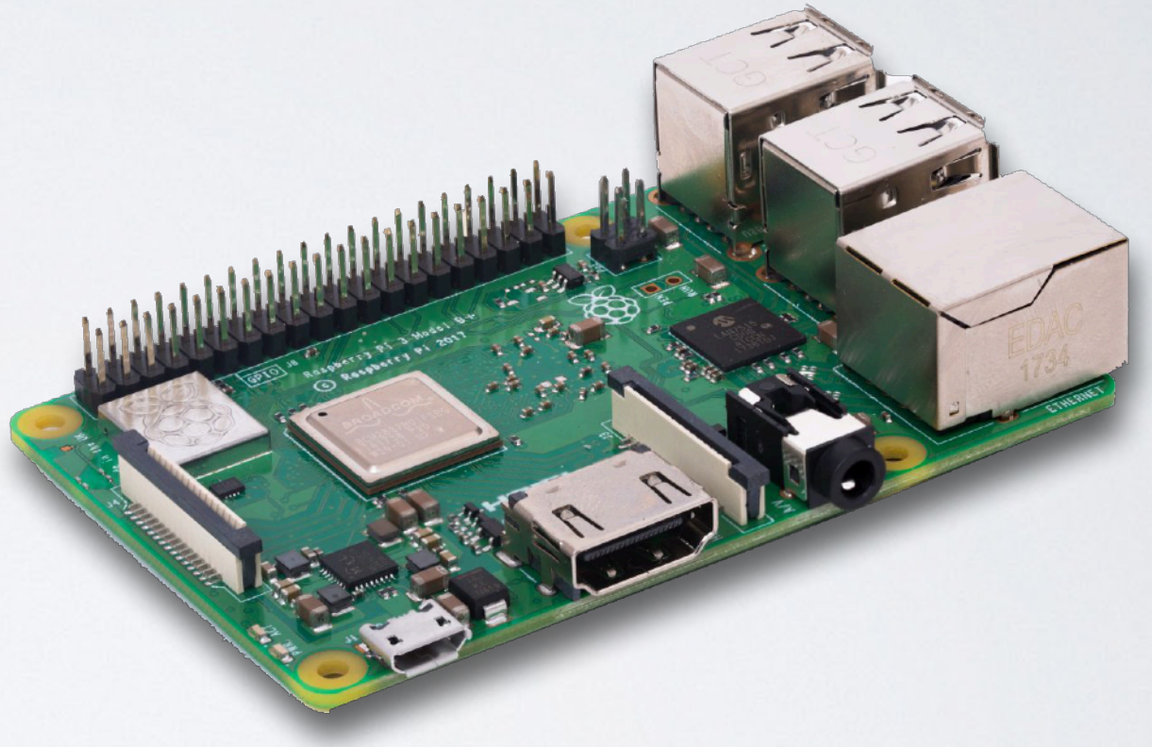
Tim Poulsen

Software Engineer

