Techgirlz Workshop
Scratch and Raspberry Pi

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in conjunction with CoderDojo RTP

Introduction:

Thanks

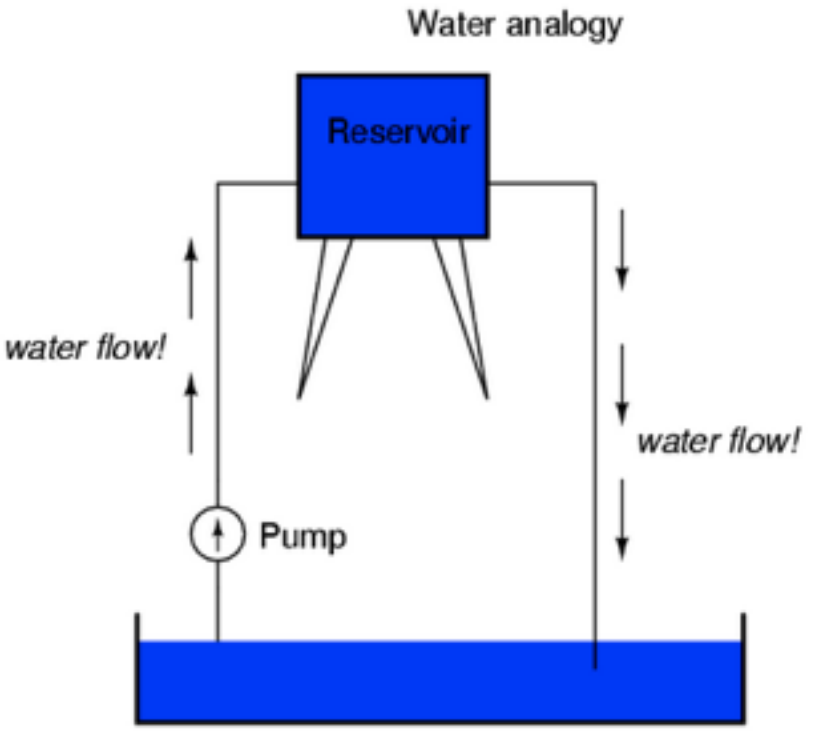
- IBM: Raspberry Pi grant to Techgirlz
- Coderdojo and VMware: Raspberry Pi grant to Coderdojo RTP
- Well Center, Techgirlz, and CoderDojo RTP volunteers

What we're using

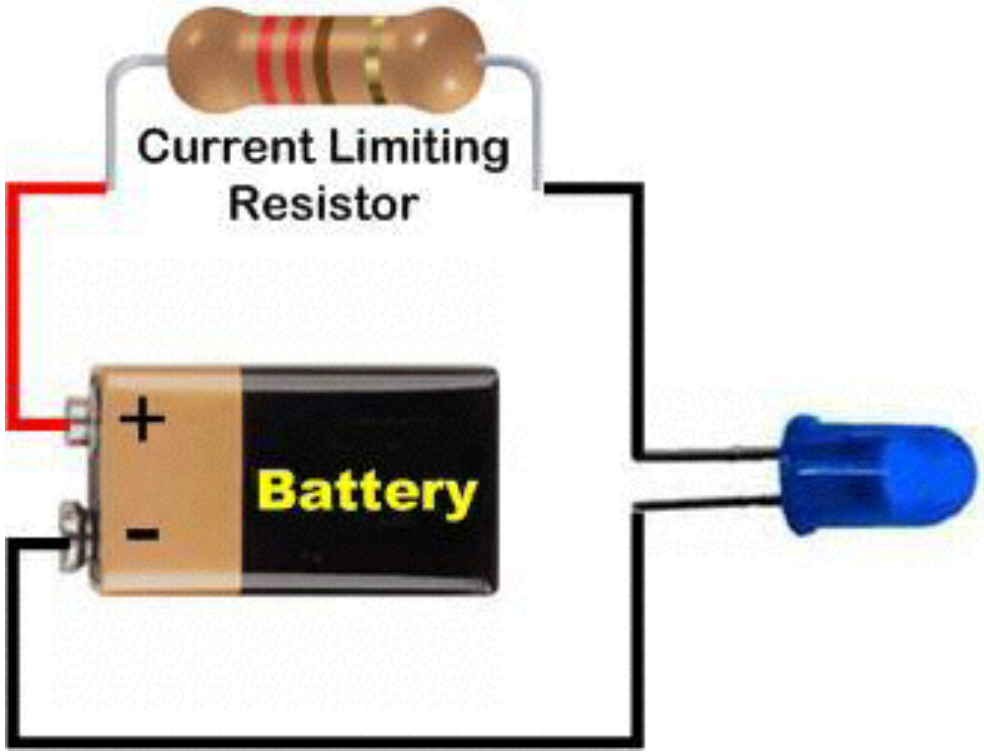
- Scratch: We will use Scratch to write the code
- Raspberry Pi: It is a mini computer
- Electronics: We will use wires, a breadboard, lights, and resistors to make circuits

Electric Circuits

- Electric current is what makes the light come on. To have a current you need voltage and resistance
- Voltage:
  - High (+)
  - Low (-)
- Just as water has to flow from high to low, electricity needs high voltage to get the electricity to flow “down” to the ground and around your circuit.
- Think of resistance like a faucet. The resistance can help control how much electricity goes through the circuit.



