



UNIVERSITY OF
ILLINOIS
URBANA-CHAMPAIGN

ME 370

Package Dispensing

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10/10/2025



Package Delivery

- Students need package delivery in dorms
- Deliver small packages to doorstep

Ideal User Experience

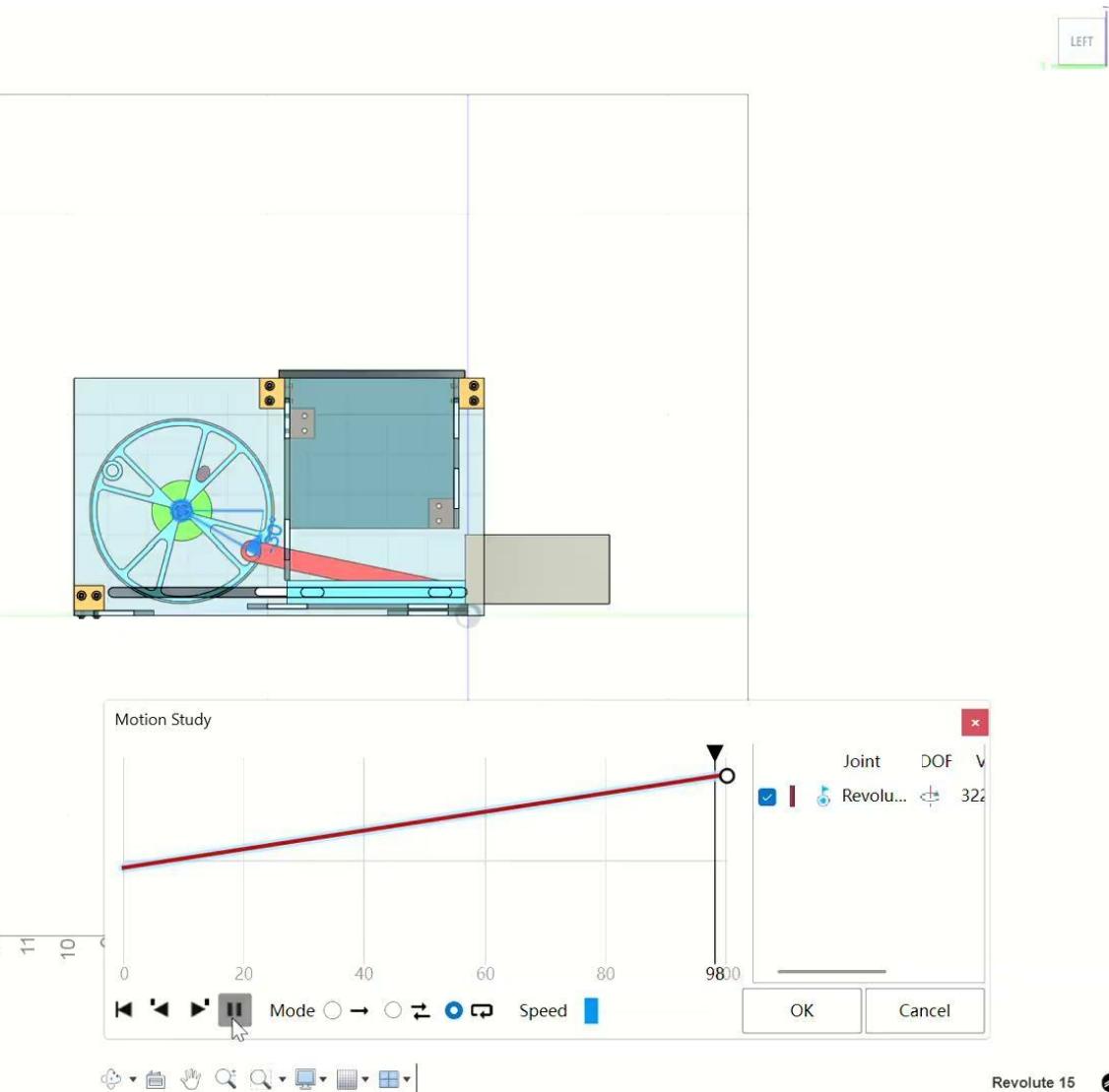
- User must be able to quickly load packages into machine
- Delivery robot must be easily identifiable in its environment
- Must keep packages secure during transit to destination
- Loading and unloading should take less than a minute each

Design Decisions Made

- Designed for $\frac{1}{4}$ scale of Amazon common boxes
 - Box code 100: 13.75" x 11" x 5" -> 3.4" x 2.75" x 1.25"
 - Box code 81: 14.5" x 10" x 4.25" -> 3.6" x 2.5" x 1"
 - Box code A3: 10" x 7" x 5.25" -> 2.5" x 1.75" x 1.3"
- Handle packages of multiple size -> Hopper sized to fit above boxes and only dispense one at a time
- Quickly load packages -> Large top-loaded hopper easily accessible and intuitive to use
- Protect packages -> Dispenses packages from a low height



