

The Girl and the Dragon. The Dumb Fish Detector. An LED Light Show using Scratch & Raspberry Pi



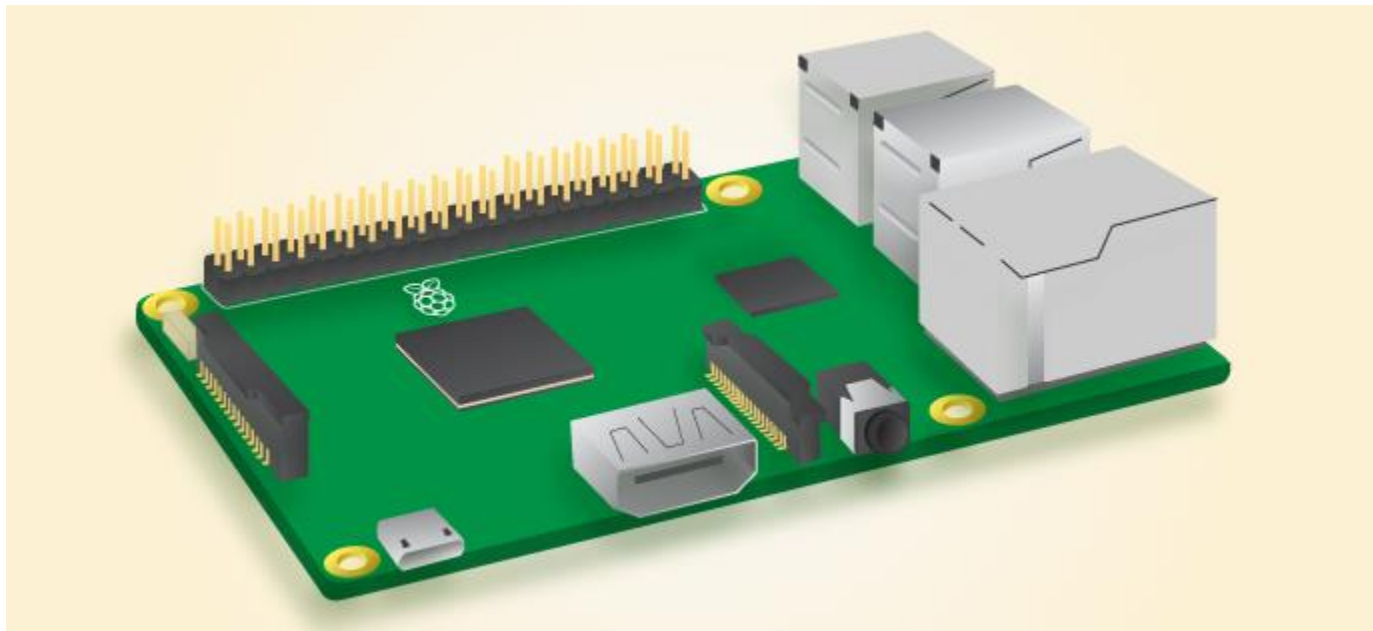
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coderdojomac.org



What is Raspberry Pi?

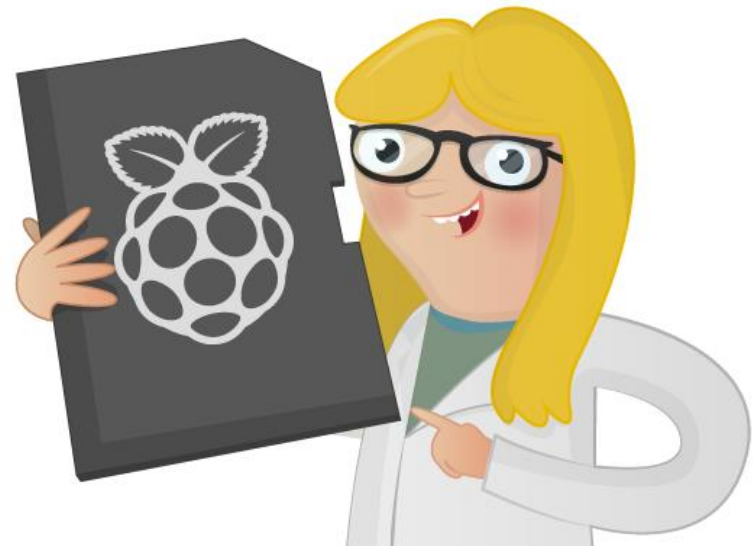
- * A powerful, inexpensive, credit card sized computer.