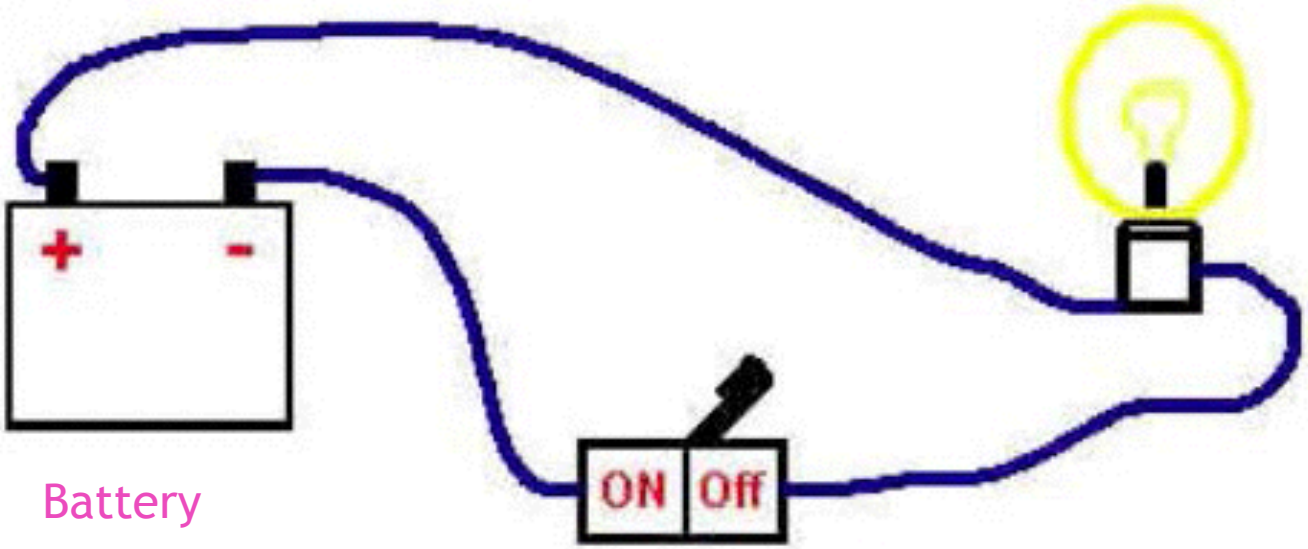
Electric Circuits



- The lights we will use are called LEDs (Light-emitting diode)
- Note: LED has two different sides. The longer leg is (+), and the shorter leg is (-)

Electric Circuits

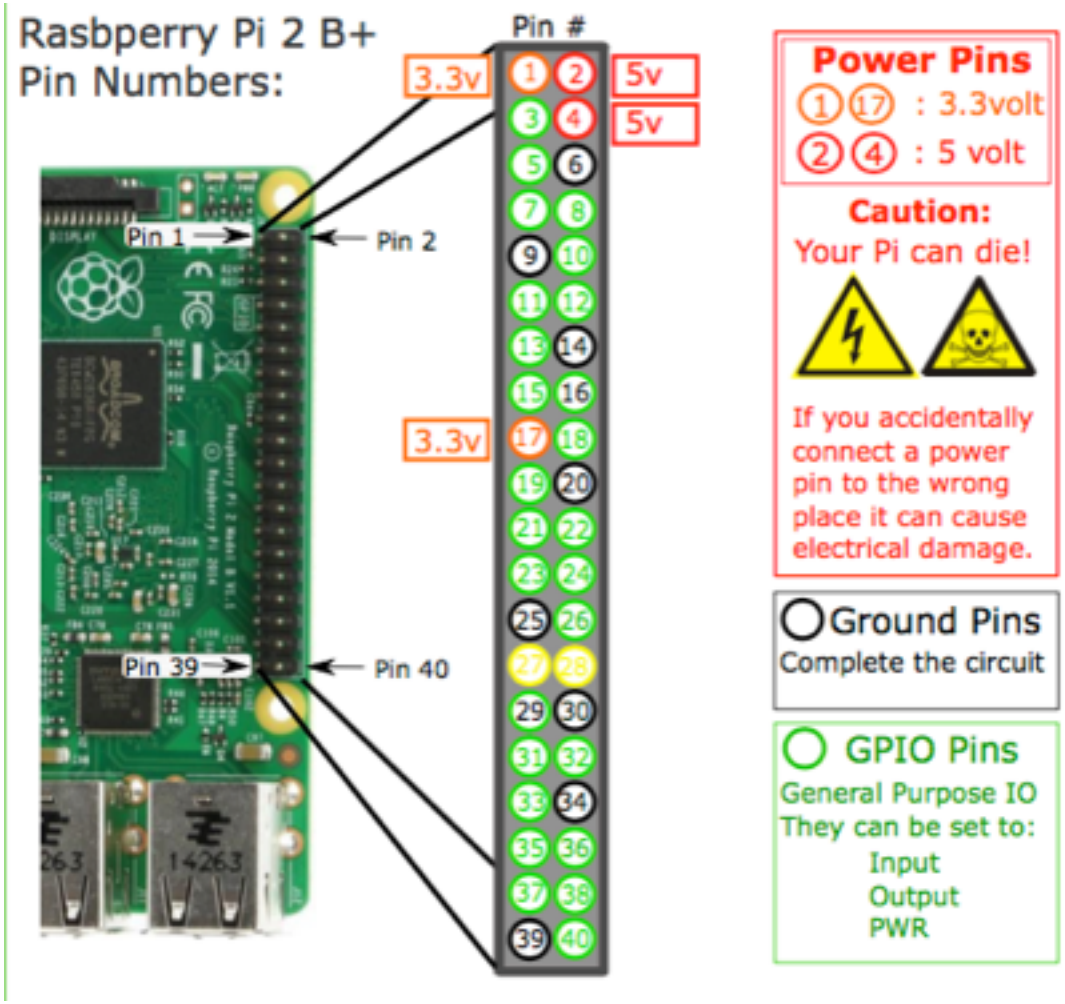
The Raspberry Pi is going to act as our light switch—a switch we can control with our code



