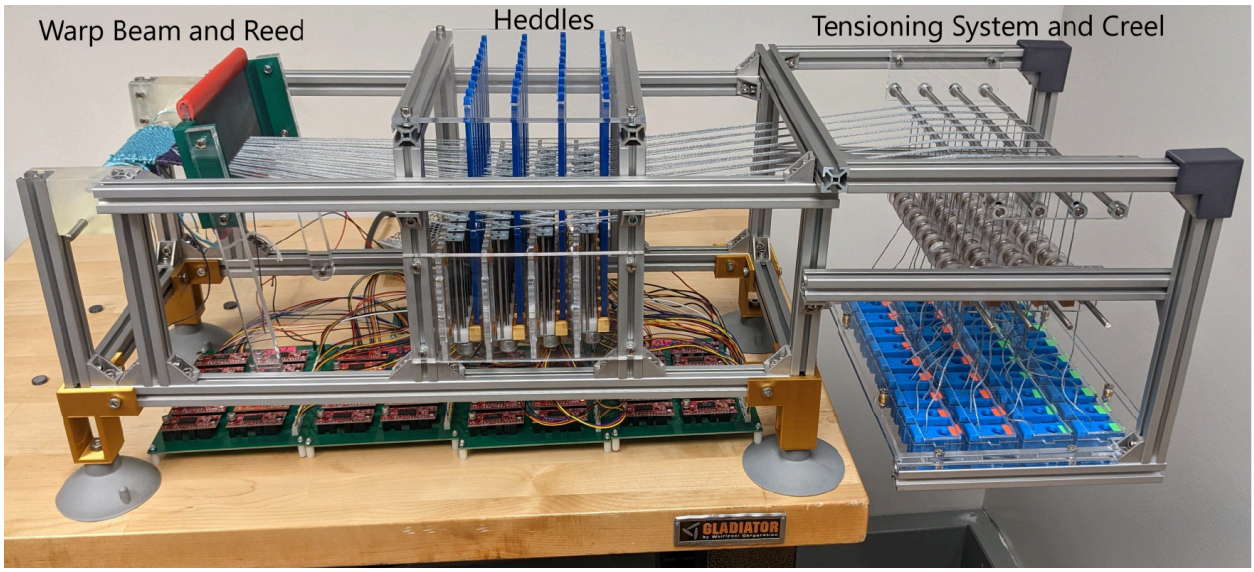
Tools

- Phillips Head Screwdriver
- Tweezers
- M 3.5 Allen Key
- M2 Allen Key
- M1.5 Allen Key
- 3/32 Allen Key

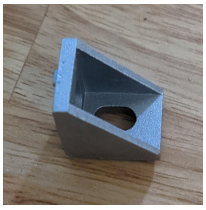
Final Loom

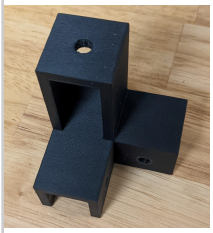


Frame

Materials

-

8020 560mm	2	
8020 250mm	4	
8020 330mm	1	
8020 178mm	6	
8020 200mm	4	
8020 260mm	4	
8020 220mm	2	
8020 540mm	2	
8020 290mm	1	
8020 300mm	2	
Corner Bracket	46	
M5 t-nut	124	
M4 t-nut	18	
Suction Cup Feet	4	
M5 8mm Socket Screw	108	

