Scribble Battlebots

Background

Japan is world's leading manufacturer and consumer of robots. About half of the world's robot are made and used in Japan. About half of the world's 4,500 robot engineers are in Japan. In 2000, $5.7 billion worth of robots were produced in Japan. Robots have been developed in Japan to help build products, to provide useful services and entertainment for people and to provide companionship for them. Research is taking place at corporations such as Sony, Honda and NEC and universities, most notably Waseda University's famed robotics lab in Tokyo.Tokyo hosts the world's largest robot fair---the International Robot Exhibition---every other year in late November or early December. First held in 1973 and last held in 2007, is is organized by the Japan Robot Association and Nikkan Kogyo Shimbun (a newspaper). The 2007 event featured robots, including humanoid and manufacturing robots. made by 199 companies and 66 organizations. In the 1920s, robots began appearing in department stores in Japan. The first humanoid robot made in Japan was named *Gakutensoku*, ("Learning from the Laws of Nature"), created by biologist Makoto Nishimura (1883-1956) in 1928. Consisting of a three-meter-high upper half of a body sitting being a desk, it could open and close its eyes, lift a scepter with its left hand and move a pen with its right hand. The world's first robot, a humanoid named Televox, was constructed in the United States in 1927. In 2003, Japan had 348,734 of the world 800,772 industrial robots. By contrast. The European Union had 249,200 and the United States had 112,390. The same year Japan had 320 robots for every 10,000 employees, compared to 148 in Germany and between 50 and 80 in the United States. Spain and France. [Source: International Federation of Robotics]

More information can be found by visiting the link:
http://factsanddetails.com/japan/cat26/sub163/item873.html

Overview

Being able to recognize a problem and design a potential solution is the first step in the development of new and useful products. In this activity, students are given a Bristlebot Kit and must design it to travel as straight as possible.

The lesson focuses on mathematics knowledge and skills used to engineer scribble bots or bristle-brush bots. Measurement, circuits, and problem solving are among the areas that will be addressed. Throughout unit learning experiences, students have many opportunities to read, write, speak, listen, solve problems, and work cooperatively.

Education Standards

- *Evaluate competing design solutions using a systematic process to determine how well students meet the criteria and constraints of the problem.*
- *Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.*

Materials Needed

Per team:

- 3-4 thin markers (variety of colors)
- 2 AA batteries
- AA battery clips (optional)
- 1 small DC battery (hobby motor)
- 1 counterweight (small eraser, a cork, a coin, a bottle cap, or lid... anything of that size)
    - Odds and ends that can be placed on the motor shaft to cause it to spin off balance; this is what makes the scribble bot travel to create the interesting designs
- 1 paper cup (a lump of foam, a margarine tub, or a toilet roll insert would all work too)
- Wooden craft stick (or small ruler)
- White paper (variety of paper sizes) and decorative pieces (eyes, pipe cleaners, etc)

Optional tools: Hot glue gun, Duck tape and/or electrical tape, pipe cleaners, googly eyes

Vocabulary

Measurement: area, perimeter

Circuits open and closed circuits

Electric Circuits: a path through which electric current may flow

Student Objectives

Students will be able to use their understanding of electrical circuits and the Engineering Design Process to make a Scribble Bot.

Students collaborate to design and build a scribble bot.

Students are encouraged to modify their design so that each of the markers produces its own individual footprint.

Activity

Simple video link to help build: https://www.youtube.com/watch?v=qCMuZG7qUGk

Before the build:

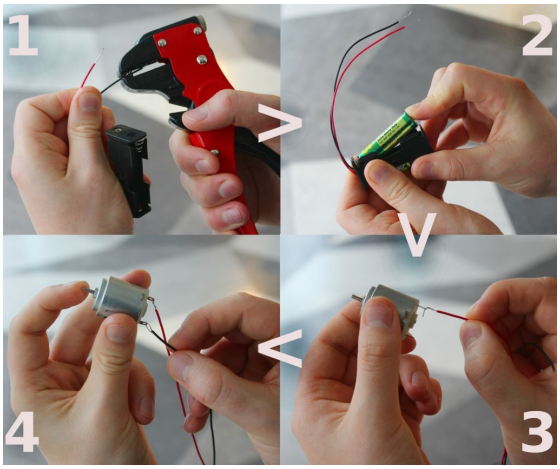
Because creative design is an important element in building a scribble machine, give students very limited instructions. Introduce students to their project by challenging them to build a machine that scribbles as it moves. Then stand back and let them tinker on their own.