- * See <http://raspberrypi.org>

What can you do with a Raspberry Pi?

- * Just about anything!
 - * Browse the Internet
 - * Play Minecraft
 - * Animation
 - * Create a Home Theatre System
 - * Create a Musical Instrument
 - * Take Pictures and Videos
 - * Hack It!
 - * Programming
 - * Scratch
 - * Python
 - * Smalltalk



Today – we will create a LED light show!

Interfacing to the Real World

- * Camera
- * Sensors
 - * Motion
 - * Temperature
 - * Humidity
 - * Infrared
 - * Pressure
- * Switches
 - * On/Off
- * Lights
 - * LEDs
 - * Laser
- * Displays
- * Touch Screen
- * Game Controller
- * Speakers/Sound



Create your own Internet of Things (IoT) device!
(a smart device connected to the internet)

Example projects from raspberrypi.org

PARENT DETECTOR



GPIO MUSIC BOX



HAMSTER PARTY CAM



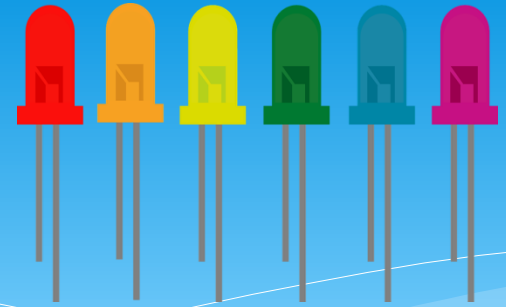
A WINDOW ON THE WEATHER



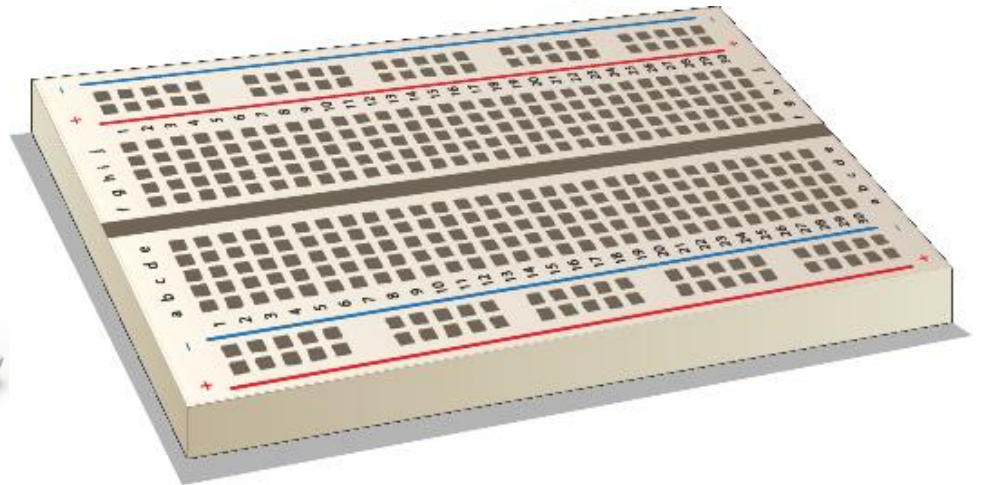
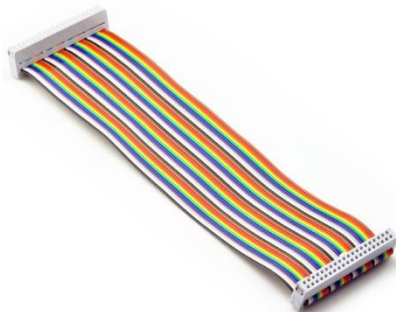
Today – We Will:

- * Learn how to build a simple circuit for LED Lights
- * Learn how to turn on a LED Light using Scratch
 - * It's easy!
- * Create a mini story of a girl with a pet dragon
 - * Maybe a dragon is not a good pet!
- * Create a dumb fish detector using Scratch.
 - * Flash an LED Light every time a fish hits the wall of the fish tank!

