deSTEMber

SCIENCE ★ TECHNOLOGY ★ ENGINEERING ★ MATH

PRESENTED BY: girlstart

Scribble Bots

Engineer a robot that will scribble and draw a design on its own! Get creative with circuitry and explore electrical energy to power a motor that will vibrate your scribble bot and make unique and colorful artwork.

TEKS:

SCI 4.6 B: The student is expected to differentiate between conductors and insulators of thermal and electrical energy.
SCI 4.6 C: The student is expected to demonstrate that electricity travels in a closed path, creating an electrical circuit.
SCI 6.8 B: The student is expected to identify and describe the changes in position, direction, and speed of an object when acted upon by unbalanced forces.
SCI 6.9 C: The student is expected to demonstrate energy transformations such as energy in a flashlight battery changes from chemical energy to electrical energy to light energy.

Materials:

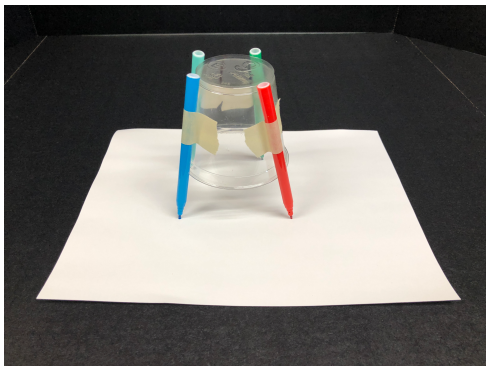
- AA battery
- Clothespin
- 3V DC motor
- Electrical tape
- 4 fine-tip colorful markers
- Hot glue gun and hot glue sticks
- Masking tape
- Paper
- Plastic cup
- Rubber band (size #82)
- Wire strippers

How To:

1. Start by placing the plastic cup upside down on a flat surface.
2. Space the markers around the cup evenly and position the markers vertically with the marker cap side

down. You want the markers to hang below the open end of the cup to suspend the cup in the air.

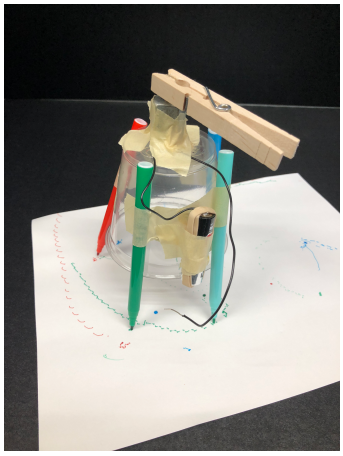
3. Use masking tape to firmly secure the markers to the cup. Try your best to keep the markers from moving. This is your robot base.



4. Place the robot base on a flat surface. If the bot is unstable or slanting, adjust the markers to make the robot stable.
5. Check that your 3V DC motor is ready. Make sure that there are two wires attached to the motor. If the wires seem like they could fall out easily or are loose, use electrical tape to secure them in place. The wires should also have at least 0.5 inches of metal wire exposed at their open ends. If the wires are not exposed, use wire strippers to remove the plastic coating around the tip of the two wires. **Safety: An adult should assist when stripping wires.**
6. Gather your AA battery and 3V DC motor. Test the battery and motor by touching the open end of the wires (attached to the motor) to the battery. Place one wire end on each side of the battery. If the motor does not spin, try flipping the battery around. Remove the wires from the ends of the battery once you've tested that you have a working motor.
7. Clip a clothespin around the spinning tip of the motor. This acts as an unbalanced weight to help the scribble bot move around. Use hot glue to glue these pieces together so that the clothespin does not come off the motor. **Safety: An adult should assist when using hot glue.**

8. Wrap the rubber band around the battery edges so the rubber crosses the positive and negative metal ends of the battery. This will later help hold the wires in place at each end of the battery.

9. Now attach the battery and the motor to the plastic cup. You can position them along the sides or top of the cup. Use masking tape to secure them to the cup as tightly as possible. Make sure the clothespin on the motor will not hit anything as it spins!
10. Remove the marker caps from the attached markers and place your scribble bot onto a flat surface lined with a piece of paper.
11. Slide the free ends of the wires into the rubber band so that the metal of the wires touches the metal ends of the battery.
12. Let go and watch your robot make scribble art!



STEM Explanation:

A circuit is a path for electrical current to pass through. The components of the circuit in this activity include a battery, wires, and motor. Chemical energy from the battery transforms into electrical energy to travel through the wires to the motor. Once this energy reaches the motor, it is transformed into kinetic energy, which causes the motor to spin. When the circuit is incomplete, or open, the wires are not connected to the battery and therefore there is no flow of electricity. To make the motor turn on, the battery must be connected to the wires. This makes a closed circuit through which the electric current can pass.

The scribble bot moves because the clothespin that was added to the motor creates an offset weight. As the motor spins, the offset weight results in unbalanced forces on the spinning motor, causing the robot to vibrate and move. A cell phone vibrates the same way by having an offset weight motor inside. When the markers are added to the robot, their pattern on the paper allows you to see the vibrational pattern of the

moving robot. Try changing components of your robot to see how it affects the markers' drawing design. What happens if you change the clothespin to another object, add weight to the robot, or change the height of the markers?

Career Connection:

Electrical engineers work with electricity in many forms from designing small-scale circuits to building large electrical systems. Electrical engineers use their knowledge of the conductivity of materials to design circuit boards that are used in cell phones, TVs, toaster ovens, computers, and many other devices. Understanding the dangers and potential of mixing electricity and water helps engineers design for safety as well as creative measurement tools.

Resources:

https://tinkering.exploratorium.edu/sites/default/files/Instructions/scribbling_machines.pdf
https://crystalandcomp.com/motorized-coloring-machine/
http://lemonlimeadventures.com/scribble-bot/