M5 10 Socket Screw	16	
1/4-20 Nut	4	
M4 8mm Screw	16	
Foot Holders	4	

Process

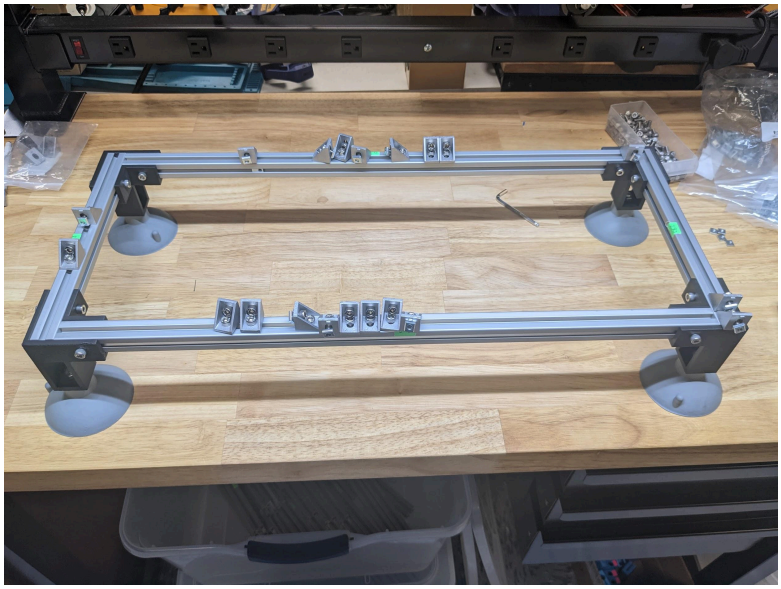
Base Frame

- Create 20 corner brackets with screws and t-nuts
    - Use 1 corner bracket, 2 M5 8mm screws, 2 M5 t-nut per corner bracket
    - Follow this video for guidance: https://drive.google.com/file/d/1L8QmOtq9gIF1c5JuHrio1G74nZc9EJNH/view?usp=sharing
    - Make sure the flat side of the t-nut is facing the corner bracket as shown:
    
    - Do not screw the t-nut on too much, 3-4 revolutions is all it takes, leave room to slide it onto the 8020
- Follow the following video for the remaining steps: https://drive.google.com/file/d/1L9suzpK_Nu51HjAXQzA2KCVYHQ-ojs0a/view?usp=sharing
- Lay out the bottom 8020 pieces
    - 2x 250mm
    - 2x 560mm
- Slip in the right number of corner brackets on each bottom square piece
    - 2 on short
    - 8 on long
- Slip a ball t-nut on the inside of each long piece
    - Use 2 M4 Ball T-nuts (one each side)
- Put the holders onto the bottom square pieces
    - Use 4 M5 10mm screws, 4 M5 T-Nuts per foot holder

    - Total 16 M5 10mm screws, 16 M5 T-Nuts
    - Put a screw through the holes and each side of the foot holder and screw on a t-nut to each screw
    - Slide the 8020 into the holder
- NOTE: the way they're put into the foot holders matters
    - The shorter 8020 piece should extend all the way to the edges of the feet holders. The longer 8020 should be against the shorter 8020, as the below image.

- Put the suction cup feet on the feet holders

It should look like this when you’re done:



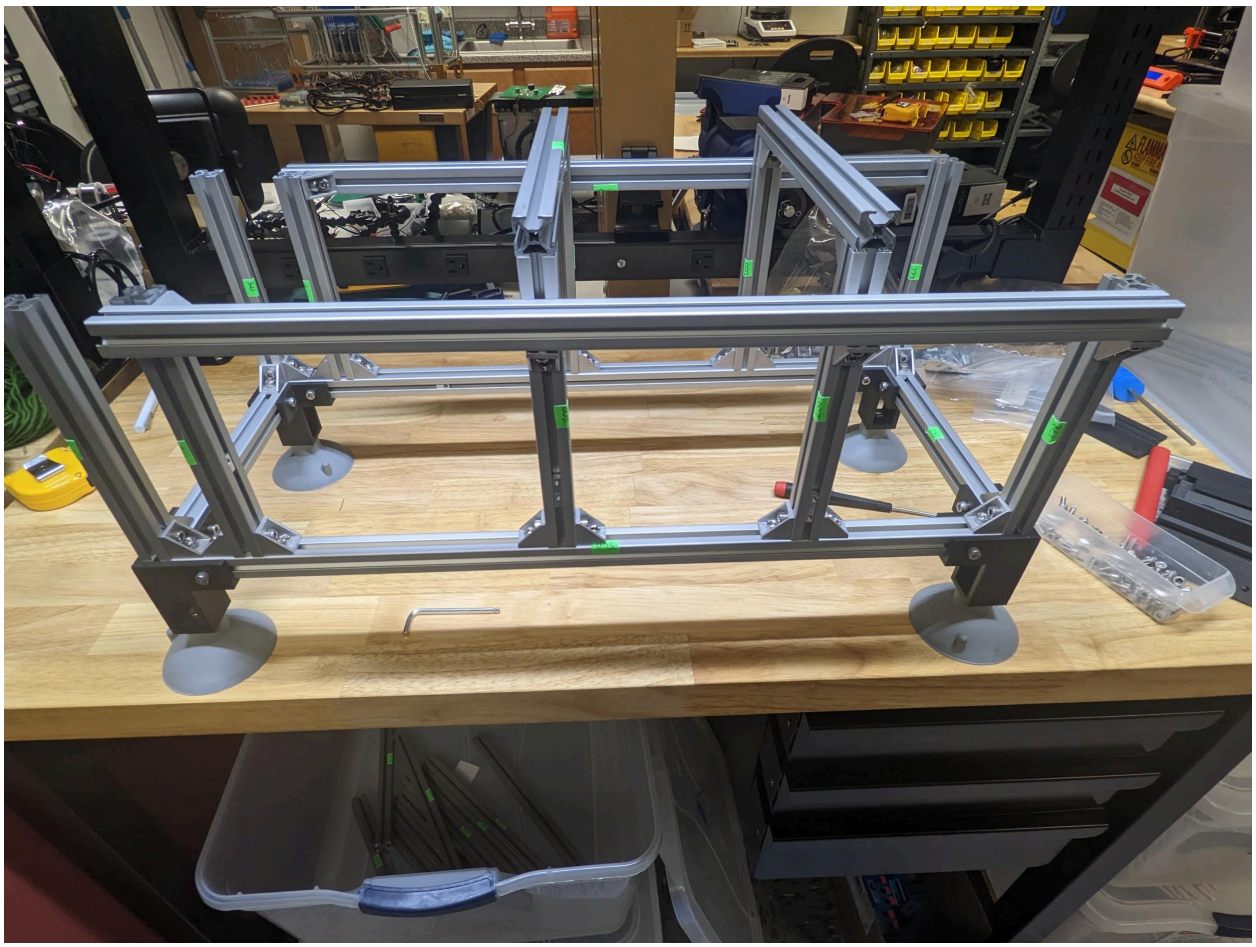
Warp and Heddle Frame

- Video for this section is here: https://drive.google.com/file/d/1LALhTHe8uoe-dAp9glmacT7A_3YCAzZd/view?usp=sharing
- Put height beams on
    - 178mm 8020 height beams
        - Put 4 on one end
        - Put 2 on the other end
    - 200mm 8020 height beams
        - Put two on each side in between the 178mm height beams
        - Screw the corner brackets onto the height beams
        - Measure the distance before screwing down onto the frame
            - Measuring from the outside edges ensure 160mm from back 178mm height beam:

            - Measuring from the outside edges ensure 185mm between the 200mm height beams:

- Make 16 corner assemblies
- Slip 2 m4 ball tnut onto each 200mm beam on the outside
- Slip one corner on each 200mm, slip one corner on the back 2 178mm height beams
    - The back is the side with 2 178mm beams, not 4 178mm beam
- Put 250mm cross pieces on the 200mm height beams
- Slide the 540mm length beam on the three corners from before, adding another corner bracket assembly on the second front 178mm beam
    - Slide through corner on 178mm beam, then both 200mm beams, then last 178mm beam
    - Screw down 178 corners to hold height, then screw down 200s for support
    - NOTE: Should leave one length beam pulled back so you can get the heddle frames in place

It should look like this when you're done:

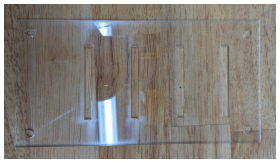
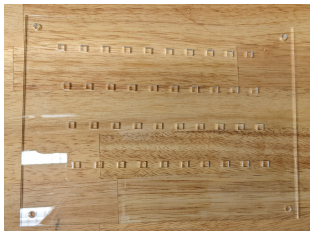


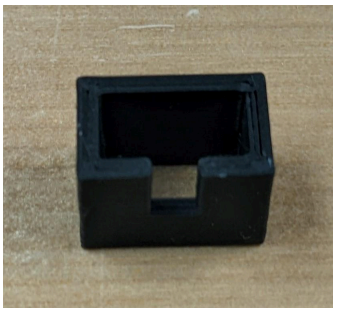
Tensioning Frame

- Video for this section is here: https://drive.google.com/file/d/1KUPVo__eCaQx1YOnCrmo6Hn7O2T1GdQM/view?usp=sharing
- Make 10 corner assemblies
- Build the tensioning cage
    - Make an L from the 260mm beams, make two of these
    - Put two m5 tnuts in each of the 260 top beams
    - Put the 330mm cross beam on
    - Put the 220mm beams on
    - Put the middle support 300mm beams on
        - Measuring from the outside of the top to the outside of the 300mm beam should be 120mm
- Put cage onto frame
    - Slide corners onto 330 beam
    - Slide cage on
    - Slide on and screw down the loose brackets on the 178mm beams to the 300mm beams