Electric Circuits

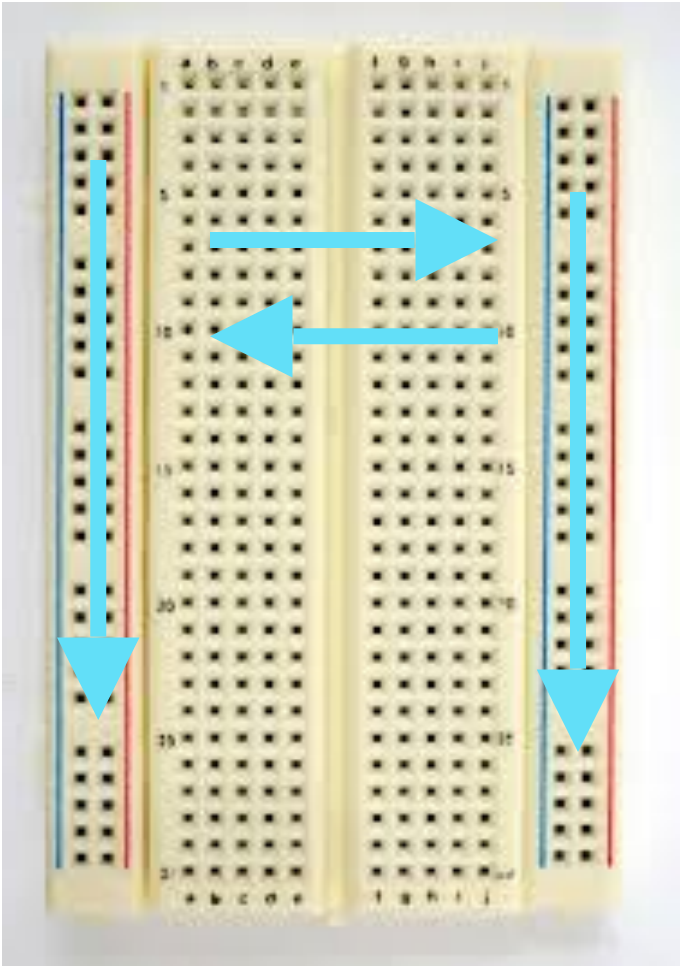
- In an electric circuit, there is a battery with a positive and negative end. For our circuits we are going to get power from the Raspberry Pi's GPIO pins.
- The cobbler connects the Raspberry Pi to the electronics. It creates spots for electricity to come from and go to (ground).
- Here are some pins you should know about:

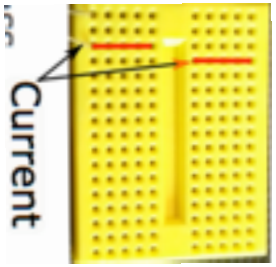
- **Power:** 3.3V and 5V. These are always on (high voltage) when your Pi is on
- **Ground:** 0V (low voltage)
- **Programmable Pins (GPIO pins):** These are pins that we can turn on and off from the Scratch code. This means that they have low voltage, 0V when off and high voltage 3.3 V when on.
- **DNC:** This means DO NOT CONNECT! If you do, it will fry the Raspberry Pi and you will no longer be able to use it



