

Art and maker class: Build a simple robotic hand using cardboard



Overview

About this class

Learn how to make a simple cardboard robotic hand extension to help you pick up things that are out of reach. This fun STEAM (science, technology, engineering, art and maths) project will help you understand the basics of robotics and human anatomy. You don't need any electronics to complete the project, just the everyday materials listed below.

Materials and tools

You will need these materials and tools to complete the project:

- Corrugated cardboard, for example an old packing box
- A retractable craft knife or a pair of scissors
- A hot glue gun and glue that can be purchased from a craft store if you don't already one
- Paper straws
- String or twine, for example cooking string which is available in supermarkets
- A marker or pen
- A cutting mat or a safe surface to work on.

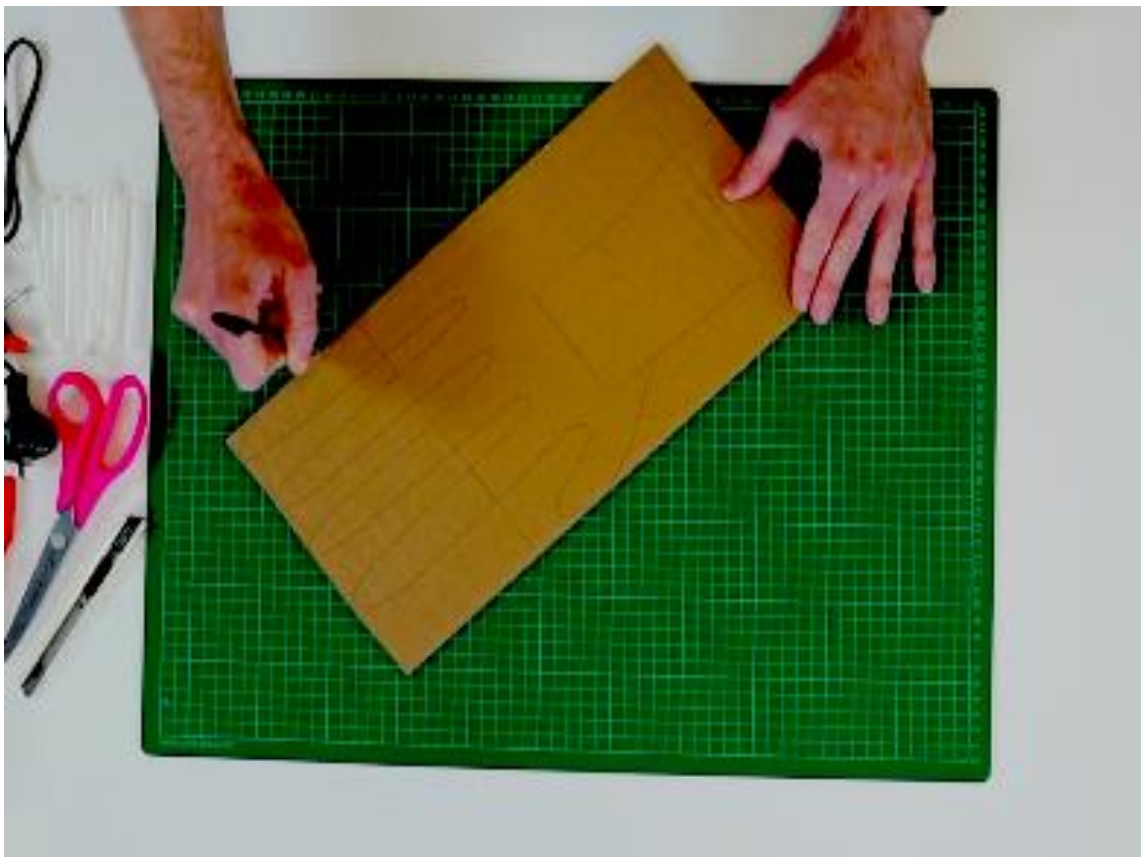
Step 1: Creating a template of your hand

Take a piece of cardboard that is roughly the half the size of an A3 size of paper or larger. The robot hand needs to be four or five times bigger than your own hand.

Start by positioning your hand with palm facing up at the shorter end of the cardboard. Make sure that the parallel lines of the cardboard run sideways across your palm.



