

Robotic Arm

Lesson 1 of 2

Grade Level: 9-12

Subject(s): Space Science, Physical Science, Technology

Prep Time: < 10 minutes

Activity Duration: 50 minutes

Materials Category: General classroom

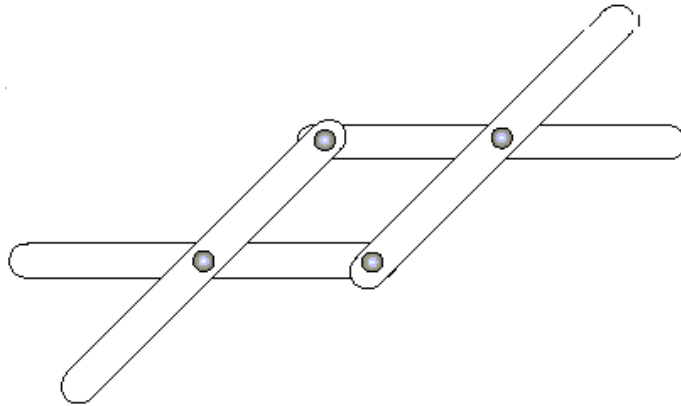
National Education Standards				
Science	Mathematics	Technology		Geography
		ISTE	ITEA	
1e, 3d, 6a, 8a		14c	1c, 3b, 6c, 9a, 9c, 9d, 11e	

Objective:

To develop a robotic arm and an end effector to interact with the environment.

Materials:

- Wooden craft sticks
- Drill
- Small brass paper fastener
- Assorted small materials



Related Links:

Let's Talk Robotics - Video Resource Guide - EV-1998-04-015-HQ

<http://spacelink.nasa.gov/Instructional.Materials/NASA.Educational.Products/Let's.Talk.Robotics/Let's.Talk.Robotics.pdf>

NASA Rover Ranch

<http://prime.jsc.nasa.gov/ROV/>



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Teacher Sheets

Pre-lesson Instructions

Optional: Order a copy of the NASA video "Let's Talk Robotics" from NASA CORE (<http://catalog.core.nasa.gov/core.nsf/bb02d51770e10ea58625672300732508/e5fbf6f8a84eb32a86256722007cc45e?OpenDocument>)

Video Synopsis

Length/Year	14 minutes/1998
Format	1/2" VHS
Item Number	011.0-04V
Price	\$10.00

Description:

This video program examines some of NASA's robotic research and how robots are used in space exploration. In this video, several of NASA's robotic applications are explored. Viewers will learn about the Pathfinder robot that landed on Mars in 1997 and released a microrover spacecraft (Sojourner) to explore the nearby Marscape. Viewers will also learn about the 15 meter-long Remote Manipulator System arm that Space Shuttle astronauts use to handle payloads in space and to assist in space construction and satellite repair operations. Research being done to test robotic arms for the International Space Station and a free-flying camera robot will also be seen.

Note: This lesson can be completed with or without the video. The video is a great introduction to the topic of robotics.

Guidelines

1. Read the 9-12 NASAexplores article, "Astronauts' Little Helpers." Discuss the use of robotics in movies and in everyday life.
2. Provide time for students to brainstorm and modify their robotic arms.
3. Each student or group of students will need a minimum of four craft sticks and four brass fasteners.

Extensions

- ❑ Complete Lesson 2 under 9-12 NASAexplores article, "Astronauts' Little Helpers."
- ❑ Explore K-12 Experiments in Robotic Software at the NASA Rover Ranch (<http://prime.jsc.nasa.gov/ROV/>).



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Student Sheet(s)

Materials

- Wooden craft sticks
- Drill
- Small brass paper fastener
- Assorted small materials

Background

The word robot comes from the Czech word robota that means forced or repetitive labor. Czech playwright Karel Capek coined the term for his 1920 play R.U.R. (Rossum's Universal Robots). In the play, the human-like robots take over the world.

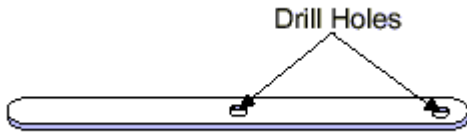
Today's robots usually look very different from humans. They are found in manufacturing, research, medical treatment, entertainment, and space. NASA uses robots to explore Earth and the other planets and to manipulate payloads on the Space Shuttle, and plans to use several robotic arms on the International Space Station.

The definition of what a robot is varies with the source referenced. Generally, robots are machines that operate by computer controls. On Earth, robots are often used for dangerous, dirty, or dull jobs. Examples include painting and welding robots in automotive assembly lines and robots used to dismantle old nuclear power plants. In NASA-sponsored experiments, walking robots were used to explore active volcanoes in Alaska and the Antarctic.

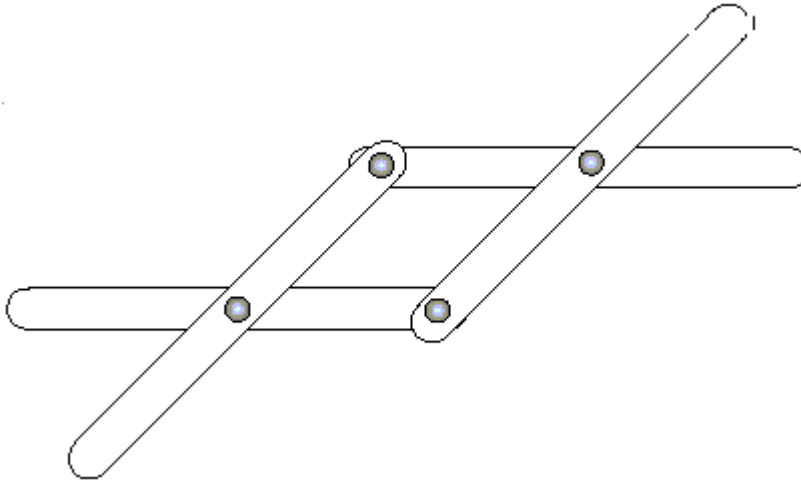
One of the important objectives in the development of robots is to enable robots to interact with their environment. Interaction is often accomplished with some sort of arm and gripping device or end effector.

Procedure

1. Define the following terms:
 - ❖ Articulated
 - ❖ End effector
 - ❖ Telerobotics
2. Drill holes through the craft sticks as shown in the diagram.



3. Each student will need four drilled sticks and four brass paper fasteners. Note: dampening the sticks before drilling can reduce cracking the wood.
4. Assemble robotic arms as shown in the illustration below.



5. Try to pick up a pencil or some other object with the arm.
6. Next, design some sort of end effector for the end of the arm that will enable you to pick up different objects.
7. Attach the effector to the ends of the arm with glue.
8. Write a paragraph evaluating your design by picking up different objects.
9. Would the arm and end effector have to be modified to pick up sediment and pebbles on Mars?