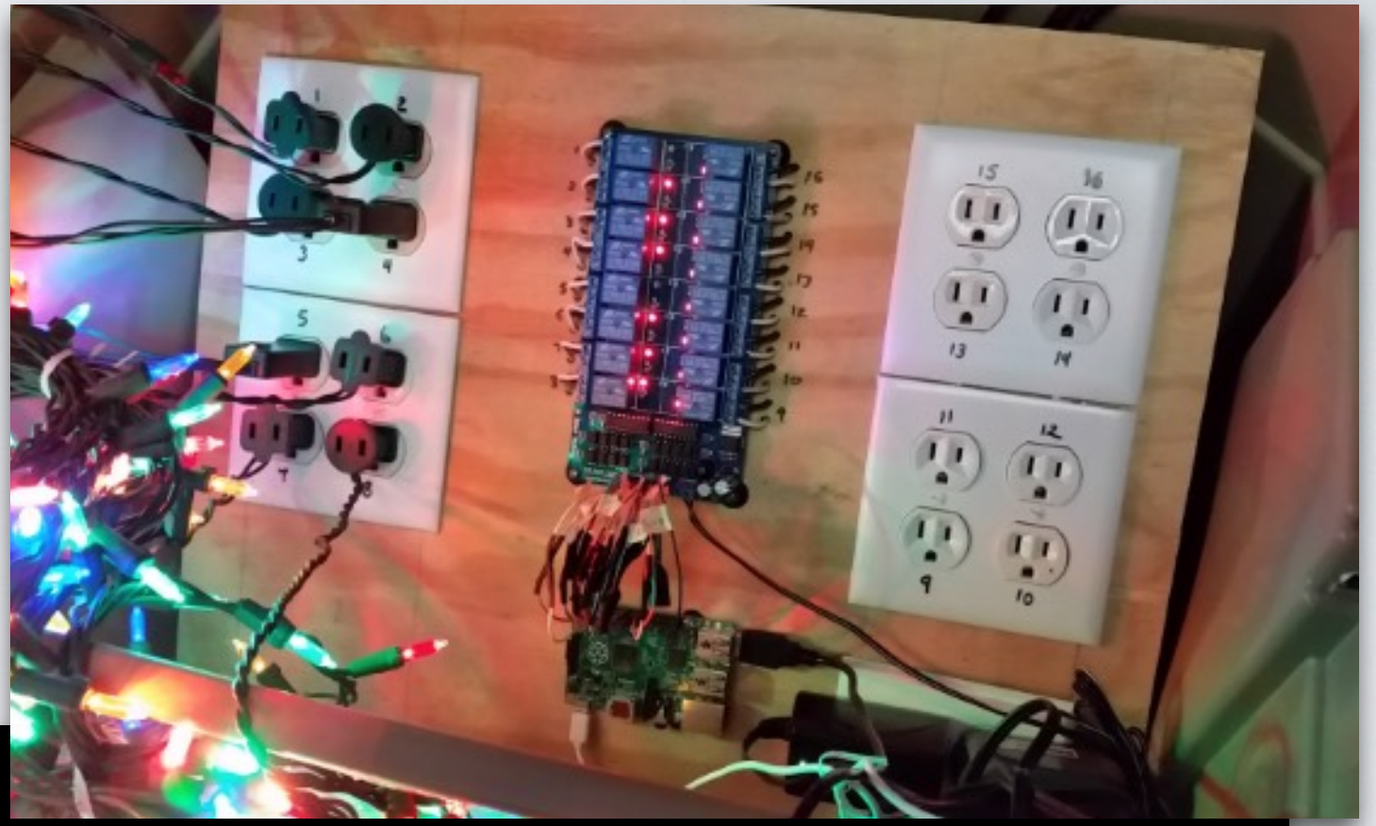
ACV Labs (R&D team)

