deSTEMber

SCIENCE ★ TECHNOLOGY ★ ENGINEERING ★ MATH

PRESENTED BY: girlstart

Bristlebots™

Did you know that you can turn a toothbrush into a robot? Use a battery, vibrating motor, and a toothbrush head to create a robot that can move across a smooth, flat surface. Then, use your creativity skills to decorate your robot to look like your favorite winter animal.

TEKS:

6.8B Identify and describe the changes in position, direction, and speed of an object when acted upon by unbalanced forces.
6.9C Demonstrate energy transformations, such as when energy in a flashlight battery changes from chemical energy to electrical energy to light energy.
8.6A Demonstrate and calculate how unbalanced forces change the speed or direction of an object's motion.

How To:

Note: If you purchased a bristlebot kit, follow the instructions included in the kit and skip to Step 5.

1. To start, you will need to remove the toothbrush head from the rest of the toothbrush. Using pliers or wire cutters, cut the handle off from the head, leaving no more than ½ inch of the handle. This will be known as our "stalk."
2. Strip the end of the motor's wires so that the wire showing is ½-inch long. Test the motor by touching one wire to the top of the battery and the other wire to the bottom. You should see the motor spin quickly.
3. Using a piece of electrical tape, attach the motor to the top of the toothbrush bristles over the stalk, making sure the motor can spin without hitting the toothbrush. Wrap one of the wires around the brush so that the exposed part of the wire is on top of the bristles (you may need to wrap the wire several times depending on how long it is).

Materials:

- Copy paper
- Cardstock
- Construction paper
- Markers and/or crayons
- Scotch tape
- 1 bristlebot kit (can be purchased here) **OR** purchase the following materials separately**:**
  - 1 micro vibration motor (this can be purchased here)
  - 1 lithium battery (1-3 volts)
  - 1 toothbrush with bristles set at an angle
  - Wire strippers
  - Electrical tape
  - Googly eyes
  - Pipe cleaners

How To (continued):

4. Place the battery over the exposed wire (the bottom of the battery should touch it) and attach it to the toothbrush head using electrical tape, making sure that some of the battery is still exposed so the top wire will still be able to complete the circuit.
5. Decorate the bristlebot like your favorite winter animal, such as a penguin or polar bear. You can use different materials, including copy paper, cardstock, or construction paper. Use googly eyes or pipe cleaners to add detail. Once you're done, tape the exposed end of the second wire to the back of the picture using Scotch tape.
6. Make sure your winter animal decorations are securely attached to your bristlebot.
7. Verify that your exposed wire makes contact with the top of the battery to make the motor spin. If the motor does not spin, recheck to make sure the battery and wires make a complete connection.
8. Place the bot on a smooth, flat surface to test the bot's ability to move across it. If your motor is spinning, but your bot is not moving, adjust the angle of your bristles. (You can set a heavy weight on top of the brush for a few minutes if they aren't angled enough). If your bot is spinning in one spot, shift the position of your motor, battery, and/or winter animal decorations to make sure that the weight is evenly distributed on all of the bristles.

The STEM Explanation:

The electrical energy from the battery causes the motor to vibrate, which creates mechanical energy (the energy of motion). The vibrations cause the toothbrush head to move along the surface. Because the motor bounces the bristlebot up and down on the tilted bristles, the bot scoots in the direction that the bristles lean.

Career Connection:

Careers in *artificial intelligence (AI)* involve automation, robotics, and the use of sophisticated computer software and programs. People pursuing jobs in this field require specific education based on math, technology, logic, and engineering knowledge and skills. Working with artificial intelligence requires an analytical thought process and the ability to solve problems with cost-effective, efficient solutions. AI specialists need technical skills to design, maintain, and repair technology and software programs. They must also communicate effectively and possess the ability to work with colleagues on a team.

Resource:

- http://pbskids.org/designsquad/build/bristle-bots/