About the Breadboard

- We can make all of the parts of our circuit connect using a breadboard.
- The bright blue arrows follow the flow of electricity through the breadboard
- The red arrows follow the flow of electricity through the little breadboard





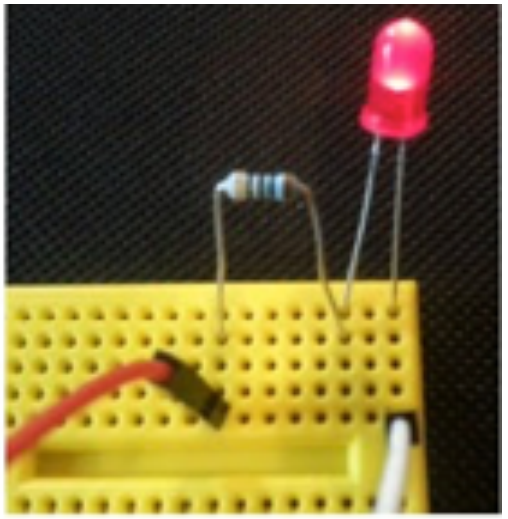
Some Basics

- Power on the pi
- Double click on Scratch

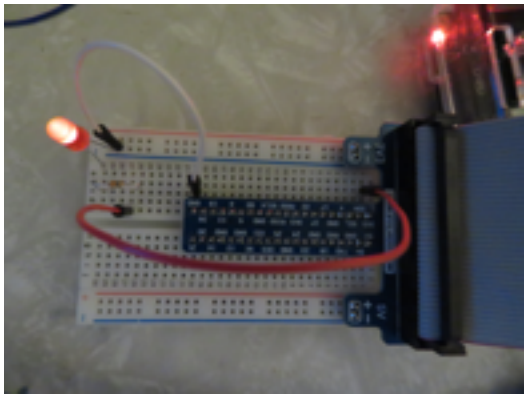
- On the little breadboards: always connect the ground wire to the pi before connecting the power wire
- On cable connected boards, wire the board prior to connecting the pi