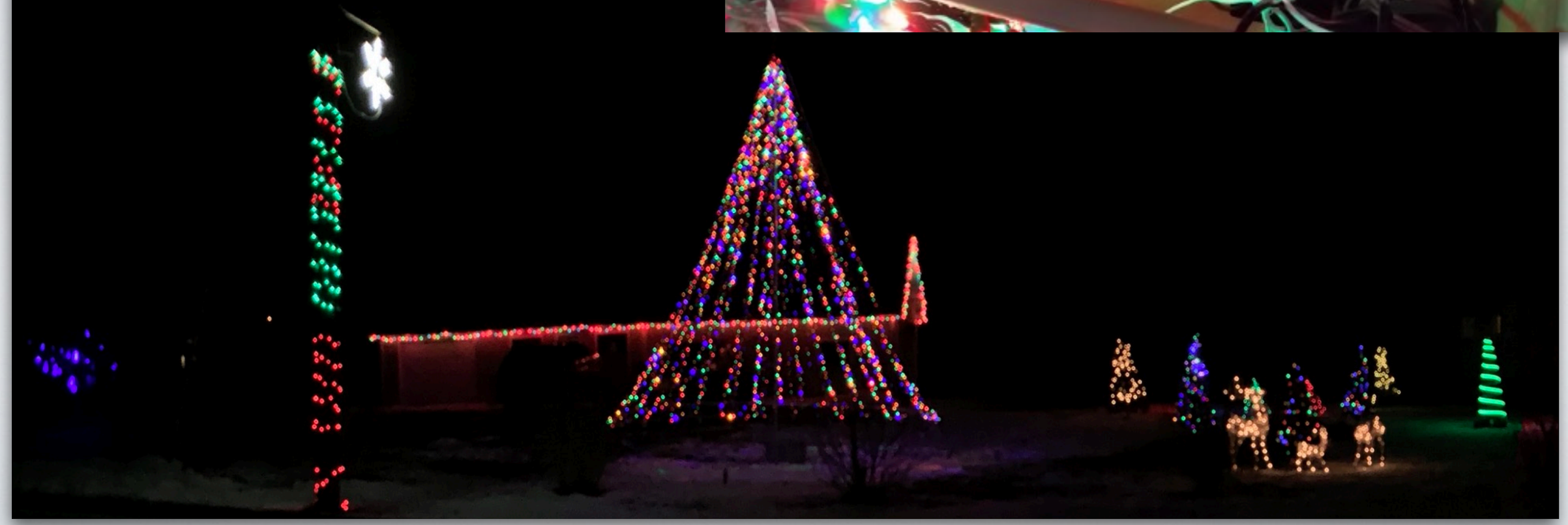
Raspberry Pi

Overview & Examples
Board components
Basic setup
Software dev
Resources