Heddles and Motors Assembly of Loom

Materials

M3 low profile screw	44	
M3 nut	44	
Motor	40	
Frames Mount	2	
Heddles	40	
Heddle Guide	1	
Motor Mount Row 1	1	

Motor Mount Row 2	1	
Motor Mount Row 3	1	
Motor Mount Row 4	1	
Motor Mount Brackets	8	
M4 8mm Screw	8	
Heddle to motor cap	40	
M5 10mm Screw	4	

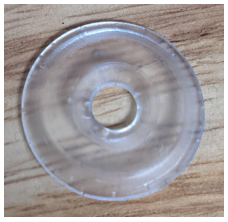
Process

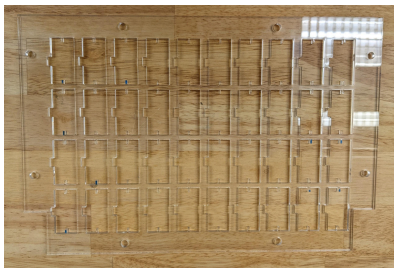
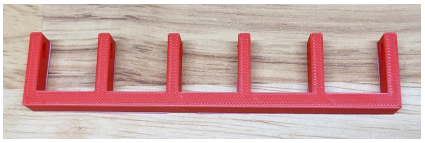
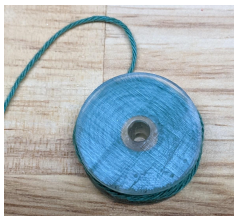
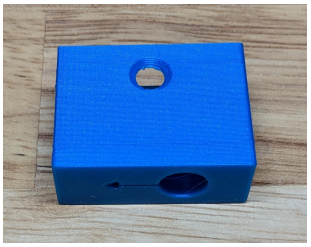
- Video for this section is here: https://drive.google.com/file/d/1hSk5e-FOVZ-IyOv6BzxsM-ym7mfZYfA6/view?usp=sharing
- Make a motor assembly
    - Put heddle onto motor
    - Slide on cap
    - Do 40 times
- Put 10 motors on each frame

    - Orient the mount the correct way: Number should be on the left, upright, and reading properly (not backwards)
    - Put on motor one
    - Screw in only the two screws to left
    - Put another motor on
    - Then screw in screws between last motor and new motor
    - NOTE: Ensure the bracket is flush with the acrylic and is seated in the notches of the motors fully
    - Then put on another motor
    - Repeat to end
    - Put in last two screws on end
- Put one frame holder onto the 8020
    - The large space should go towards the back beam
    - The bottom of the frame mount should be at the top of the corner brackets
- Put frames into frame holder
    - Note the front of the motors face the back of the loom
- Put the second frame holder on
    - Align the m4 tnuts first then slide the frames in then screw down
- Put on the heddle guide
    - Note the orientation, see video for correct orientation

Tension System

Materials

Warp Line Guider ¼” Shafts	4	
¼” Shaft Colars	8	
Tension Assembly 5mm Rod	4	
5mm Collars	16	
Tension Disk Spring	40	
Tension Disk	80	
Warp Line Guider Mounts	2	
Tension Rod Mount	2	

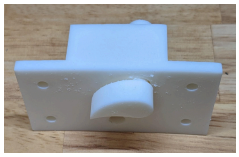
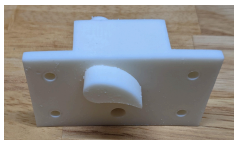
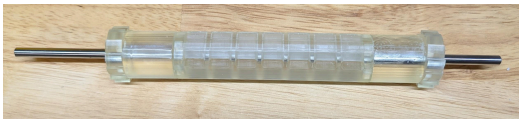
Bobbin holder bottom	1	
Bobbin holder top	1	
Tension Rod Spacer	8	
Bobbin	40	
Bobbin Case	40	
M4 20mm Flat head	40	
M4 nut	40	
M5 20mm Socket Screw	4	
M5 Nut	4	
M5 10 Socket Screw	12	
Creel Spacer	4	
M5 T-Nut	8	