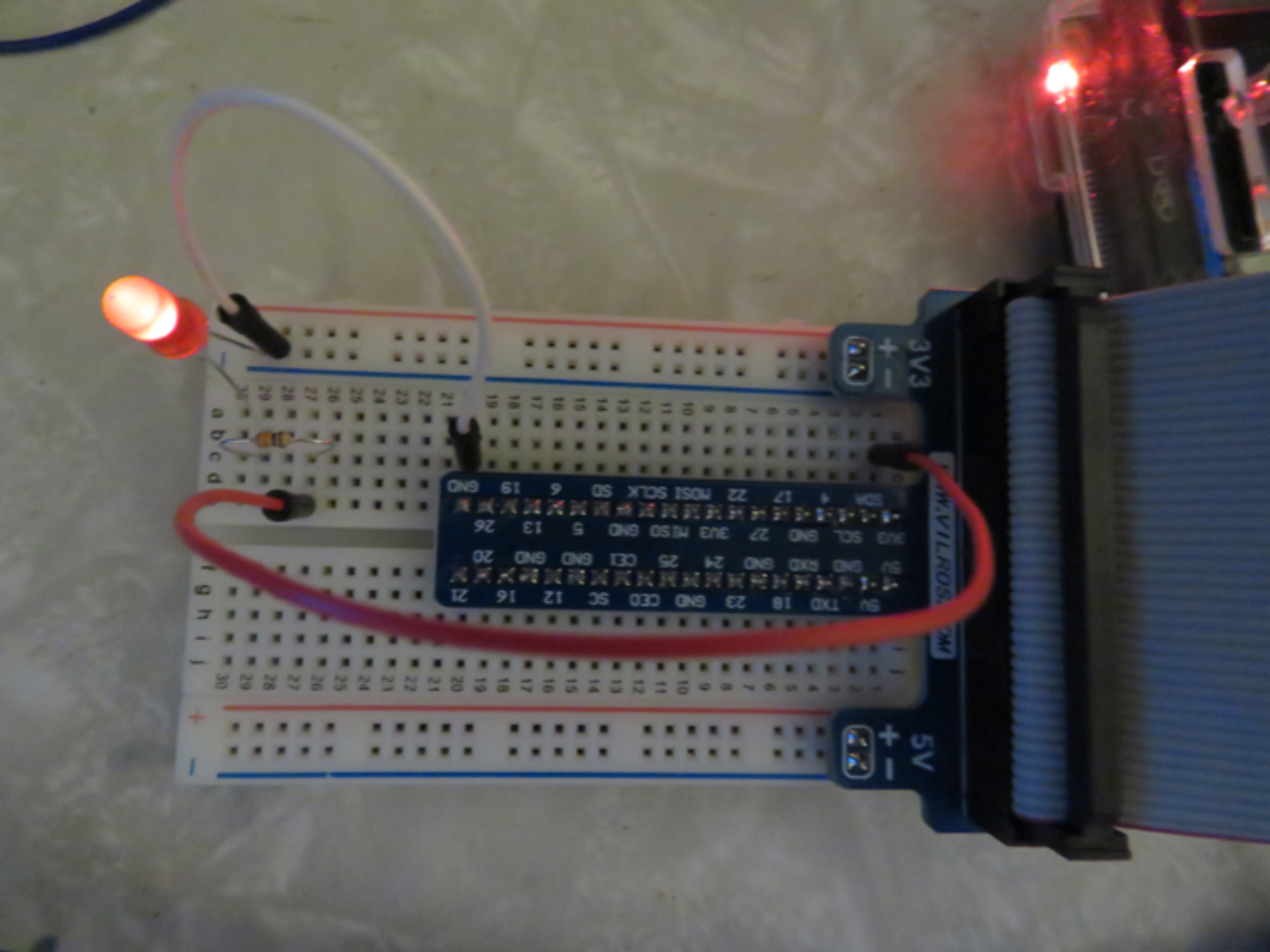
Activity 1: Turn on the Light

We will complete a circuit to make an LED shine!



1. Insert a resistor across 2 rows
2. Put the long leg of pin in row with the end of the resistor so it gets current
3. Put the short end of pin in a different row
4. Plug the ground wire into the row with the short leg
5. Connect the ground wire
    1. directly to pin 6 on the pi or
    2. a row with gnd on cable connected boards
6. Plug the power wire into the row the resistor starts so power goes into the circuit
7. Connect the power wire
    1. directly to pin 1 on the pi or
    2. 3v3 row on the cable connected board



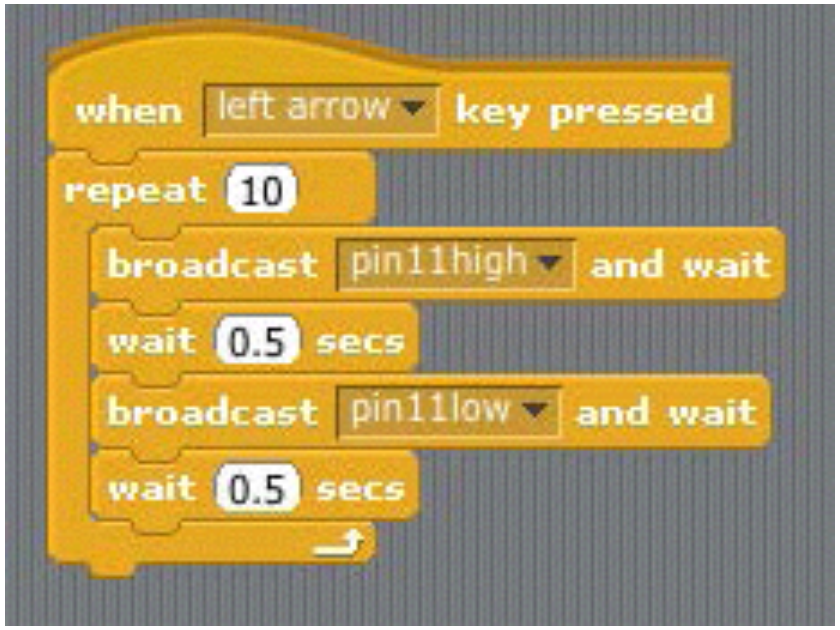

3V3
5V

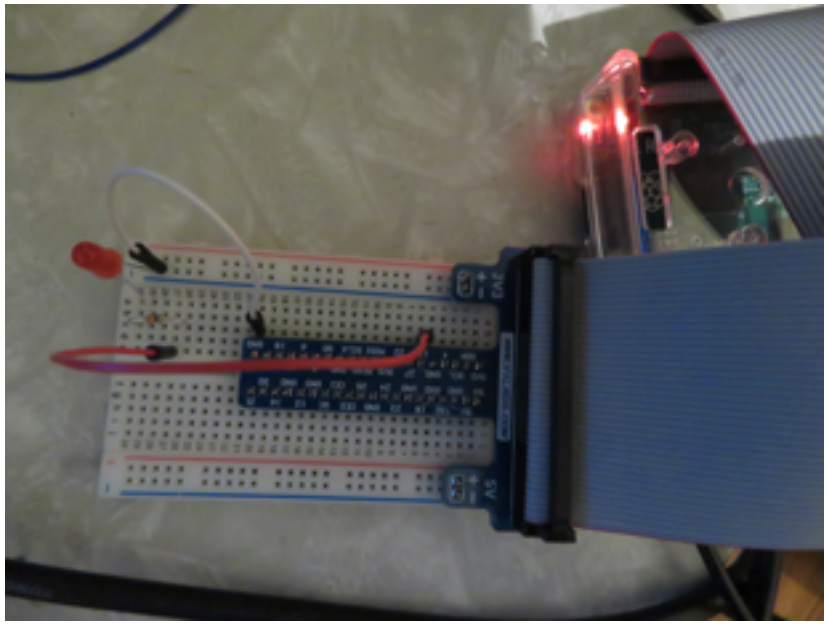
Activity 2: Make it blink

- This activity will connect our circuit to Scratch!
- Use the left arrow key on your keyboard to blink the LED
- Step 1: connect the circuit
- Step 2: write your code
- Step 3: make it shine!