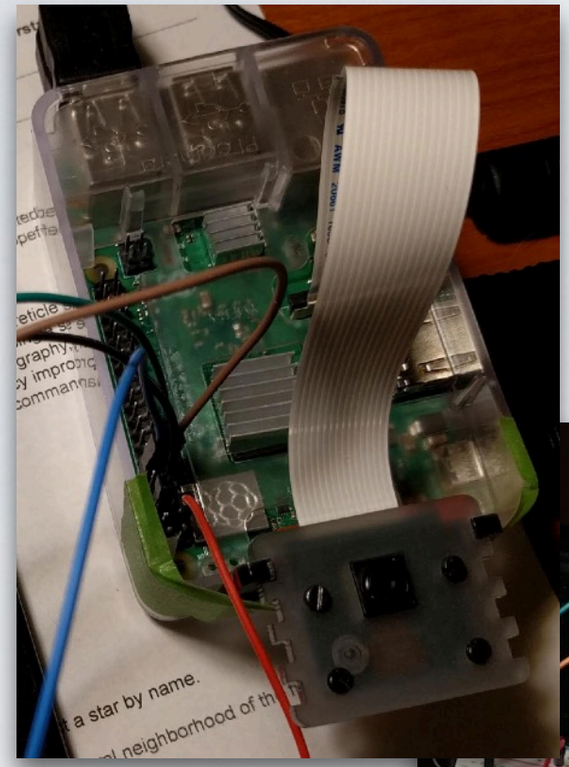
https://github.com/skypanther/PiLit

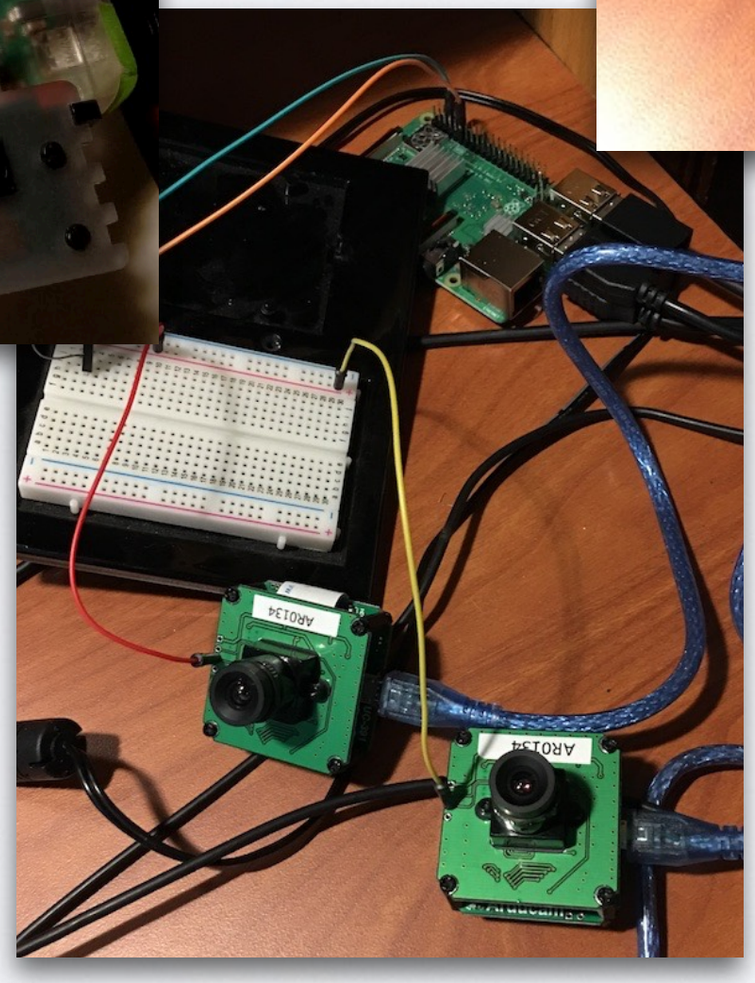