Pi Teams



- * Six teams of two people
- * Each team will share a Raspberry Pi
- * Accessories:
 - * Breadboard – to build circuits
 - * Ribbon Cable
 - * LED lights
 - * Wires & resistors



Pi Rules – Follow the Instructions!

- * Randomly plugging wires and power sources into the Pi, however, may kill it.
- * Bad things can also happen if you try to connect things to the Pi that use a lot of power; LEDs are fine, motors are not.

* If you follow the instructions, then messing about with the circuit is safe and fun!

Introduction to Scratch

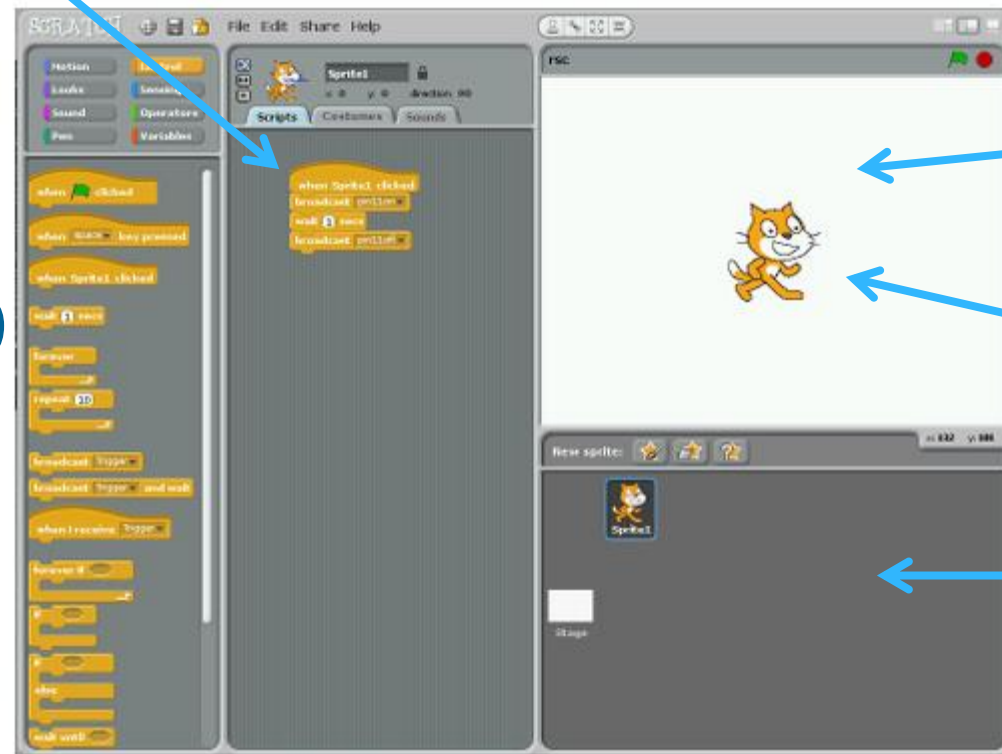
- * Scratch is located on the Programming Menu



Scratch Screen

Scripts, Costumes & Sounds

Instruction blocks
to create
a script (program)



Stage
(background)

Sprite

Sprite
List

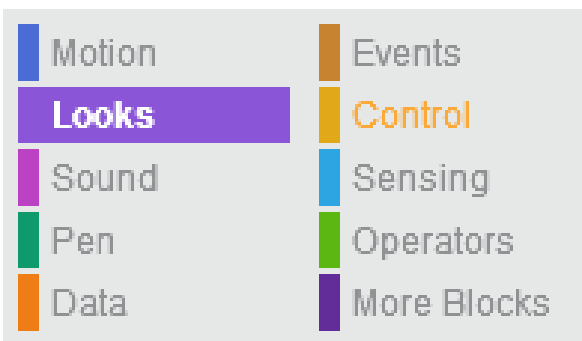
Create our first Program

- * Create New [File->New]
- * Change the Stage to Spotlight-Stage
 - * Click on the Stage in the Sprite List
 - * Click on the Background Tab
 - * select Edit and Import the Spotlight-Stage from the Indoors folder