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Design elements:

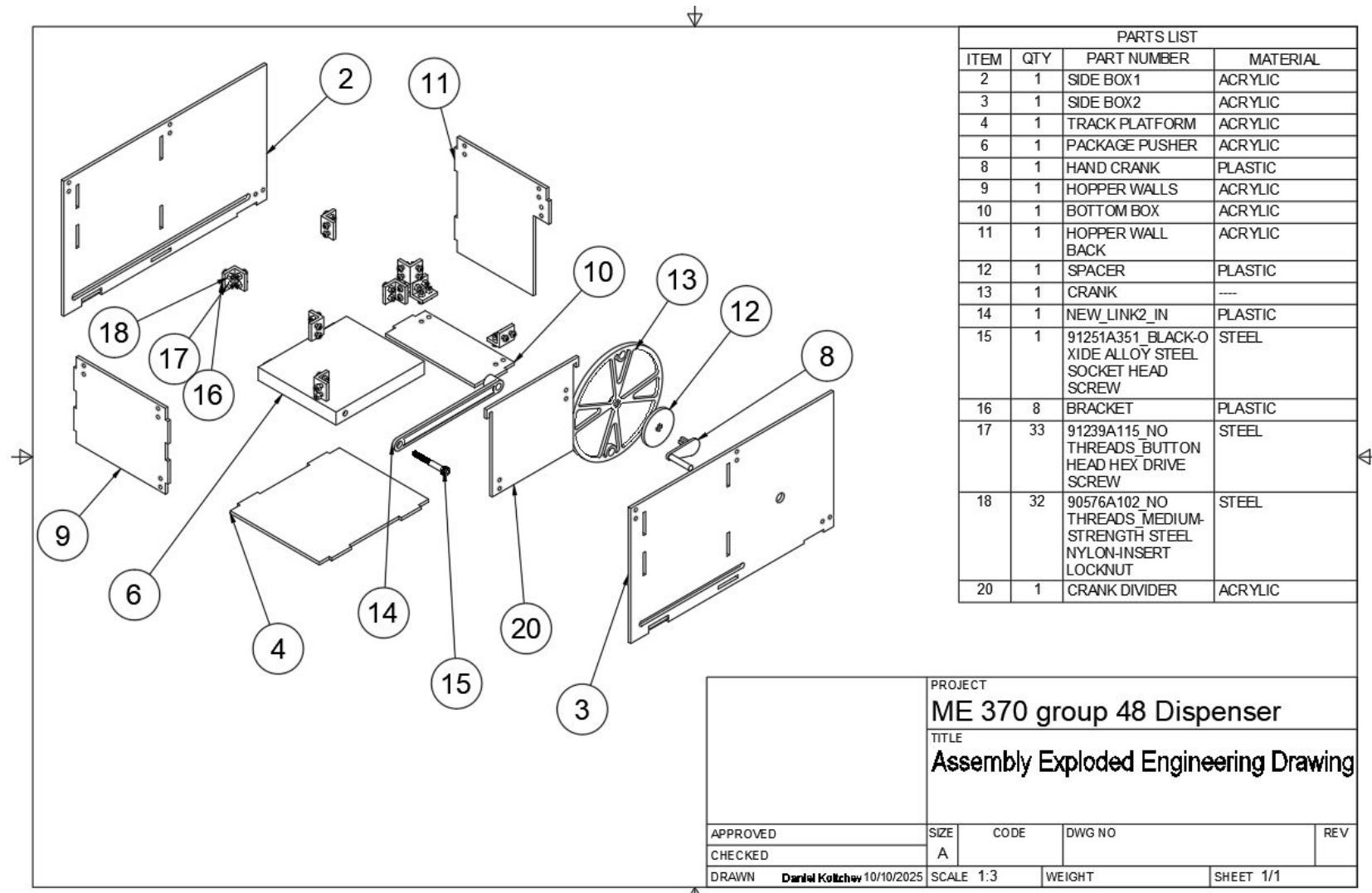
1. Crank-Slider Mechanism: The crank rotates to move the slider back and forth.
2. Using the slideway to fix the slider, prevent it from rotating.
3. Screw fixation, free adjustment of tightness and reduce friction
4. Acrylic box fixes the blocks to ensure they are pushed one by one.

