



The Volume Control

Learn to read continuous input from a virtual knob (potentiometer) to control the volume of a song in real-time.

Courses

- Grades 3-12

Materials

- Cellphone, tablet, or computer
- Internet connection

Educational Objectives

- Understand the concept of a potentiometer.
- Create a technological object (prototype) using a device.
- Identify relationships between technology and the surrounding world.
- Evaluate personal work and the work of others.
- Engage in dialogue and reflection on improvement ideas.

Start (10 minutes) - Beyond On and Off

1. Welcome students and introduce the day's activity: **"Today, we are going to learn how to create a volume knob that gives us smooth, gradual control."**
2. Ask a guiding question: **"Think about a volume knob on a stereo or a dimmer switch for a light. How is it different from a simple on/off button?"**
3. Guide the discussion to the idea of 'gradual' or 'in-between' values. Explain that this is called **analog control**, and the component that allows us to do this is a potentiometer. Let's dive into how it works and how we can program it.

What is a potentiometer?

Have you ever adjusted the volume of a radio? Or changed the brightness of a lamp using a dimmer? If so, you've probably used a potentiometer. It's the technology behind any control that isn't just on or off, but allows for a smooth range of values in between. Usually, you control it with a **knob**!

How does it work?

A potentiometer works by changing its electrical resistance as you turn it. Think of it like a faucet for electricity. By turning the knob, you can **gradually** change how much electrical current flows through it. In the case of a speaker, adjusting the current allows you to smoothly **increase or decrease the volume**.

How do we program it?

To make our volume knob work, our program needs to know its current position. We have two great ways to do this: * **The Main Loop:** We can put our code inside a "repeat forever" loop. The program will constantly check the knob's value and update the volume, over and over. * **Events:** A more efficient way! We can use an event that triggers *only when the knob is turned*. The program waits quietly until it gets a signal, then updates the volume. In programming, there are often different solutions to the same problem!

Development (20-30 minutes) - Building the Volume Controller

1. Now that the students understand the concept of a potentiometer and how to read its value, it's time to build a real-time volume controller.
2. Lead them through **the instructions for connecting the components and programming the volume control logic**, as detailed in the hands-on section below. Encourage them to see how the knob's value directly affects the audio player's volume as they turn it.

Closure (5-10 minutes) - The World of Analog

1. Once everyone has a working volume knob, it's time to brainstorm other uses for this powerful analog input.
2. Use the final section to spark a creative discussion about other things that can be controlled gradually and to challenge them to visualize the data from their new sensor.

Reflect

You've just unlocked the power of analog control!

Simple ON/OFF is fine, but gradual control opens up a whole new world of possibilities. *What other things in a game or an app would you want to control smoothly with a knob or slider? (Think character speed, screen brightness, or the brush size in a drawing app).*