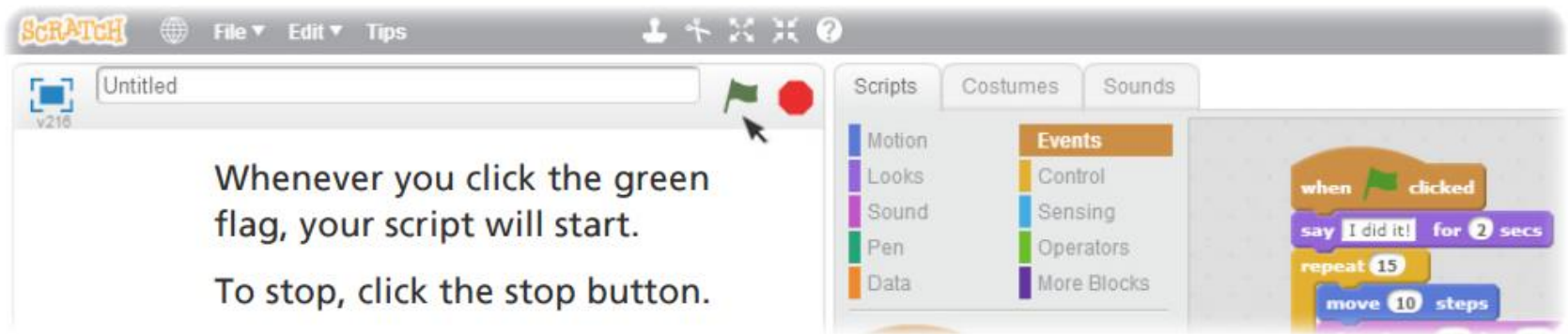
Create the Script for the Scratch Cat

- * Click on the Scratch Cat
- * Click on the Scripts Tab
- * Drag blocks to create:

Hint: find the blocks using the block color



Starting and Stopping Scripts

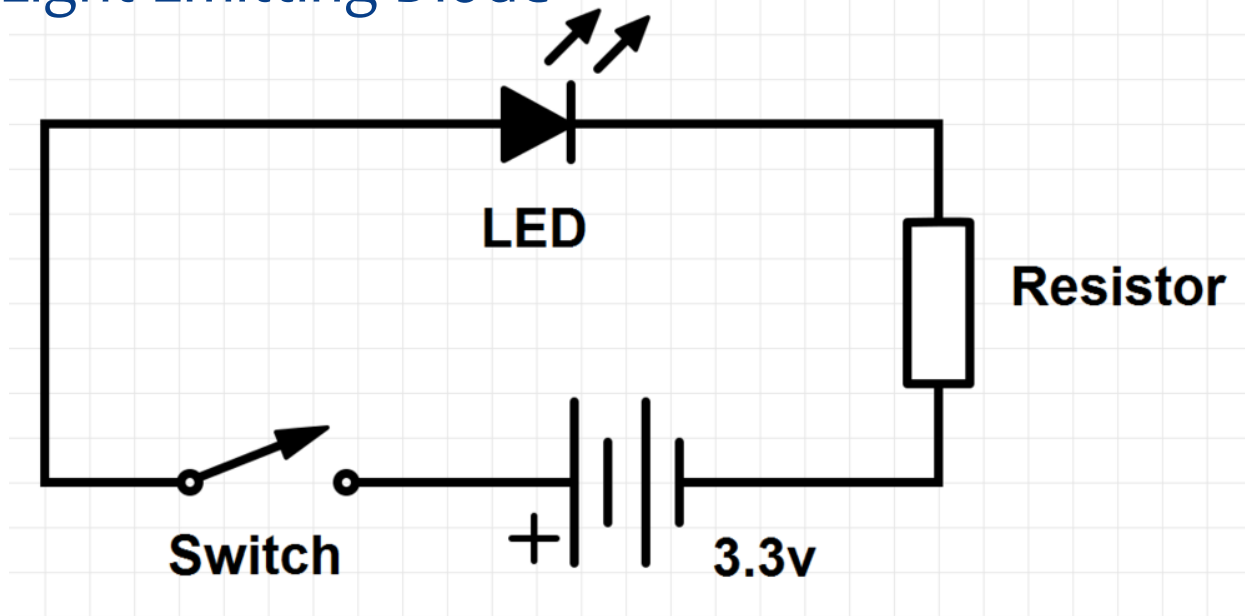


Script (code) Block →

- * Important Programming Concept: Events
 - * Mouse Click
 - * Key Pressed
 - * Button pressed
- * Teach Sprite (Scratch Cat) to respond to events!

A Simple LED Circuit

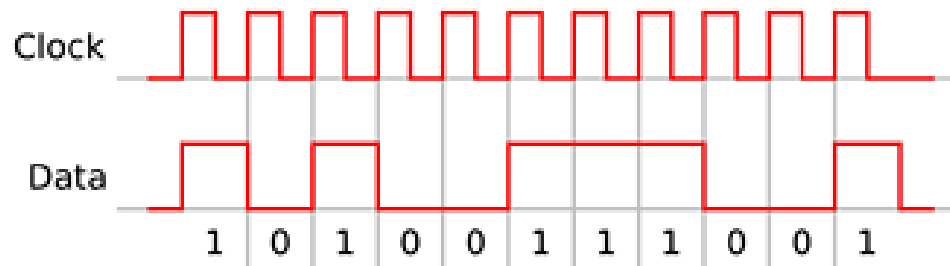
* LED= Light Emitting Diode



The Raspberry Pi will act as the switch in the circuit!

How? Digital Electronics!

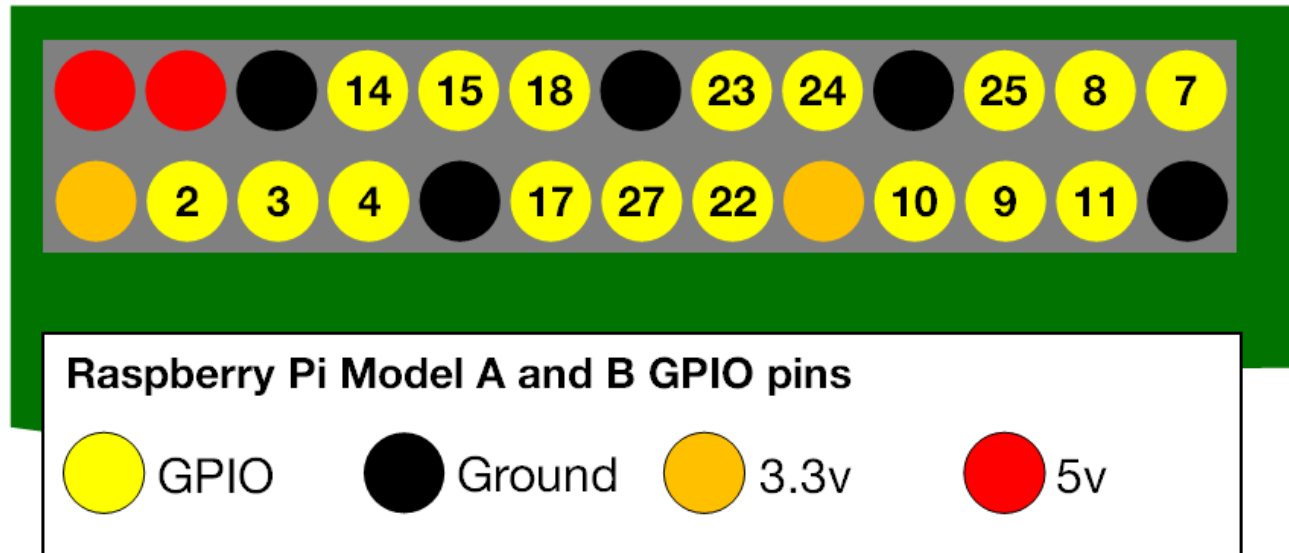
- * Digital – has two values: 0 and 1
 - * typically represented by the values of a physical quantity such as voltage (V).



