V5 - Experiment Procedure “Robotic Digits”

GENERAL INFORMATION

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Version number	1
Last edited on	27-Oct-2024

SHORT EXPERIMENT DESCRIPTION

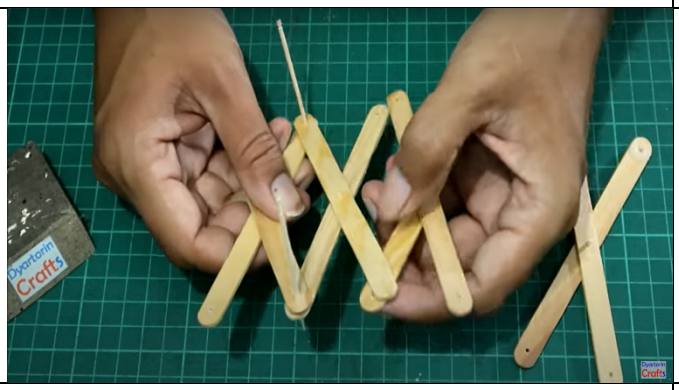
Students will make robotic/mechanical arms out of popsicle sticks or cardboard and learn the importance of robotics in space. With different tools such as drills and hot glue guns, the students act out the manufacturing progress and discover the Mechanics and Physics behind important machinery.

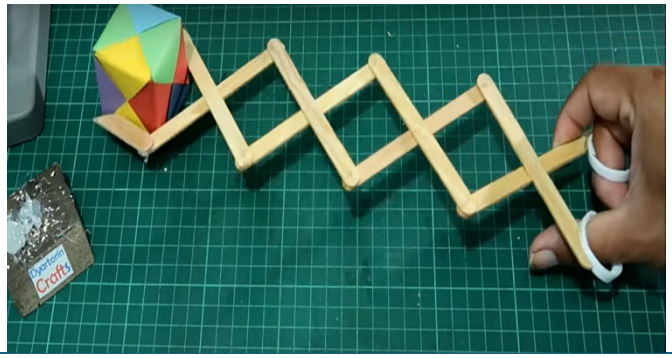
HARDWARE CHECKLIST

	Popsicle sticks (8 or 10 pieces)
	Toothpicks
	Drill
	Hot glue gun
	Water bottle cap ring
	Utility knife
	Scissors
	Cardboard sheets
	Straws for drinking
	String
	Velcro Strips

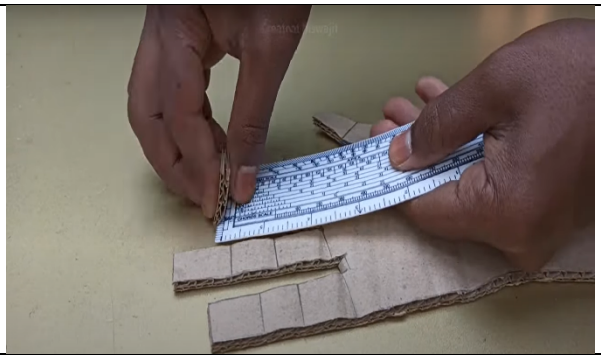
PROCEDURE

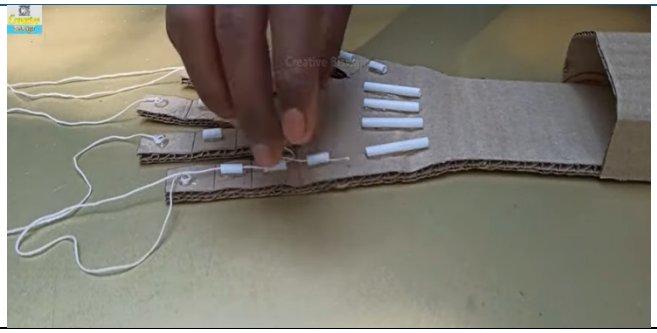
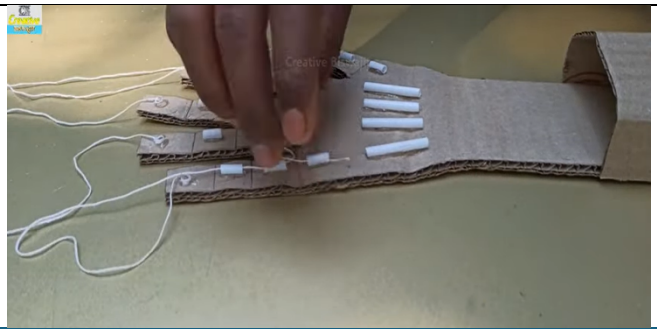
ROBOTIC ARM