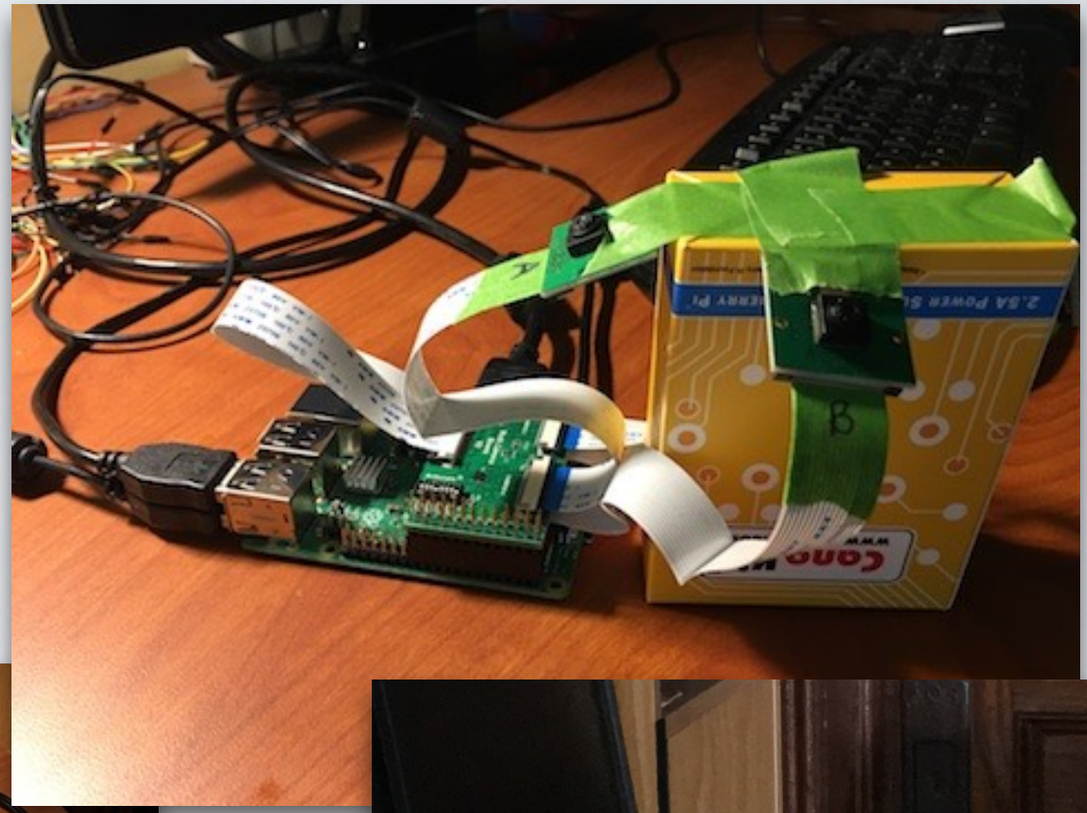


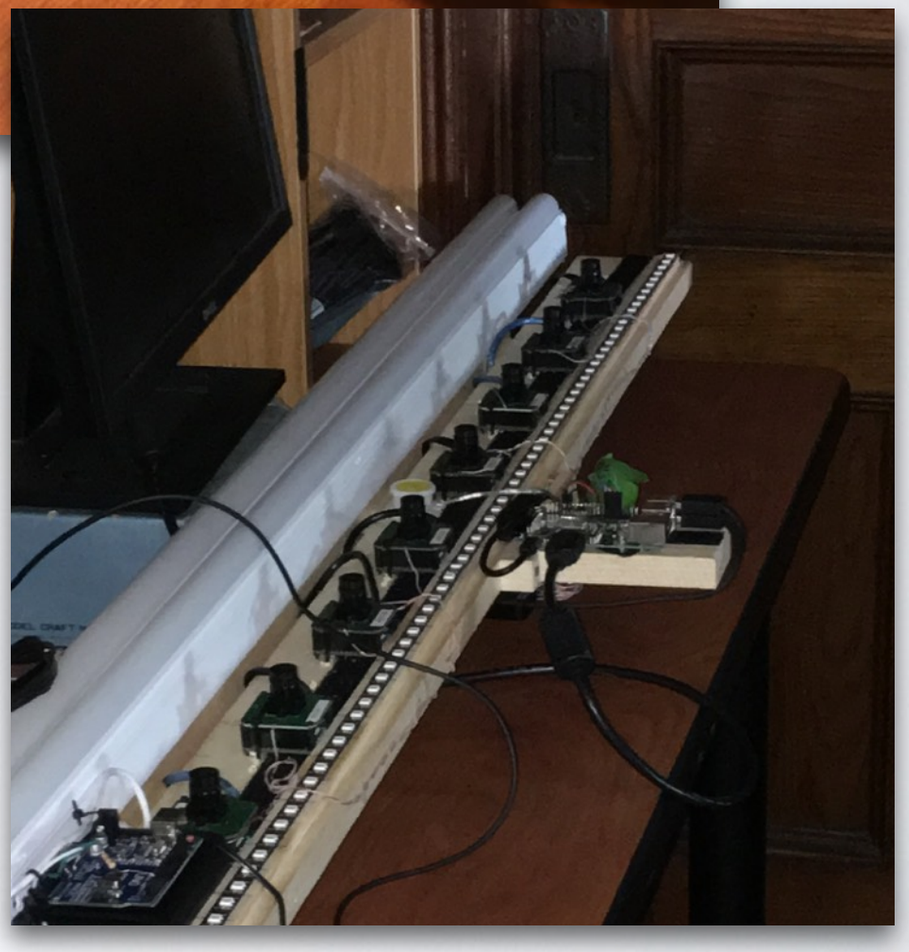
https://www.timpoulsen.com/2018/pi-birdcam.html