Using a marker or pen, draw the design for your robot hand. Trace a rough rectangle around your actual hand, which will become the wrist of the robot hand.



You can draw the robot fingers and thumb using a ruler or freehand. It's important to make the hand nice and open with the fingers spread out, to give the fingers room to move.

Step 2: Cutting out your cardboard hand

Before you start, place a cutting mat or another material like a thick piece of cardboard down to protect your table. Using a craft knife or scissors, cut out your robot hand design, always remembering to cut away from you.

If you're uncomfortable using the craft knife freehand, you can either use a ruler, or a pair of scissors. There should be enough room between each finger so that they can move freely.



Step 3: Bending the fingers

If you look at and feel your own hands, you'll notice that each finger has joints which allow the finger to bend. Our fingers have three bends and our thumb has two bends. You're going to crease the cardboard to mimic where your fingers bend. Create each fold, so that it is evenly spaced down the finger. To make it easier you can place a ruler where you want to bend the finger and then carefully fold the finger back over the ruler.



Repeat this for each of the fingers and thumb.

Step 4: Creating a support to hold the robot hand

When using a hot glue gun, clear your workspace and make sure you are in a well-ventilated area. Place the glue gun cord away from your workspace so that it doesn't get in the way when you are gluing.

The support used to hold the robot hand is made from a loop of cardboard. Your fingers and hand should fit through the loop, with your thumb on the outside.

Cut a strip of cardboard approximately 20cm by 3cm, or slightly longer for bigger hands. Bend the cardboard around into a loop. Using the hot glue gun, carefully put glue on one end of the loop and then overlap the other end to glue the two ends together. Press the two sides of the cardboard where the glue is firmly then wait a minute or two for the glue to dry.



This loop will then be attached to the wrist of your robot hand.

Using the hot glue gun, carefully put glue on the wrist or forearm of the cardboard hand where you would like to connect the loop. Then attach the loop. Press the inside of the loop down onto the cardboard hand firmly then wait a minute or two for the glue to dry.

Step 5: Creating ligaments from paper straws

A ligament is a short band of connective tissue that attaches one bone to another bone and stabilises a joint. To connect the joints of your robotic fingers, you're going to use paper straws. The straw pieces help guide the string which acts as the muscle, to allow the finger to bend.



Using a pair of scissors, or carefully with a craft knife, cut the straw into the following pieces:

- 10 pieces that are roughly 1cm long. These shorter lengths will be glued to each section of the fingers
- 4 pieces that are roughly 3cm long. These will be connected to the palm of the robotic hand.

Before gluing down your pieces of straw, make sure each piece is short enough to not get in the way when the fingers bend. You may need to trim the straw so there is enough space.



Using the hot glue gun, stick the shorter pieces of straw vertically in the middle of the finger, between each bend. Glue the longer pieces to the palm like a fan.

Step 6: Attaching the string 'muscles' to the hand

The next step is to create the muscle of your robotic hand. A muscle is a connective tissue or band that allows different parts of the body to contract to produce movement. The string will be acting as the muscle for your robot hand.

First, measure a piece of string to go from the top of the finger to the forearm of the cardboard hand. Provide a little bit of extra length as you can always trim the string later if you need to.



Use one piece of string per finger, thread the string through the straw pieces. Make sure that the top of the string reaches the tip of the finger and the bottom of the string reaches the wrist.

Using the hot glue gun, carefully glue the top end of the string to the tip of the finger. When you pull the string, the finger should bend.



Repeat this step for all the fingers and the thumb.

Step 7: Creating finger loops to control your cardboard hand

Instead of tugging each individual string, you're going to create finger loops, so that the robotic hand mimics what your actual hand does.

Create a loop on the loose end of the string big enough for your finger to fit in and then tie a knot.



The knots may have to be adjusted to fit your hand and allow better movement of the fingers.

Repeat this step for each finger and the thumb.

Finished

You have now completed your robotic hand.

Place your hand through the wrist support with your thumb on the outside. Then insert each your fingers into the corresponding finger string loop. When you contract your fingers and hand, the robotic hand should do the same thing.



Now see what you can pick up using your new robotic hand.

Don't forget to check out our other City of Sydney Art and maker classes online at whatson.cityofsydney.nsw.gov.au/programs/city-of-sydney-art-and-maker-classes-online