Process

- Video for this section is here: https://drive.google.com/file/d/1daSU7YR-RIImE0Dje5L2WyvquTXLPC7D/view?usp=sharing
- Put bobbin in case
    - Align yarn in the direction of the arrow
    - Do not over tighten the screw
    - Pull the yarn through the slot so it's in the arrow
    - Repeat with all 40 bobbins
- Assemble Creel
    - Put creel bottom on loom
    - Put cases in creel bottom
    - Put creel top on
        - Use spacers to align
- Put Warp line Guiders on
    - Put acrylic mount on
    - 128.5mm away from front bar, measured on outside of the 8020 to the front side of the acrylic mount
    - Put shafts through holes and secure with shaft collars
- Put Tension guiders on
    - Put acrylic mounts on
    - Assemble the tension rod spacers x8
        - Using 5mm rod and the tension spacers
        - One spring, two disks per space
        - Assemble one space at a time, sliding the rod through each space as you get the pieces in place
        - Note the video shows only pne space being filled, you should fill all spaces of all 8 spacers before attaching them to the loom
    - Mount the spacers
    - Secure with shaft collars

Warp Beam and Beater Assembly

Materials

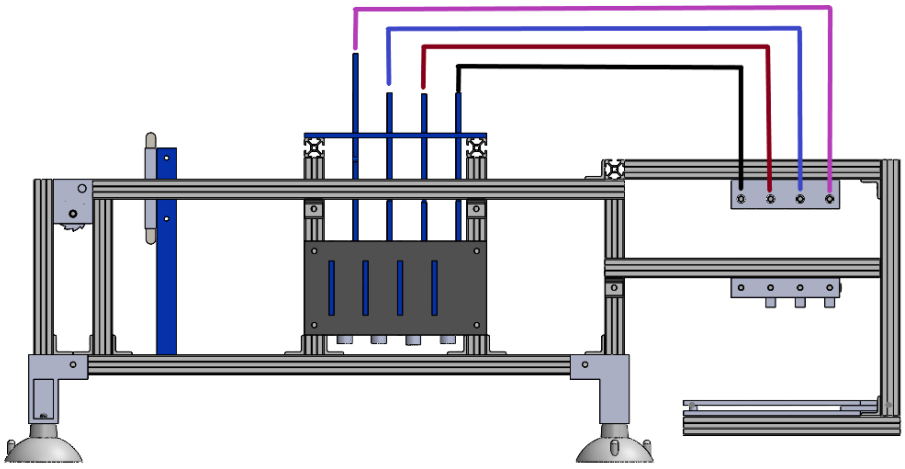
M4 16mm Screw	6	
M4 nut	4	
M4 8mm screw	8	
M4 Ball T-Nut	8	
Pawl Holder	1	
Pawl Holder Flipped	1	
Warp beam assembly	1	
Beater Arms	4	
Reed Bracket	2	

Process

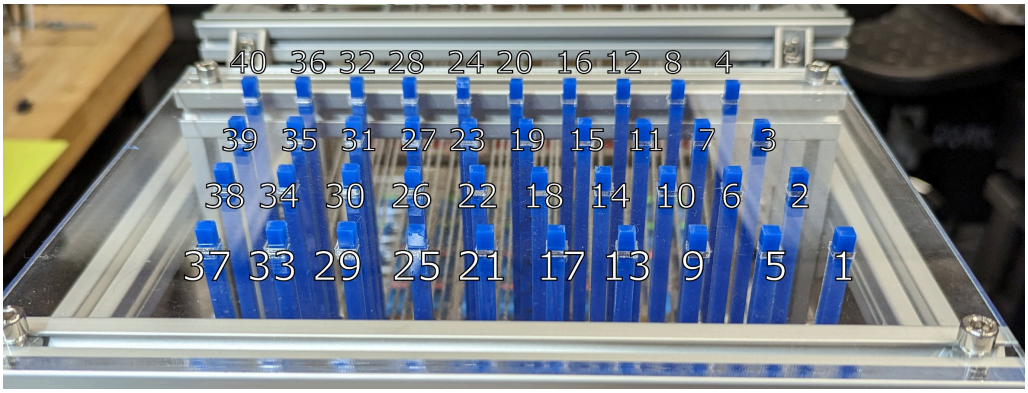
- Put the warp beam on: https://drive.google.com/file/d/1uCJ0xp6FN9pGCa_vqAFrAki4osB_xB8t/view?usp=sharing
    - Put the warp beam holders onto the warp beam
    - Ensure they are lined up such that the warp beam can spin freely away from the loom, but cannot spin towards the loom
    - Slide the warp beam into place
    - Slide 2 M4 Ball T-Nuts onto each 178mm height beam