Expense Report



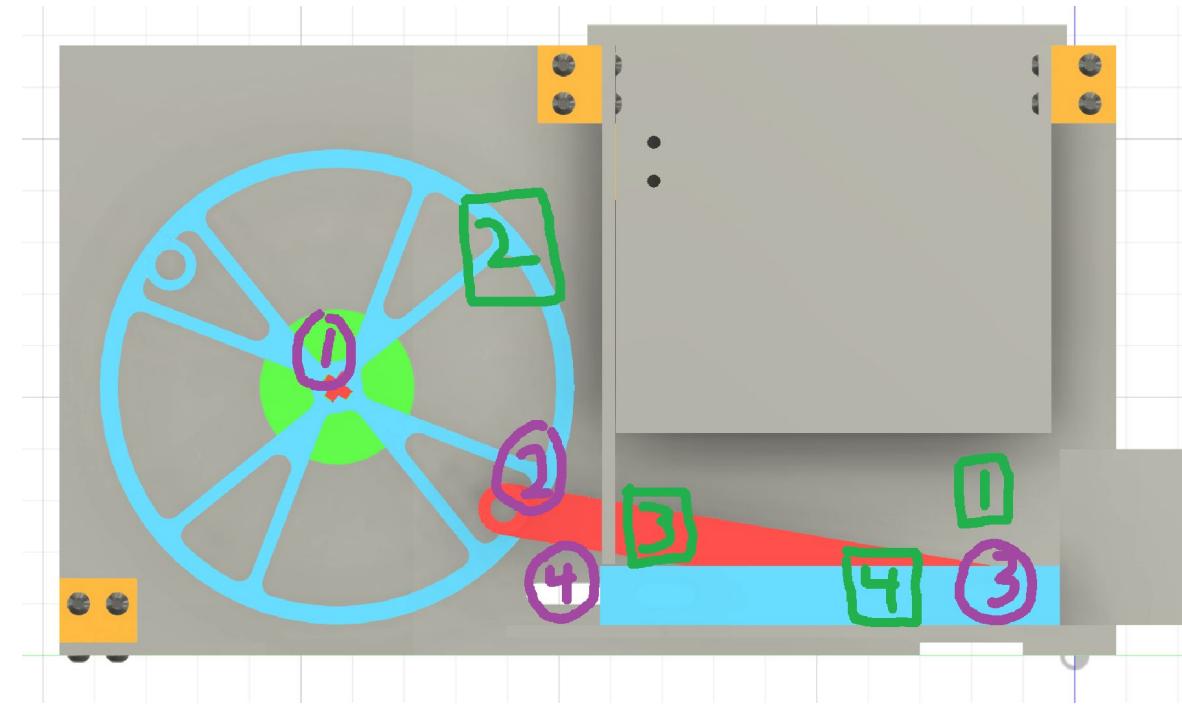
Lab section number, day, time: (click on cell to right & select section from drop-down list - click on down arrow in lower right corner)	BB1 (13:00-14: 20 W)				Team Number and Names: (in cell to right, enter team number and names of team members)	Team 48	
Description	Qty/\$	Unit Price	Qty purchased	Source (click in space below and use drop-down list)	Purpose	Total Cost	
Locknut M3	20/\$	\$ 0.05	32	Innovation Studio	For box assembly	\$ 1.60	
HDRHS M3 x 10	6/\$	\$ 0.17	32	Innovation Studio	For box assembly	\$ 5.44	
Metal Barrel Fastener, 1/2-5/8" L	10 Sets/\$5	\$ 0.50	1	Innovation Studio	For box assembly	\$ 0.50	
1/8" Acrylic, 12x24"	1/\$10	\$ 10.00	1	Innovation Studio	To make mounting box panels	\$ 10.00	
Socket Head Cap Screw, 10-32, 1.5"	2/\$	\$ 0.50	1	Innovation Studio	For crank assembly	\$ 0.50	
washer #10, ID:0.203"	24/\$	\$ 0.04	1	Innovation Studio	For crank assembly	\$ 0.04	
Hex Nut. 10-32. 3/8" W	24/\$	\$ 0.04	3	Innovation Studio	For socket head assembly	\$ 0.12	
3D Printing (PLA Filament, Innovation Studio)	1g/\$0.03	\$ 0.03	195	Innovation Studio	Pusher, Wheel, Spacer, Handle,	\$ 5.85	
Manufacturing cost for laser cutting	\$0.001/cm	\$ 0.001	516.89	Innovation Studio	Laser cut box panels	\$ 0.52	
Manufacturing cost for printing	\$0.25/hour	\$ 0.250	19.5	Innovation Studio	Pusher, Wheel, Spacer, Handle,	\$ 4.88	
				Total Expenses		\$ 29.45	