There is no single method for building a scribble machine. Any design that scribbles is a success, and the open-ended engineering possibilities of a scribble machine are part of what makes them so fun. Without any help, students may create perfectly working scribblers. If they get stuck, here is one possible design:

Check the batteries and motor to make sure everything's working.

1. Strip a little insulation from the end of each of the wires coming from the battery pack.
2. Put batteries in the battery hold (make sure they are place in correctly).
    - Each battery is 1.5 volt (3 volts with 2 batteries). Small hobby motors are meant to be used with 2.5 to 6 volts.

3. Make a little hook in the end of one of the wires and hook it through one of the tabs on the back of the motor.
4. Hook the other wire through the other tab. Touch the small bit poking out the front to see if it's spinning.



Tell/ask students: What would happen if you swapped the red (positive) and black (negative) wires? Give it a try!

* **REMEMBER:** DO NOT CONNECT THE WIRES TO THE SAME TAB OR TO ONE ANOTHER. That would create a **short circuit**, and batteries and other components do **not** like short circuits.

Building the Bot:

Remind students that all parts of a circuit connect in two places. There are two wires on the motor and two wires on the battery. Student groups are given time to connect the wires and make the circuit.

Attach the motor and battery to the wooden craft stick (or use a battery/motor holder if available). Students place these on top of the cups or main body of the scribble bot. The wire connecting to one end of the battery should be easy to connect/disconnect as this will be our on/off switch.

The scribble bot can use up to three markers. Most student groups choose three different colors.

Glue (or tape) your markers inside the cup, making sure it can stand on its own without falling and that it can write while moving about. Making sure they are balanced will help with stability of the bot.

Glue (or attach firmly) a mini-clothespin (or a small eraser piece) to the motor's rotor so it will spin around and cause the motor to vibrate. Normally, motors are set to run smoothly. If the

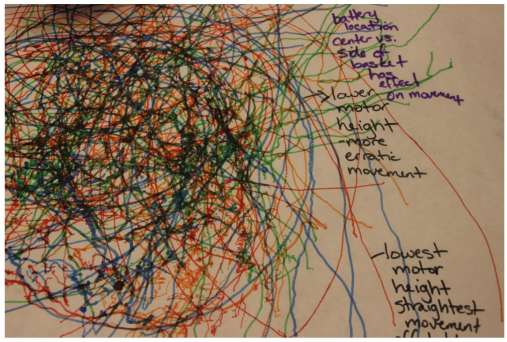
scribble bot has a smooth running motor, then it will not be able to create an interesting art footprint. Several odds and ends are provided for student experimentation: small rubber bands for students to use to attach items to the motor shaft, some small gears, K'NEX pieces, foam, packing peanuts and other odds and ends to try.

Glue or tape your motor and battery pack to the outside of the cup.

It's time to give the ScribbleBot some personality! Decorate with pipe cleaners and googly eyes to give your ScribbleBot a unique personality!

Data Tracking:

A nice feature of scribble machines is the fun, visual data they create. As students' machines begin drawing, have students describe their machine designs by writing directly on the paper beside their scribblers' drawings. After students have recorded one pattern and design, encourage them to try new designs, and see how it alters their scribbles. Then have them record and compare this new data to the old.



Explore with the Bot:

- Set up a course for the robot using blocks (legos, books, supply boxes, etc.)
- Give students a specific measurement (area or perimeter) for them to cover
- Have fun and set up a rink area to have friendly Scribble Battlebot competitions!

Prompts:

- Has anyone figured out how to make the motor run?
- What happens when you swap which end of the battery each wire touches?
- What is the purpose of the glue-stick? How does off-centering it make a difference to the motion of their scribbler? Why would this be?
- What will adding a second motor do?
- Can you change your design so that it scribbles without the glue stick?
- Can you make your scribbler draw a perfect circle?

- How did everyone attach the different pieces of their scribble machines? Can you make it sturdier? Can you make it more aesthetically pleasing?

Extension

All students to explore more engineering challenges. The expectation will be that students use the engineering content specific vocabulary as they work and communicate as engineers.

What else can they engineer using the same materials? Bristlebot using a toothbrush? A ScribbleCar Bot?