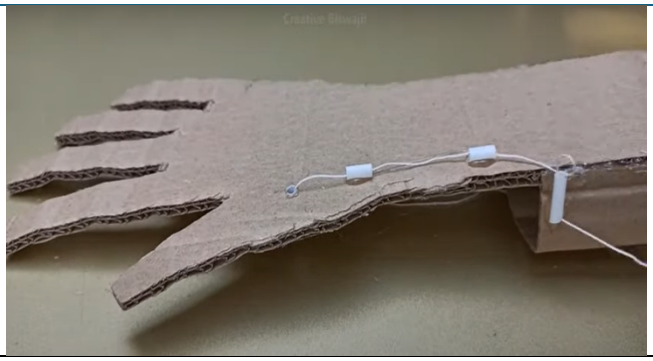
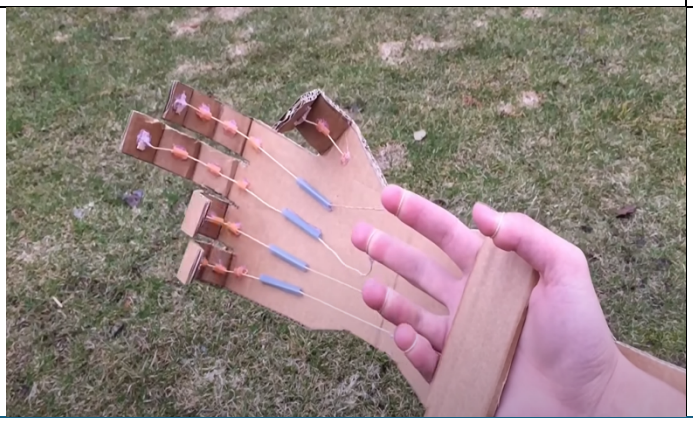
Step	Action	NOTES	Duration	Check
1	Drill 3 holes in each popsicle stick (one in the middle and two on each at the end)	Ensure the holes are large enough to fit toothpicks.	10 min.	
2	Insert a toothpick into the middle hole to join two popsicle sticks.		5 min.	
3	Trim excess of toothpicks with scissors		3 min.	
4	Insert toothpicks into the end holes and attach additional popsicle sticks, creating a longer stick chain.		10 min.	
5	Cut one popsicle stick in half to make pincer pieces. Attach them to one end of the stick chain using toothpicks and secure with hot glue.		5min.	
6	Carve a curve on the opposite end of the stick chain (opposite the pincers). Gather two water bottle cap rings, onto the curved section for better grip.		5 min.	
7	Glue plastic water bottle rings to the curved section with hot glue gun		2 min.	

8	Try grabbing things		15 min.	

MECHANIC ARM

Step	Action	NOTES	Duration	Check
1	Place your hand on a cardboard sheet and draw the outline of the hand. Trace outlines with ruler, making them straight and parallel	not making “fingers” too thin	5 min.	
2	Cut out cardboard hand		2 min.	
3	Make three lines perpendicular to the fingers, designing the phalanges (finger segments) and folding them using ruler		5 min.	
4	Cut drinking straws into short pieces and glue them along each folded line. Use 3 pieces per finger and 2 for the thumb.	3 pieces per finger and only two for the thumb 	10 min.	

5	Cut four longer strips and glue onto hand palm in line with the “finger straw pieces”		3 min.	
6	Drill a hole under the thumb’s straw piece near the palm and thread a straw through the hole.		1 min.	
7	Use leftover cardboard strips to fasten a loop perpendicular to direction of the arm and glue it onto the hand	This is the part to hold onto with hand, like a grip	4 min.	
8	Glue straw piece onto thumb side of this grip, pointing downwards		1 min.	
9	Glue two or three more straw pieces on underside of cardboard hand to guide a string from the hole underneath the thumb to vertical straw piece on grip		3 min.	
10	Cut string into strips		2 min.	
11	Knot one end of strings and glue to fingertips	Attach one end to the fingertips with knots and glue.	3 min.	
12	Guide string through straw pieces on the four fingers and thumb		1 min.	

13	Repeat for thumb, guiding string onto the bottom of the hand and up through the vertical straw		1 min.	
14	Place your hand into the grip and knot loops around your fingers for control.	Let friend or neighbour help Ensure the loops are secure but not too tight,, so that fingers can still get out of loops	5 min.	
15	Glue velcro strip onto the back of cardboard arm, to better secure the robotic arm to human arm	Attach a Velcro strip to stabilize the arm on your forearm.	3 min.	
16	Test the robotic hand by grabbing objects.		15 min.	

NOTE:

- Encourage creativity and experimentation with different designs and materials.
- Discuss real-world applications of robotic arms in space exploration and other industries.