Bill of Materials

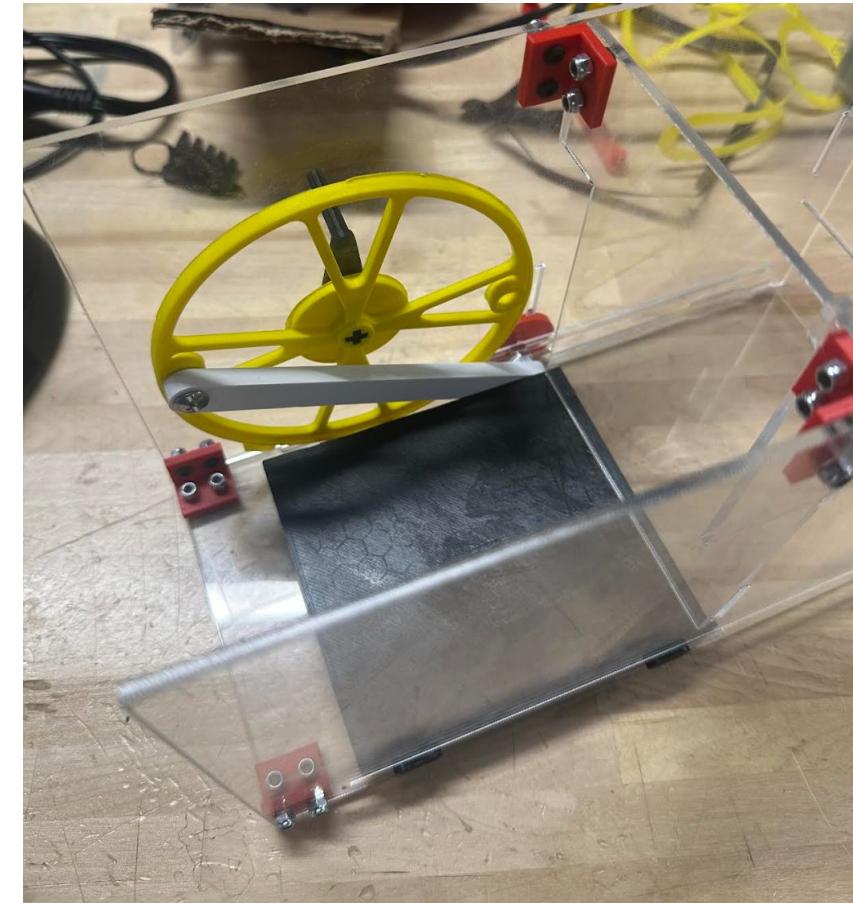
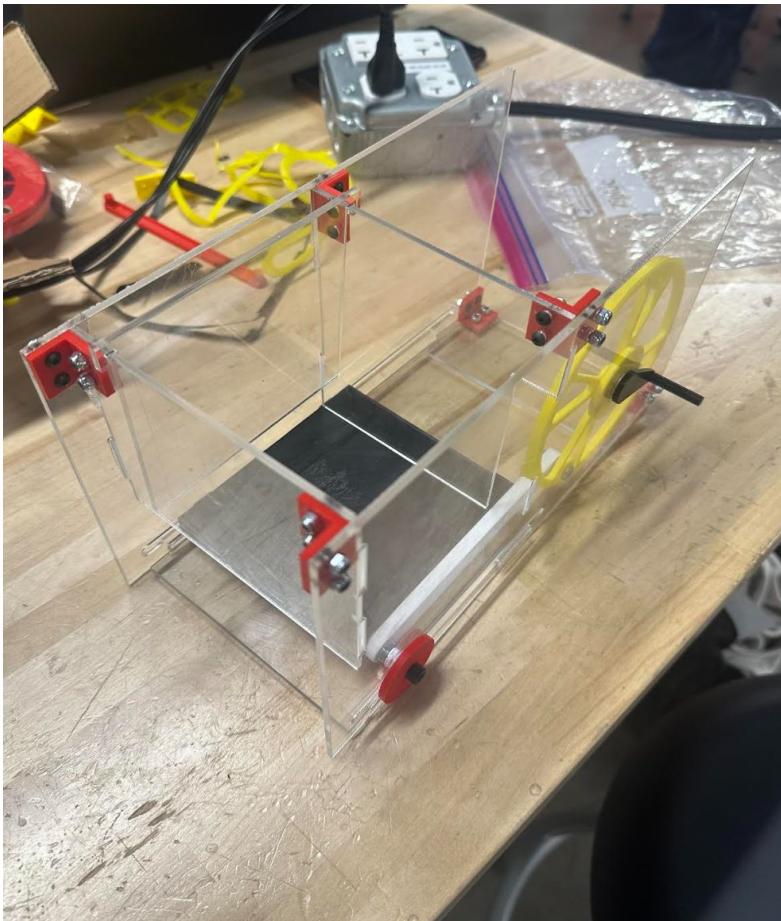


Crank-Slider Mechanism

- DOF= $3*(n-1) - 2*J_1 - J_2$
 - $n = 4$ links (green)
 - $J_1 = 4$ full joints (purple)
 - 1 DOF
- User turns the cranks and linkage converts rotational motion to linear motion of the slider
 - Linear motion pushes out packages



Prototype demo





The Grainger College of Engineering

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