peak Current (A)	Did it Cut?
1	8.5	close		yes
2	8.3	mid		yes
3	9	far		yes
4	9.5	close		Yes (attempt 2)
5	7	mid	1.5	Yes
6	7.5	far	2.2	No
7	6	close		yes
8	7.5	mid	1.5	Yes (attempt 2)
9	9.2	far	3.5	yes
10	9.5	close	2.5	yes
11	8.2	mid		yes
12	10.2	far		yes
13	10.5	close		yes
14	8.4	mid	3.5	no
17		mid		yes

Notes:

- Performed fairly well
- Need to reduce form factor because the diameter of the peduncle is such that it runs into the base of the gear housing before it hits the blades
 - We are strongest at the near position but can't even cut there
- Playing with the deg positions to increase torque worked well
 - Even got our first cut at the far position
 - However, this is difficult for the links, they start to see wear & tear (may need to look into this)

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Successful Peduncle Extractions



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Test 2 Results:

Test Date: 4/7/23 Calibrated Goal Positions: Cut 105 deg, 160->180->190 deg, Grip 205, 125 (gripper + cutter)				
Test #	Peduncle Diameter (mm)	Cut Location	Peak Current (A)	Did it Cut?
1	5.6	far	0.7	no
2	6.2	mid		yes
3	6	near		yes
4	6.6	far		yes
5	5.6	mid		yes
6	5.5	near		yes
7	5.8	far		yes
8	6.1	mid		yes
9	12	far		yes
10	5	mid	.4	yes
11	8	near	.27	yes
12	7	near	0,5	yes
13	5.6	far		
14	5.2	near		
15	5.8	mid		
16	5.6	far	0.42	yes
17	5.8	far	0.48	yes

Notes:

- Not too bad
- Some geometric concerns with the peduncles of shorter length not being able to fit within the cutter and gripper at the same time
- First time the cutter has actually cut at the far position
- Some potential concerns about the alignment of the blades

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Test Date: 4/18/23 4/19/2023 Calibrated Goal Positions				
Test #	Peduncle Diameter (mm)	Cut Location	Peak Current (A)	Did it Cut?
1		mid		yes
2		mid		yes
3		mid		yse
4		mid		yes
5		mid		yes
6		mid		yse
7		mid		yes
8		mid		yes
9		mid		yes
10		mid		yes
11		mid		yes
12		mid		yes
13		mid		yse
14		mid		yes
15		mid		yes
16		mid		yse
17		mid		yes
18		mid		yes
19		mid		yes
20		mid		yes

- SVD Encore Prep and Encore Both showed successful maneuvers

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Cumulative Spring 2023

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