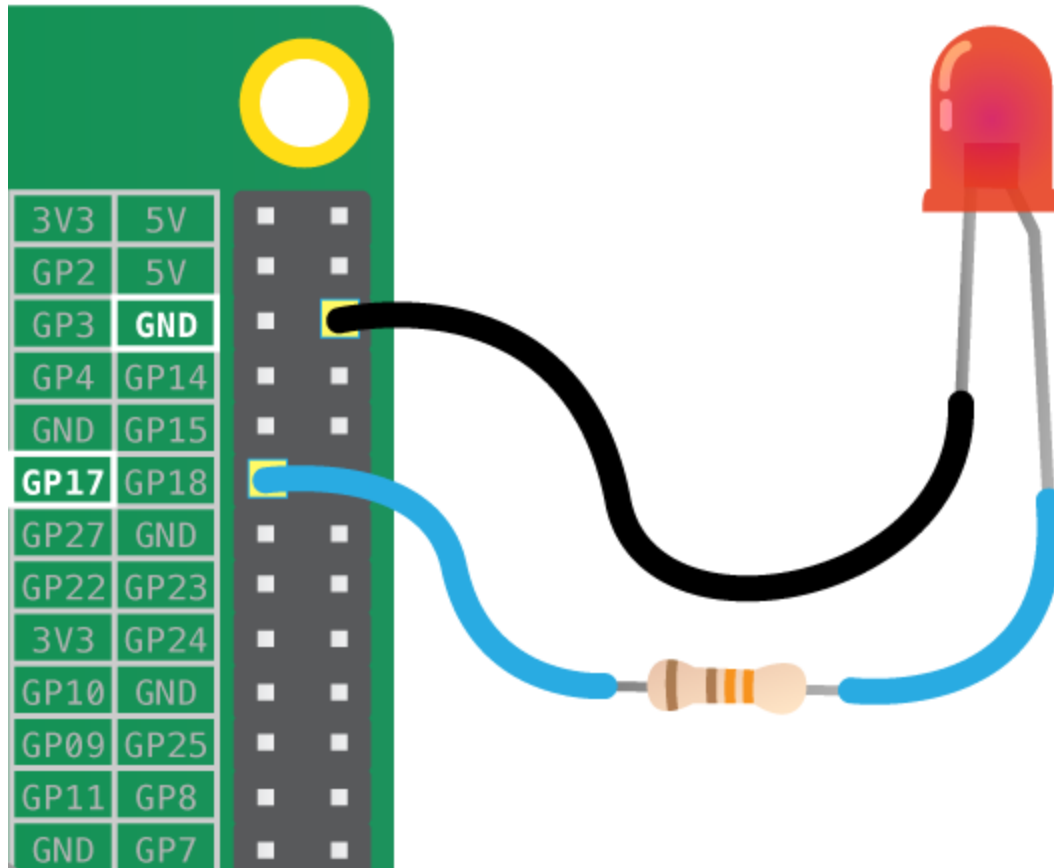
- * For example:
 - * 1 = LED On (+3.3 volts)
 - * 0 = LED Off (0 volts)

Raspberry Pi GPIO

- * GPIO = General Purpose Input-Output
 - * This is how we connect to the real world!

