

# STEM Connections

## Battery Manufacturing

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## What is the role of robots in battery manufacturing?

This demo shows a mini Gigafactory! The robots working here are just some examples of the types of jobs robots would in a real Gigafactory, like testing and sorting the hundreds and thousands of individual cells, building those cells into modules and connecting the modules together in the final battery pack that goes into the electric vehicle.

Lithium-ion cell



Module



Pack



The batteries shown in this demo are small and light, but the ones in real life can weigh between 1000 and 1500 kg! Imagine the size of the robots required to lift, turn and move these! Now consider the thousands of electric vehicles, not just electric cars, that we need to make a year to achieve cleaner transport, and that's millions of batteries a year. Robots and automation will help us do that by keeping workers safe and doing repetitive jobs. Robots and automation are also really great at tackling jobs that need very fine accuracy, like welding batteries together to get the energy we need to power a car. There are thousands of welds in a battery pack, and these have to be tightly controlled for the battery to perform correctly, so repeatability is key, something robots are much better at.

## How to make your own robot arm

**Suitable year groups:** Year 4, Year 5, Year 6, Year 7, Year 8, and Year 9

### **Learning Objective:**

- To understand how each finger or joint plays an important role in the motion of hand. (KS2)
- To recognise mechanisms to allow forces to move objects. (KS2)
- To understand how accurate the instructions need to be for a robot to be able to pick items up. (KS3)
- To understand how forces are used to cause objects to stop or start moving or change their directions. (KS3)

### **Materials required:**

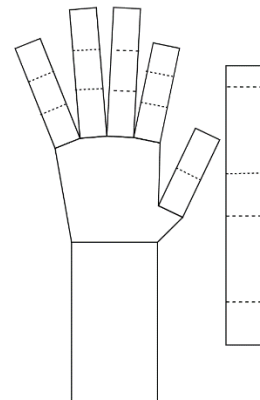
- Cardboard box
- Three straws
- Scissors
- PVA glue
- Strings
- Transparent tape

The robot arm template can be scaled down depending on hand size. The width of the wrist of the cardboard should be similar to your hand size.

**Estimated time:** 40 minutes

### **Step by step instructions:**

1. Download a template of the Robot Arm.



2. Draw around the template on the cardboard box and use scissors to cut it.



3. Except for the thumb, for each finger, three bends are made with same distance. (For the thumb, two bends are made)



4. Below the thumb, create a small hole using a pencil.



5. Cut the straw into 15 sections of length 1.5cm and 4 longer sections of length 4cm.

6. By using PVA glue, stick the smaller straws on the fingers and thumb between the bends and stick the 4 bigger pieces of straw onto the palm. Make sure they are all in a straight line. On the back of the hand, stick a small section of straw next to the hole created in step 5.



7. Use a string and pass those straw holes for each finger. Strings should be in a size of 40 cm.

8. Once the string has passed through all of the straws, make sure to use transparent tape to stick the string onto each tip of the finger. For the other side of the string, make a ring so that the movements of the finger can be controlled by pulling the rings. For the thumb, the string will need to go through the hole to the other side and through the straw there.

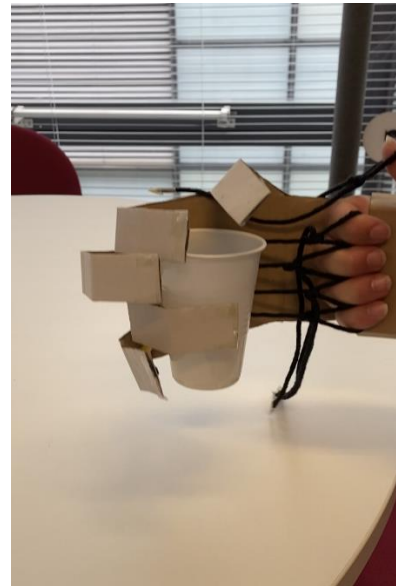


9. If the cardboard is too thin, add one more layer of cardboard to give additional strength (expect the fingers, just from the palm to the handle)

10. Use the other section of the template and another piece of cardboard to create a handle for the Robot Arm. You may need to adjust the size of the handle to fit your arm.



11. Use PVA glue to attach the handle to the Robot Arm.



12. Play with the Robot arm! Try to see what you can pick up!

## Ideas to explore this concept further

- Would the use of different types of string and cardboard make robot arm stronger?
- Program the robot challenge:

In pairs or groups, choose one person to be the robot and the rest of you will be the programmers. The robot must have their eyes closed for this activity. Draw a grid like the one shown below and choose a start and an end point. Place an object on the start position. The programmers need to give instructions to the robot to pick up the object and move it to the end position. The instructions should be simple to follow and precise.

Have a go at switching roles and discuss what you have learned from the activity.