



## Robotic Hand

Adapted from: SciencetoyMaker.org *How to Make a Working Model Robot Hand*

### Objectives

Students will:

- Learn basic information about robotics
- Build a robotic hand that closely resembles a human hand

### Suggested Grade Level

6th – 12th

### Subject Areas

Robotics, Technology, Engineering Design

### Timeline

60-90 minutes

### Standards (NGSS)

- **MS-ETS1-4** Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved
- **HS-ETS1-2** Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering

### 21<sup>st</sup> Century Essential Skills

- Creativity and imagination
- Information literacy
- Initiative
- Analysis
- Predict patterns

### Background

A robot is a machine that is capable of carrying out routine or complex actions that are programmed by engineers. Today, robots can be used for things like surgery, space exploration, manufacturing, and code analysis. Humans have been developing robotics and automata for hundreds of years.

Further advancements in technologies since the 2000s have led to more advanced automation and artificial intelligence. Automated machines are programmed to perform one action over and over and are used today in manufacturing, maritime exploration, space exploration, military, and commercialized agriculture.

The future of robotics is difficult to gauge because of the rate of innovation. However, it's predicted that robots will most likely play a greater role in the home and in the business world.

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Space exploration is another field where robotics are expected to improve human advancement. Since the Soviet Union's Mars 2 became Earth's first interplanetary robot when it landed on Mars in 1971, engineers have been developing newer and greater technologies. (Spaeth, 2019)

### **Vocabulary**

Robot, robotics, extension, joint, compression

### **Materials**

Drinking straws (five per student)  
Unused Styrofoam trays (one per student)  
String (five lengths approx. 12" long per student)  
Scissors  
Glue guns  
Duct tape  
Large wood craft sticks  
Permanent markers

### **Lesson**

1. Discuss some basics about robotics with the students, use background information and further resources if needed. Show some images of different robotic hands as visuals for the lesson.
2. Distribute materials.
3. Have the students put strips of duct tape on one side of the meat tray, covering the entire side.
4. Give the students some time to trace their own hand on the duct tape using a permanent marker (it will help if they have given some room between the fingers).
5. Cut out their hand, being careful to cut between the fingers carefully. Optional: instructor can use box cutter to assist.
6. Using the scissors, score the back of the meat tray (the side without the duct tape) where the joints are.
7. Cut the straws into short pieces that will fit inside the joints (approx. 1cm long). They will need two per finger and at least two within the palm in line with each finger and thumb. Make sure they do not put a straw at the top of the finger.
8. Using the glue guns, glue the straws to the hand. They will glue to the duct tape side. Each straw needs to be glued vertically and in line with the next one. Students need to make sure they can still close the hand after they glue each piece of straw.
9. Once the straws are in place, thread the string through the straws in line with the fingers. Glue the string to the top of each finger, making sure the string will not come off after the strings are threaded.
10. Glue the craft stick where the wrist would be, this will be the handle for the robotic hand.
11. Pull strings gently to make the fingers contract.

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### **Extensions**

- 1) Use this lesson as a lead-in for an anatomy lesson on the hand (joints, muscles, ligaments, etc.). If you cut five rubber bands and glue them to the other side of the hand (side without the duct tape), the students can learn about expansion and contraction of muscles.
- 2) Use this lesson as a lead-in for more complex robotics activities which use different materials.

### **Resources**

How to Make a Working Model Robot Hand. (n.d.). Retrieved from <http://sciencetomaker.org/robot-hand/how-to-make-a-robot-hand/>

Spaeth, D. (2019, October 29). From Single-Task Machines to Backflipping Robots: The Evolution of Robots. Retrieved from <https://www.ctemag.com/news/articles/evolution-of-robots>

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