Let's Blink

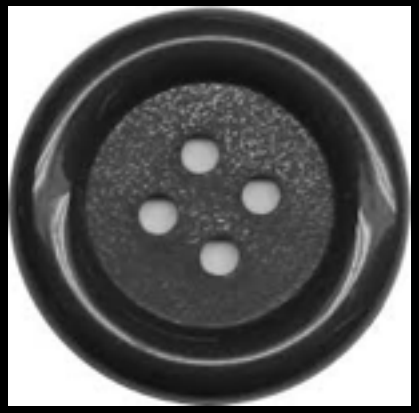
- The only change in wiring is to move the power source from the 3.3V spot to a GPIO pin
  - directly to pin 11 on the pi or
  - row 17 on the cable connected board





Bonus Activity:

- Can you make the light blink quicker?
- Can you set up a second LED so that it blinks when you click the right arrow?




BUTTONS!



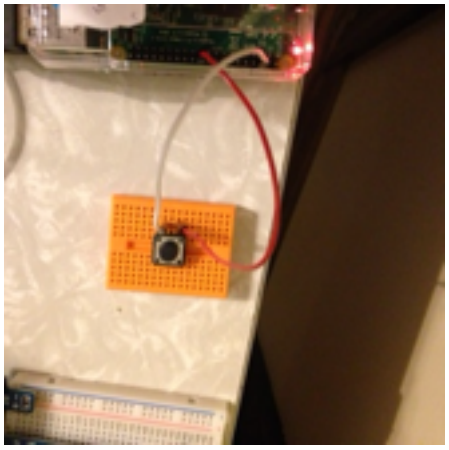


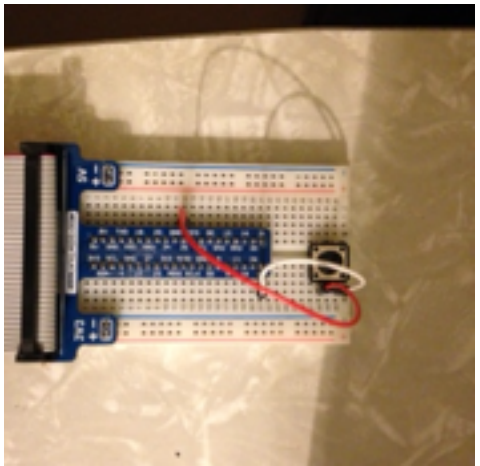
About Buttons

- Buttons turn objects on or off. When you press the button, the circuit is completed to turn the object on.
- Buttons have two values: 0 and 1. When the button is not pressed, and the circuit is incomplete, the value is 1. When the button is pressed, the circuit is complete, so the value = 0.

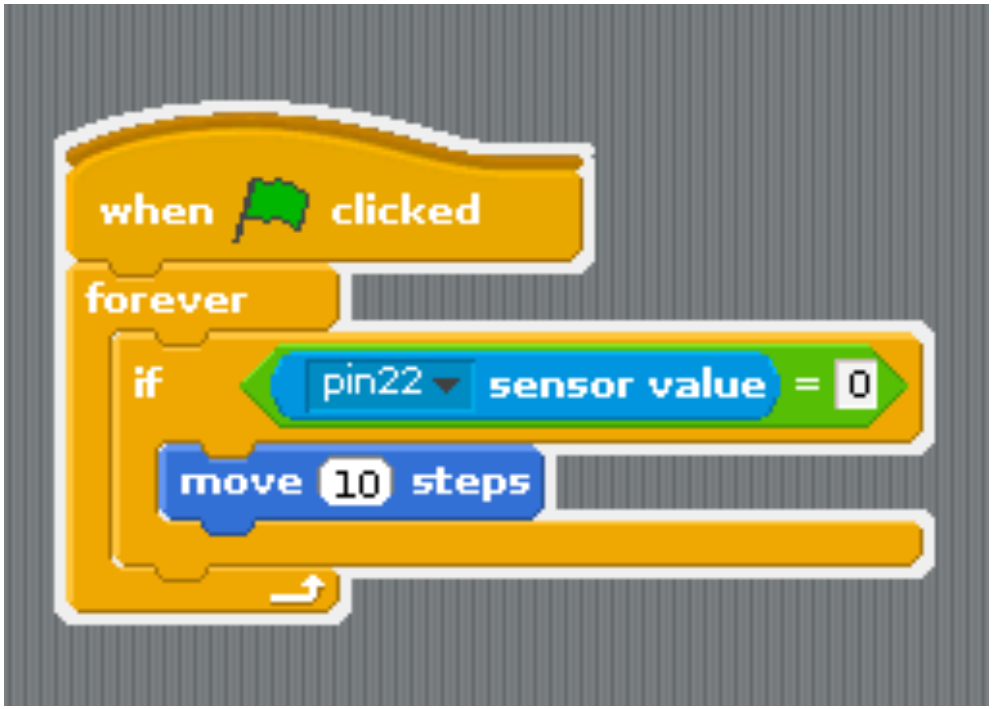
Activity 3: Using the button with Scratch