    - Screw in the warp beam using 8x M4 8mm screws
- Put the beater on: https://drive.google.com/file/d/1I_eCPG7rLr3uNIhKhSEmKmCrOnfaM35S/view?usp=sharing
    - Put the brackets onto the arms
    - Ensure you make one, then a mirrored version of that
    - Put the brackets onto the reed
    - Screw in the beater arms to the M4 ball t-nuts in the frame already
        - Note: If you forgot the M4 Ball T-Nuts, there is a way to maneuver them into the 8020 without redoing the entire frame
    - Align the beater roughly halfway between the 200mm height beam and the inner 178mm height beam
    - Tighten down the screws so the arm doesn't slide in the frame, but still rotates freely

Warping Routine

- To thread the loom, you'll take each thread, pass it through the appropriate tensioning disk, over the warp thread guide, through the appropriate heddle, and finally through the warp beam. This process for a single thread is shown here: https://drive.google.com/file/d/1MAPVWkPgJPcySMOp1dWmJmqZJYY4WSVB/view?usp=sharing
- Thread each yarn through the tensioning system
    - Wrap it fully around the rod. This means passing through the tension spacer twice. A close up video of this can be found here: https://drive.google.com/file/d/12XpKbnm54b4xVL5xSugnmOsazEdZCMOF/view?usp=sharing
    - Pass each thread over its respective guiding rod (the rod directly above the tensioning rod)
    - A video of the full process can be seen here: https://drive.google.com/file/d/12h5iHmaqU7WeOAnt2RZneYNrUXEn2dA0/view?usp=sharing
- Pass each thread through its respective heddle
    - Yarns on the guiding rod closest to the heddles go through the heddles closest to the guiding rods
    - The second closest guiding rod is paired with the second closest frame of heddles and so on
    - 
    - A video of this process can be found here: https://drive.google.com/file/d/12uckF7H2XsbnnEFzWiGwCWAqz7xol1eJ/view?usp=sharing
        - In the video, I temporarily tie the threads so they do not accidentally slip back through the heddles

- Thread each thread through the correct place in the reed
    - Make sure to center your cloth in the reed, this does not need to be exact, but should be close to the center.
    - I recommend working from the middle out putting threads 20 and 21 in the middle two spots of the reed (the video does not do this as it has one person working alone)



    - A video of this process can be found here: https://drive.google.com/file/d/12uPykp9NHIbhpIIv42tAlZCfrKo7fsE9/view?usp=sharing
- Pass the threads through the warp beam and tie them down
    - I recommend tying them in bunches of 10. I started with the middle 10 threads (16-25) then worked my way out from there (6-15 on the right and 26-35 on the left). Then I tied down the last five on each side (1-5 on the right, 36-40 on the left).
    - Once threaded down one hole of the warp beam and up through the other, tie the bunches in a knot (I used a simple overhand knot).
    - A video of this process can be found here: https://drive.google.com/file/d/12pXPe95EB38_Lqxshce2CBF2vUyttP3T/view?usp=sharing
- Once all threads are tied down, pull tension onto the loom by ensuring the warp beam pawls are hooked on the gear of the warp beam then pull each thread back on the creel side of the tension rod until full tension is reached
    - This process can be seen here: https://drive.google.com/file/d/12mhnYptuZl8djz3U4jzoWgHRvzTzo7op/view?usp=sharing
- Note that you do not need to complete all threads on each step before starting the next step.
    - For example, you can thread warp yarn 1 through the tension system then begin one warp yarn 2 threading through the tension system while another person threads warp yarn 1 through the heddles, etc.
    - Also note the video was filmed with threading a row of yarns through the tension system then through the heddles and then repeating for the next row of yarns. This order does not need to be matched.

Electronics

- Orient your electronics board such that the Arduino is closer to the tensioning cage, as shown in PICTURE