Camera controller board





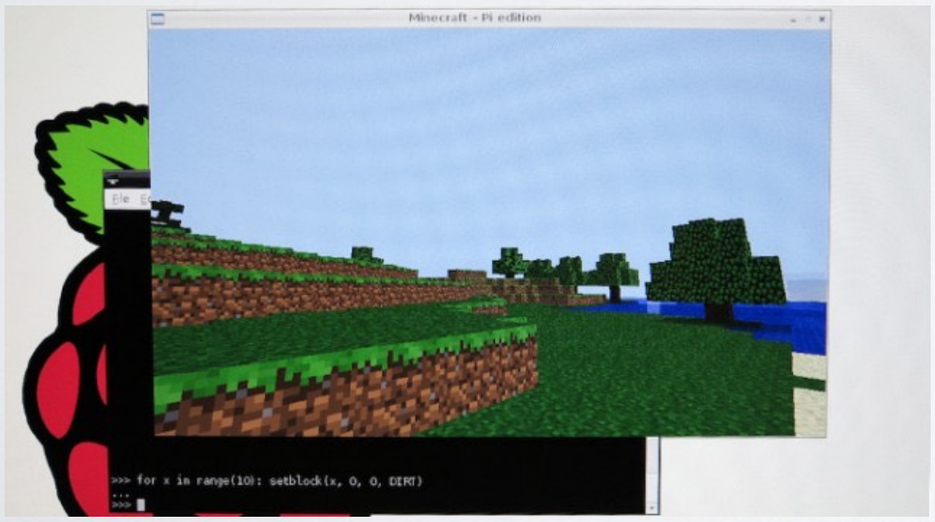




POPULAR PROJECTS

VPN

File server



Web server

RaspbiCast
(Chromecast)

AirPlay receiver

PI 3B+

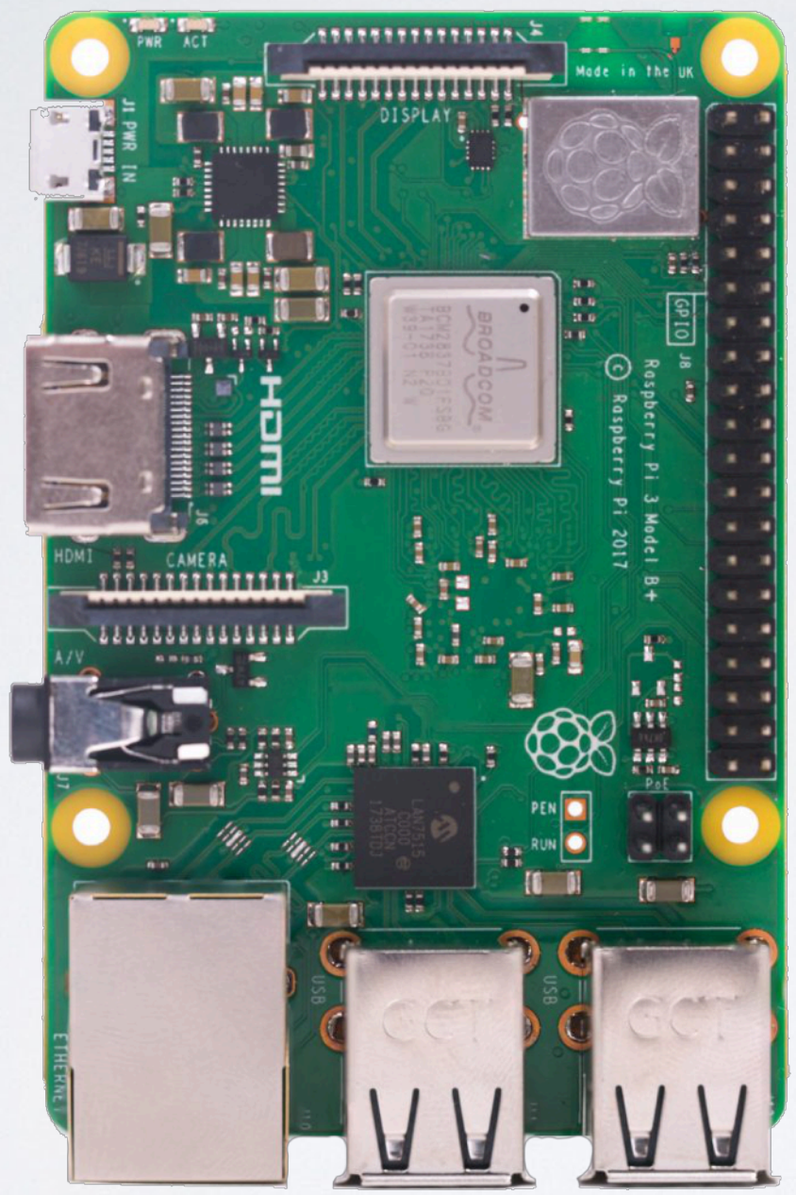
Micro SD slot (back side)