- We’re going to use a button to make an object move in Scratch.
- Push the button firmly on the board
- Wire the ground wire to one side of button
- Wire the power button to the other and then
  - Directly to pin 22 on the pi or
  - To row 25 on cable connected boards
- Note - nothing will happen until you write code





Code to take input from a button



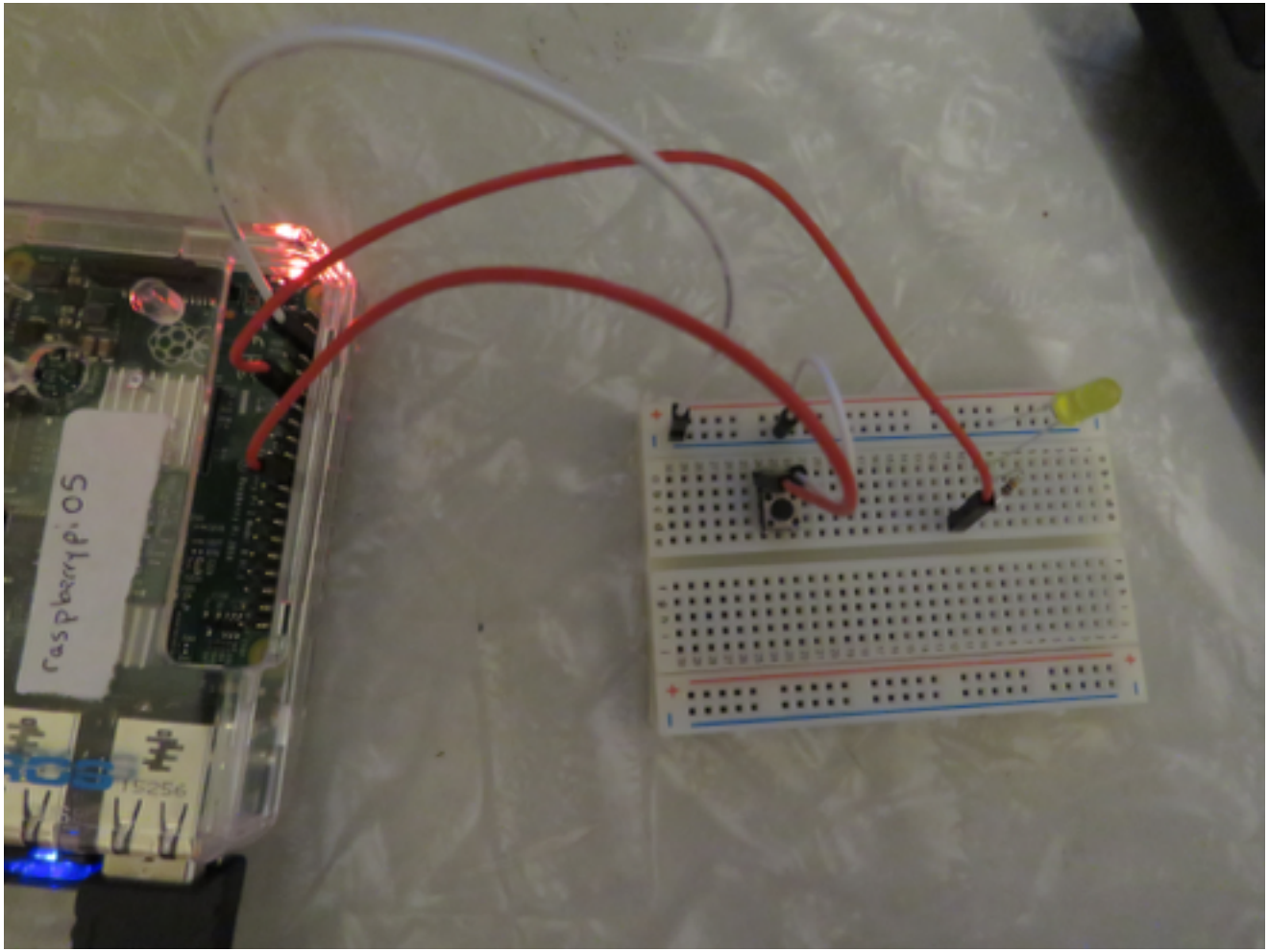
Hint: Look at the colors to help you find the scratch blocks to use

