FUN PALACE 2018
Carboard Claw

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Grab some attention with this robot claw that works using

the science of hydraulics, made with syringes, paper fasteners and zip ties.

Activity Details

Type ticketed (10 per session)

 # Deliveries 4

Duration 30 min

Learning Outcomes

Participants construct a hydraulic claw from pre-cut cardboard parts, syringes and fixings. No tools or glue are required, other than side cutters. The design involves using hydraulics, linkages and levers to make a useful tool.

Session Plan

5 min: Show the participants a completed claw, and demonstrate how to use it. Discuss how hydraulics make the device work, and elicit other examples from group members. Emphasise that hydraulic systems rely on containing a non-compressable liquid (and so avoiding bubbles is important), and why industrial machines use oil rather than water (because the much high vapour pressure of water, it tends to form bubbles by cavitation when in use and this reduces the transfer of force)

15 min: lead the participants in assembling the claw (the sequence is important - follow the guide in the file below)

5 min: troubleshoot as necessary (avoid bubbles and leaks, the mechanism might be stiff to start, and if this does not improve, try loosening the paper joiners to allow free movement)

Facilitator Notes

What other examples of a hydraulic grabbing device have you seen? (excavators, robots, tree harvesters etc) Why use hydraulics? Explain how one-way valves make a car jack possible, and a how the force applied by your arm is transmitted throughout the liquid. What about nature? (Spiders legs and squid)

Materials Req

For each participant

- 1 pre-cut cardboard claw kit
- 2 x 3mL syringes
- 90mm x 4mmID plastic tubing
- 1 x 100mm zip tie
- 1 x 150mm zip tie
- 4 x split pin-type paper fasteners (20 - 25mm long)

Equipment Req

- Side cutters (to trim zip ties)
- 2 or 3 jars of water (to fill syringes)

Assembly Instructions

1. Fill one syringe with water, invert and remove any bubbles by depressing the plunger.
2. Attach plastic tubing firmly, and fill completely with water from the syringe.
3. Remove syringe, and re-fill with water making sure no bubbles are present as before.
4. Attach water-filled syringe to the tubing.
5. Attach the other syringe to the other end of the tubing (make sure it is completely depressed before attaching – avoid any bubbles).
6. Locate handle piece, and fold neatly along the score to make an open, 3-sided rectangular tube.
7. Insert flanges of one syringe into the slots in the handle piece, and fold the handle around so that the opposite slot engages with the other flange. Secure in place with the 100mm zip-tie.
8. Locate one side of the claw base, and fit the unattached syringe into the slot.
9. Place the other side of the claw base over the syringe, and fix in place with the 150mm zip-tie.
10. Slide one of the claw arms between an open end of the handle, align holes, and fix in place with a paper fastener. Do not squeeze the fastener too tight – it needs to be able to slide freely along the slot.
11. Do the same on the other side with the other claw arm.
12. Fit one half of the central cardboard piston end under the syringe plunger, align holes and hold in place by inserting an un-opened paper fastener through each hole.
13. Mount the top half of the piston over the fasteners, and onto the syringe. Fix in place with the paper fasteners, but do not squeeze too tightly so movement can still occur.
14. Push and pull the syringe at the end of the handle a few times to free up the mechanism. If movement is still too stiff, loosen the paper fasteners.
15. If vigorous use or misadventure causes a leak in the system, you will need to cut the bottom zip-tie and open the handle so that the tubing can be reattached firmly. Refilling the syringe (and removing bubbles) may also be necessary.

Files

Assembly instructions:

cardboard_claw_assembly_instructions.docx

Cutfiles:

cardboard_claw.zip

Authors

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Reflections Learnings

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