Power in (micro-USB)

HDMI

CSI camera

Stereo audio out



Gigabit Ethernet

4 x USB 2.0

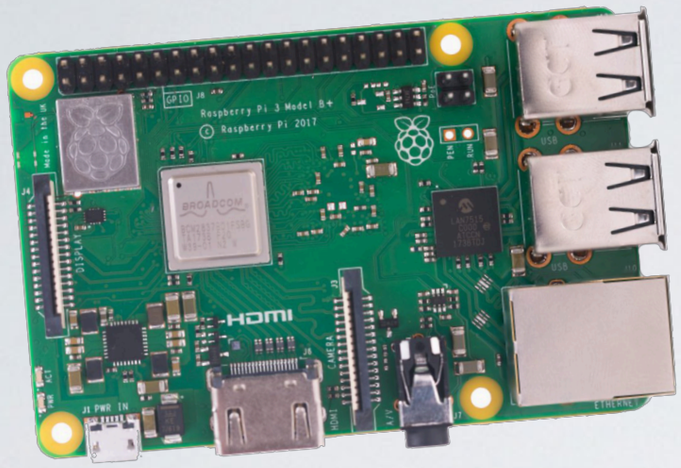
Broadcom BCM2837B0, Cortex-A53 (ARMv8) 64-bit SoC @ 1.4GHz

1GB LPDDR2 SDRAM

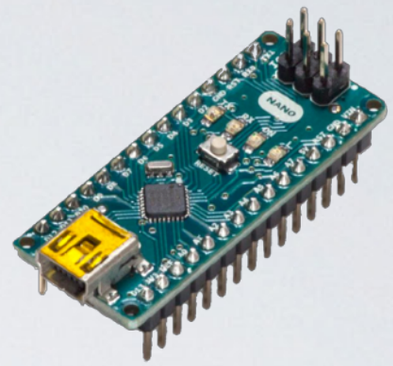
2.4GHz and 5GHz IEEE 802.11.b/g/n/ac

Bluetooth 4.2, BLE

GPIO, I2C, serial

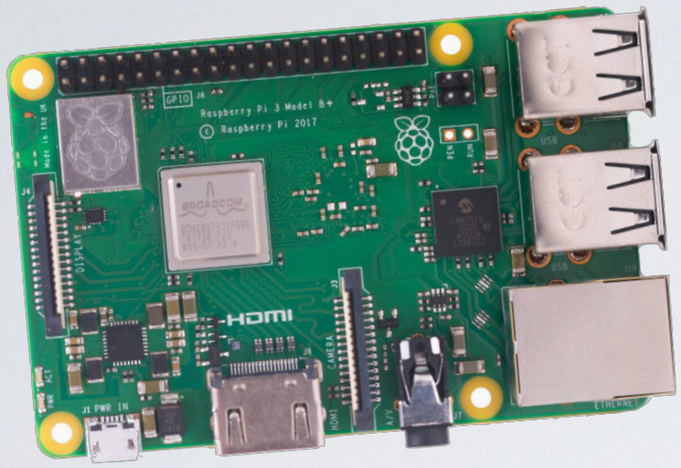


VS



- Full computer
- Full OS
- Peripheral ports, networking, HDMI, audio
- Best for:
    - Software-based projects
    - Complex projects