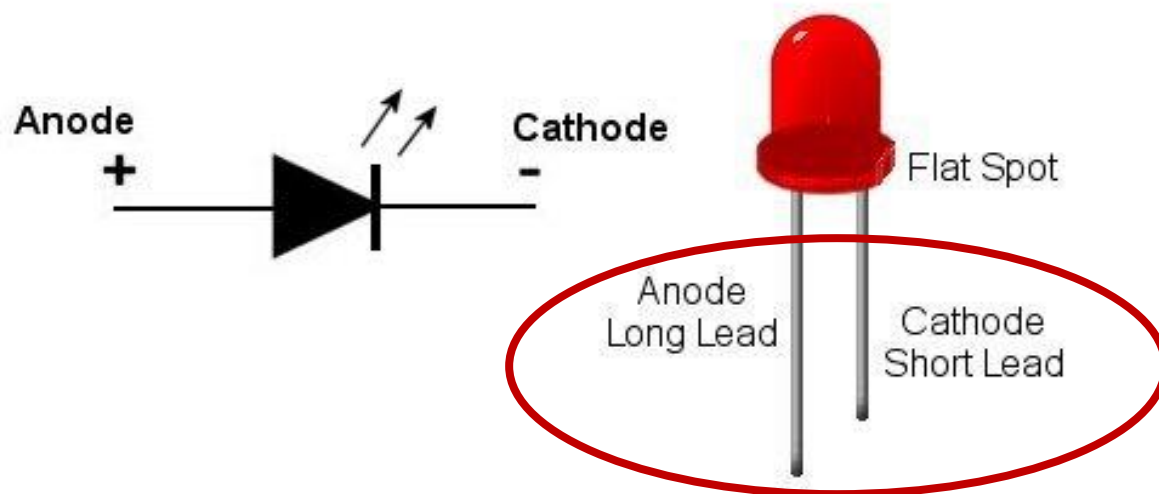


Example



Important Note on Diodes

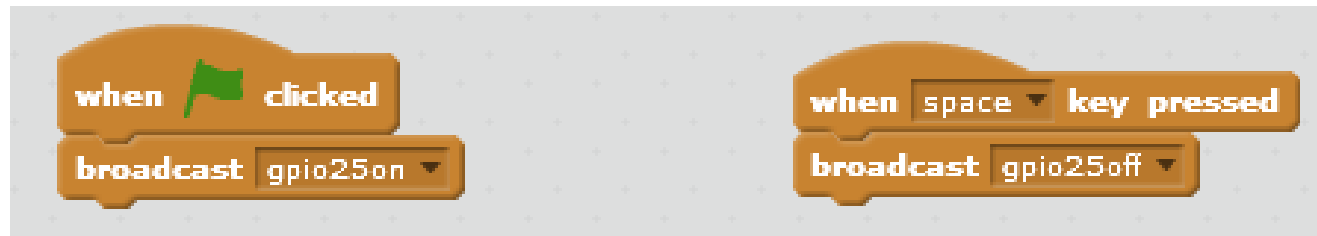
- * They have a “direction” or orientation



Pay attention to the length of the wires

Control of GPIO Pins in Scratch

- * For Pin 25 use a Broadcast block with the name:
 - * gpio25on – turns pin on
 - * Gpio25off – turns pin off

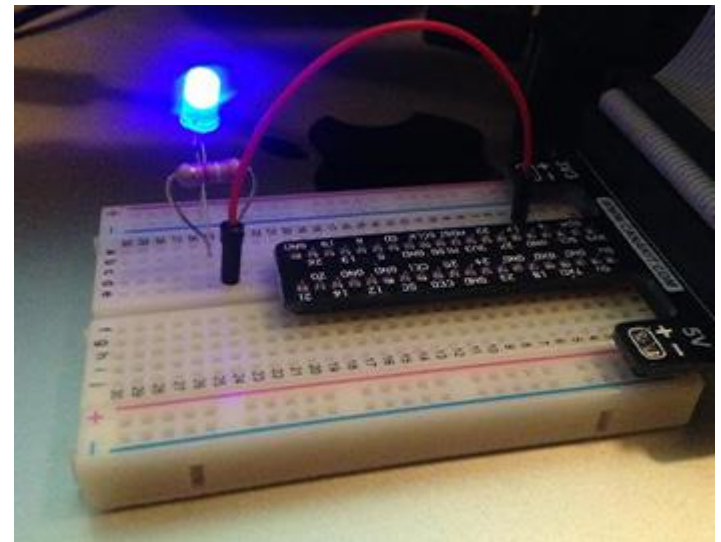


- * Clicking the Green flag turns on the pin
- * Pressing the space bar (key) turns it off

Open file LED25 and try it!

