Project Guide

Creepy Mechanical Animals

Learning goals and skills:

- Understand rotational and reciprocal movement, leverage
- Learn to use basic shop tools
- Learn to sew
- See a design project through from sketch to reality

Facilities and tools at a glance:

- Laser cutter
- Soldering iron
- Hacksaw
- Darning needles

Materials at a glance:

- Gear motors
- Laserable wood & scrap wood
- Felt
- Pin and post fasteners
- Paint
- Zipties

Preparation

Laser cut some prototyping boards (file is 24”x20”)
https://www.lindylabs.org/wp-content/uploads/2018/02/6th-grade-stuffed-animal-main-board.pdf

And some girders (also 24”x20”)
https://www.lindylabs.org/wp-content/uploads/2018/02/6th-grade-stuffed-animal-girders.pdf

The boards are designed for these gear motors
https://www.pololu.com/product/1120

These wheels fit on the motor shafts
https://www.pololu.com/product/601

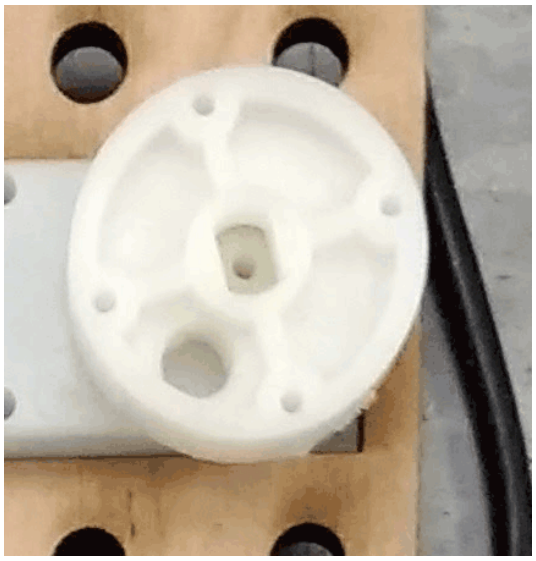
You'll also need post and pin fasteners

We used these from microplastics.com, phone 870-453-2261
https://secure.microplastics.com/catalogpictorial.aspx
(click "panel fasteners and hole plugs" then "post and pin")

We used:
27PP001 PUSH PIN WHITE
27POSTNT0500 1/2" POST WHITE
27POSTNT1000 1" POST WHITE

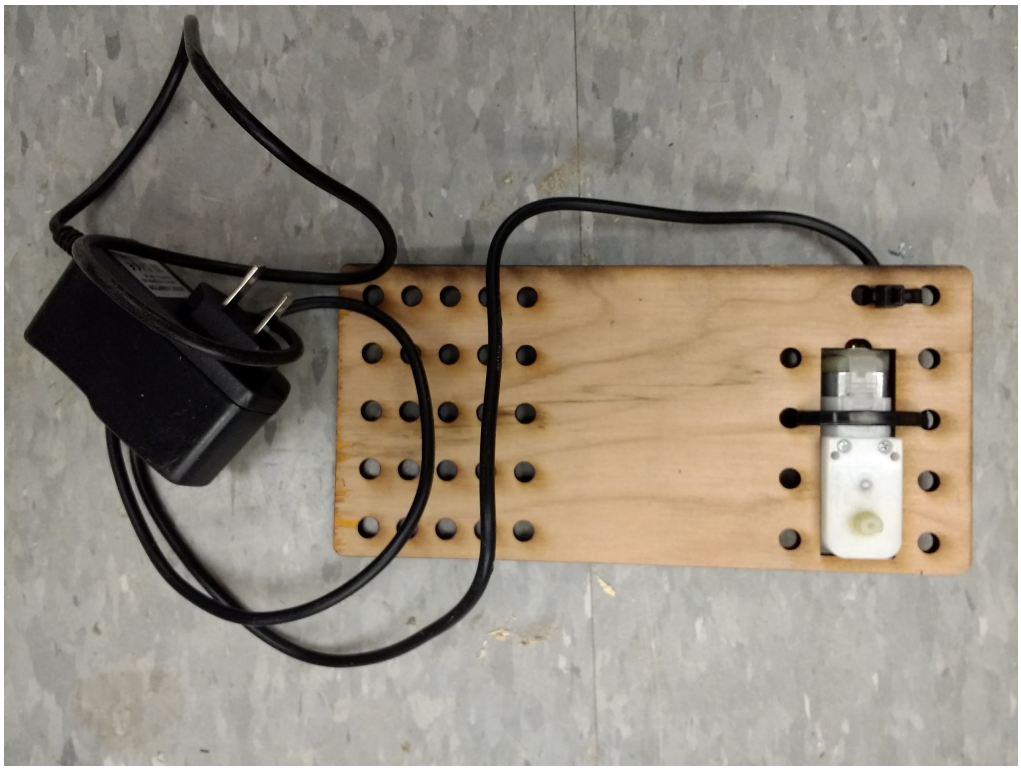
Minimum order per item is 1000 pieces, but they're cheap. 1000 pieces fit in a one liter bag, approximately.

You'll need to drill holes in the motor wheels to fit the post and pin fasteners like so:



I also filed away some of the plastic on the underside of the wheel so there'd be space for the pin's head.

Solder a power supply to a gear motor and assemble a prototyping board with zipties like this. Note the ziptie at top right for strain-relief on the cable.



Now play with girders and pins to see what movements you can create…see the video at lindylabs.org if you need ideas.

Method

I pitched this to the 6th graders as a way to own the cafeteria and creep everybody out.

We started by demonstrating some different mechanical movements on the prototyping boards and a sample animal we'd made. We then brainstormed as a group, vetting ideas for doability as students came up with them. Once they'd decided on their animals and their movements, we asked students to draw labelled diagrams that explained how they worked. The students played with the prototyping boards using the long posts without pins of the pin and post fasteners and girders to work out the

movements they wanted. Once they had that figured out they replaced the long posts with the short ones and pushed the pins into them with pliers. These are single-use- once you squeeze them together with pliers or a hammer they don't come apart.

Once the mechanisms are working, students may want to add a base. Zip-tying a small four-hole 90 degree angle bracket to the board unused holes is a nice way to attach it to a scrap of plywood. Then it's time to sew. We used felt, big darning needles, and cheap embroidery floss like this:

https://www.amazon.com/DMC-Prism-6-Strand-Assorted-Colors/dp/B00115PN6E

For extra creepiness (and longer-lasting animals) use an Arduino and a power strip relay to have the motors run intermittently.

https://www.amazon.com/Iot-Relay-Enclosed-High-power-Raspberry/dp/B00WV7GMA2

Use a simple Arduino sketch like this one to run one second on, three seconds off.

```
int relayPin = 13;

void setup() {
      pinMode(relayPin, OUTPUT);
}

void loop() {
      digitalWrite(relayPin, HIGH);
      delay(1000);
      digitalWrite(relayPin, LOW);
```

```
      delay(3000);
}
```

For photos, see lindylabs.org. For questions and comments, jmerrow@riverdale.edu