Activity 4: Using a button and a light

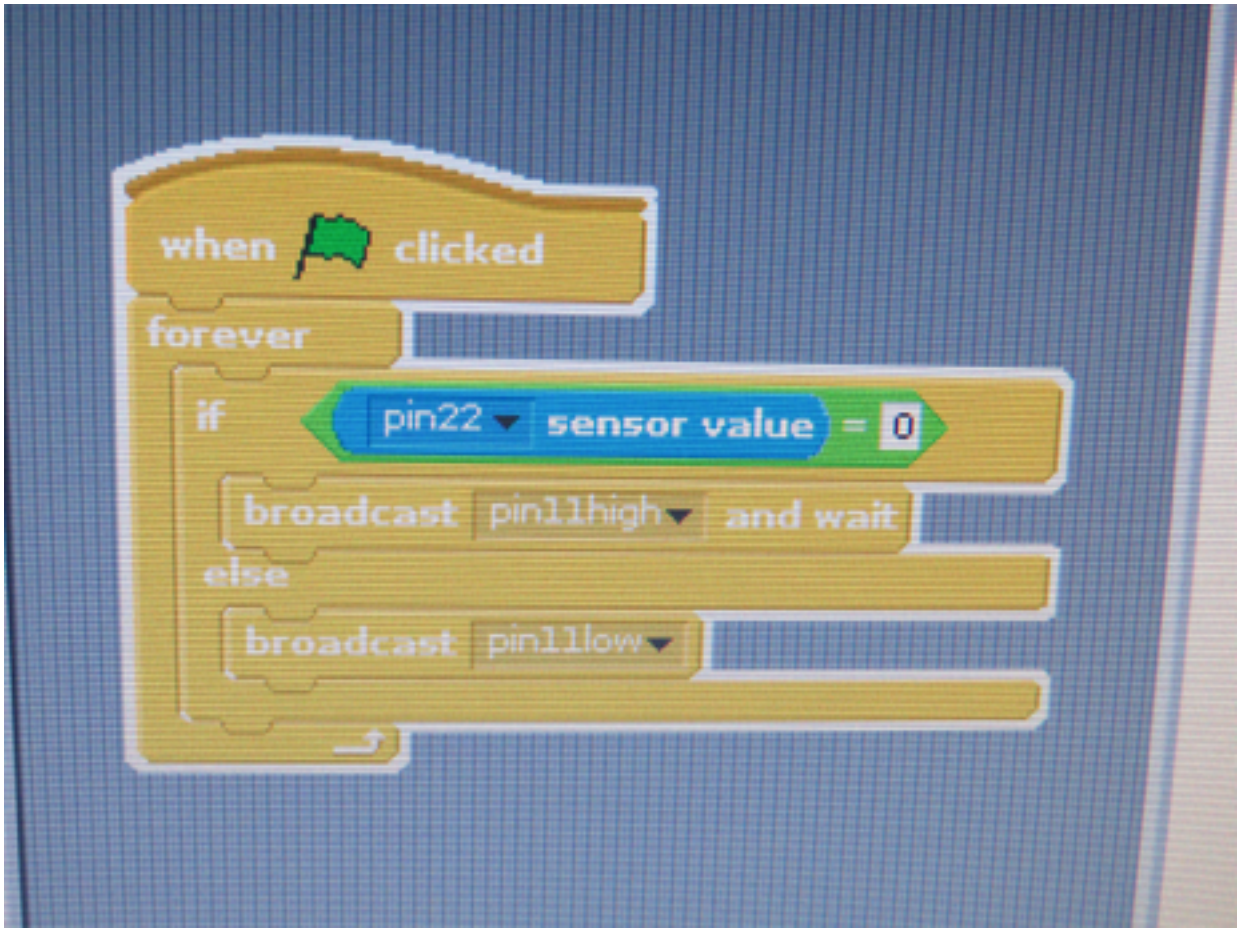
- Goal: To turn a light on using a button
- What you'll need: A button, an LED, a resistor, wires
- What's new in this project: Combining our knowledge of light circuitry, buttons, and Scratch code. Another new idea: "If Else" statements.

- Note - the wiring of the button and the light are identical to the individual wiring you did in Activities 2 and 3. You are using code to connect the button and light actions to each other, not wiring
- Note 2 - you can use one ground connection wire, as long as both the light and the button circuit ground the same current flow

Step 1: Wire it



Step 2: Write the Code



Activity 5: Create your own game!

- Challenge 1
  - Make a spirit dance
- Challenge 2
  - Build a stop light
  - Have a sprite move according to what color the light is
- Have fun!

Acknowledgements

- This deck is based on the wonderful material provided in the following resources:
  - Raspberry Pi Sushi Cards
  - Techgirlz Workshop in a Box
  - simplesi.net
  - Techgirlz Sample Scratch Projects