The Spirit Level: Is It Straight?

Use your phone's tilt sensor and advanced conditionals ('Else If') to build a tool that tells you if something is perfectly level.

Courses

- Grades 3-12

Materials

- Cell phone, tablet, or computer
- Internet connection

Educational Objectives

- Understand the concepts of "else if" (elif) and the "Cartesian plane."
- Create a technological object (prototype) using a device.
- Identify relationships between technology and the surrounding world.
- Evaluate personal and others' work in individual or team tasks.
- Engage in dialogue and reflection on improvement ideas.

Start (10 minutes) - Decisions with Many Paths

1. Welcome students and introduce the day's activity: **"Today, we will learn to prototype a digital tilt detector, just like a carpenter's spirit level."**

2. Start by briefly recapping the 'IF/ELSE' conditional for two options (like ON/OFF). Then, introduce a more complex problem: **"An IF/ELSE block is great for two choices. But what if you have *four* choices? For example, you want a program to suggest a meal based on the time of day."**

3. Use this analogy to show why we need more than just one 'ELSE'. This is the perfect setup to introduce the **'ELSE IF'** structure as a way to chain multiple checks together to make more complex decisions.

More Than Two Options?

You've seen how conditionals can work with two options: **IF** a condition is true, do something, **ELSE** do something different. This is perfect for a simple on/off switch. But what if you need to check for multiple, different conditions?

Introducing 'Else If'

The **"else if"** structure lets you chain multiple checks together in a single, neat block. You can think of it like a referee in a soccer match: * **IF** the foul is very serious, **THEN** show a red card. * **ELSE IF** the foul is just a warning, **THEN** show a yellow card. * **ELSE** (if neither of the above is true), **THEN** it's just a simple foul. The program checks each condition in order until it finds one that is true.

ELSE IF: 4 Options for our Spirit Level

We'll use this multi-path logic to program a tilt detector that helps us hang pictures perfectly straight. The screen will light up with different colors based on the tilt value: green for level, yellow for slightly off, orange for more tilted, and red for very tilted.

How does the phone detect tilt?

To detect the tilt of a phone, we use a tiny built-in sensor called an **accelerometer**. This sensor can measure forces like gravity, telling the phone its orientation in space. It measures tilt on three different axes: X (left-right), Y (forward-backward), and Z (up-down). This allows the phone to know if it's tilted to one side, standing upright, or lying flat.

Development (20-30 minutes) - Building the Spirit Level

1. Now that the students understand how to build a multi-path decision with 'ELSE IF', it's time to apply that logic to a real sensor.

2. Lead them through **the instructions for building the spirit level and programming the multi-conditional logic**, as detailed in the hands-on section below. Make sure they understand how each 'ELSE IF' block checks for a different range of tilt values, creating the different color warnings.

Closure (5-10 minutes) - Reflection on Sensors and Logic

1. Once everyone's spirit level is changing colors correctly, it's time to reflect on the sensor and the powerful logic they've used.

2. Use the final section to guide a discussion about the accelerometer's other capabilities and to challenge them to create a new prototype combining tilt and sound.

Reflect

You've built a program that can make complex decisions!

This 'IF / ELSE IF / ELSE' chain is a super powerful tool. * Our spirit level used the Y-axis (forward-backward tilt). What do you think would happen if you changed the code to read the X-axis (left-right tilt) instead? * What other real-world tool or game could you build using your phone's tilt sensor?