LEDs

- * Red – pin 25
 - * Test the light with File LED25
- * Blue – pin 23
 - * Test the light with file LED23
- * Green – pin 6
 - * Test the Light with File6



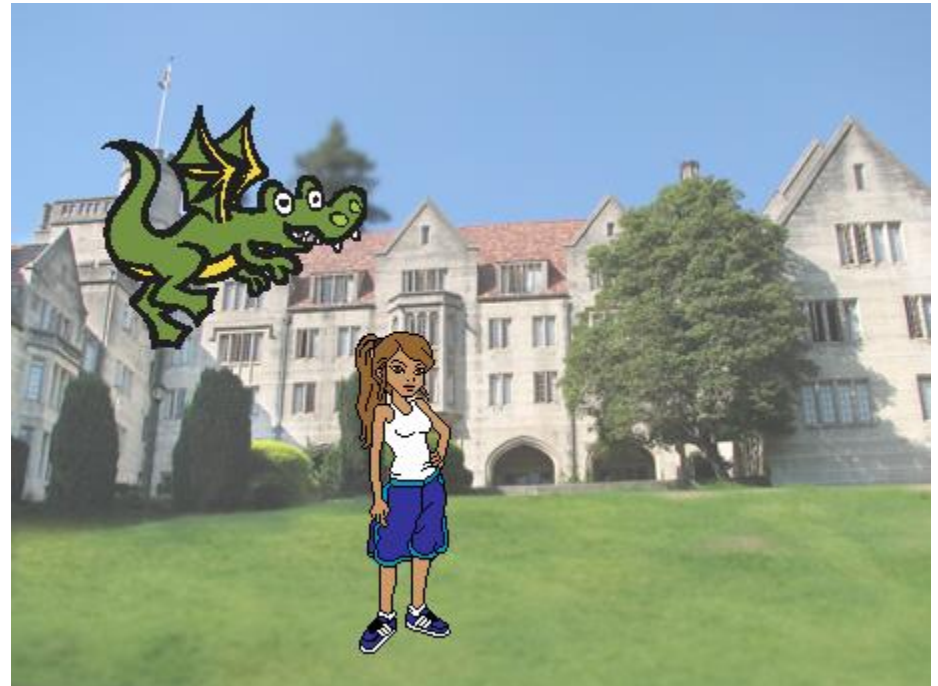
All files are in folder MPL-Steam

Let's (Raspberry) Jam!

The Girl with the Pet Dragon

- * Is it a good idea to have a pet dragon?
 - * Let's find out!
- * File: GirlWithDragon
- * When Red LED is on:
 - * Danger
- * When Green LED is on:
 - * Safe

Click the green flag
to see
what happens



Dragon Script

Danger - Fire!
Red LED on
Green LED off

It's safe now
Red LED off
Green LED on

```
when clicked
  switch costume to dragon
  forever
    play sound WolfHowl
    broadcast gpio6off
    broadcast gpio25on
    switch costume to dragon-fire
    wait 2 secs
    broadcast gpio25off
    switch costume to dragon
    broadcast gpio6on
    wait 2 secs

when space key pressed
  broadcast gpio25off
  broadcast gpio6off
  switch costume to dragon
```

The image shows a Scratch script with two event triggers. The first trigger is 'when clicked', which starts a 'forever' loop. Inside the loop, it plays a 'WolfHowl' sound, broadcasts 'gpio6off' and 'gpio25on', switches the costume to 'dragon-fire', waits 2 seconds, broadcasts 'gpio25off', switches the costume back to 'dragon', broadcasts 'gpio6on', and waits another 2 seconds. The second trigger is 'when space key pressed', which broadcasts 'gpio25off' and 'gpio6off', and switches the costume to 'dragon'. Blue arrows point from the text on the left to the 'broadcast gpio25on' and 'broadcast gpio25off' blocks in the script.

Script for Girl

Red LED on

```
when I receive gpio25on  
  play sound Scream-female  
  switch costume to girl3-running  
  move 100 steps
```

Danger - Fire!
Run!

Green LED on

```
when I receive gpio6on  
  switch costume to girl3-standing  
  point in direction -90  
  move 100 steps  
  point in direction 90
```

It's safe to
go back
now!

Dumb Fish Detector

- * They keep bumping into the walls of the fish tank!!!
- * Every time a fish hits a wall its' LED lights up!
- * File: DumbFishDetector
- * Challenge:
 - * Change the number of steps for each fish to change how often its' LED lights up!



Thank you

I hope it was fun!!!

<http://coderdojomac.org>