- CPU, RAM, GPIO
- No OS
- Requires separate computer for programming
- Best for:
    - Hardware-based projects
    - Simple / single-task projects
    - Real-time



VS Alternatives

- Widest hardware / add-on options
- Widest software / library options
- Most tutorials, blogs, community support
- The standard to which others are compared
- Various sub-types:
  - Pi 3B+ (standard)
  - Pi Zero / Pi Zero W

- BeagleBone, OrangePi, BananaPi, Tinker, ODROID, etc.
- Better hardware specs
- Wider OS options such as Android, full Windows 10 (not IoT core), etc.
- Fewer hardware / add-on options
- Fewer software / library options, more compatibility problems
- Limited community support and info

OS OPTIONS

- Raspbian (customized Debian distro)
  - *NOOBs - an installer, not an OS*
- Third-party provided Ubuntu, Windows 10 IoT Core, RISC OS, etc.
- Raspberry Pi Desktop
  - *Run Raspbian on a PC/Mac*
  - *VirtualBox or native install*

RASPBIAN OPTIONS

Raspbian Stretch with desktop and recommended software

Image with desktop and recommended software based on Debian Stretch

Version:	November 2018
Release date:	2018-11-13
Kernel version:	4.14
Release notes:	Link

Download Torrent | Download ZIP

SHA-256: 0ca644539fdaf4e19ec7cebf9e61c049b82ba45b1a21cdec91fa54bd59d660d2

Raspbian Stretch with desktop

Image with desktop based on Debian Stretch

Version:	November 2018
Release date:	2018-11-13
Kernel version:	4.14
Release notes:	Link

Download Torrent | Download ZIP

SHA-256: a121652937ccde1c2583fe77d1caec407f2cd248327df2901e4716649ac9bc97

Raspbian Stretch Lite

Minimal image based on Debian Stretch

Version:	November 2018
Release date:	2018-11-13
Kernel version:	4.14
Release notes:	Link

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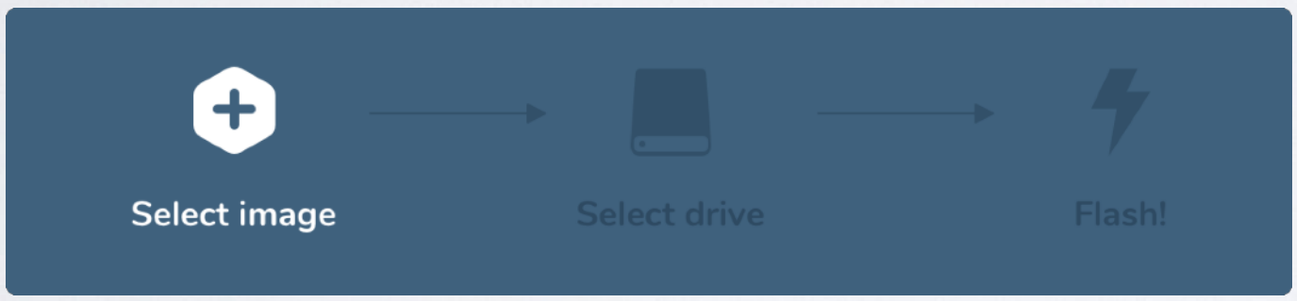
SHA-256: 47ef1b2501d0e5002675a50b6868074e693f78829822eef64f3878487953234d

OS SETUP

1. Download OS "image" .img file

2. Copy to SD card with `dd` or Etcher

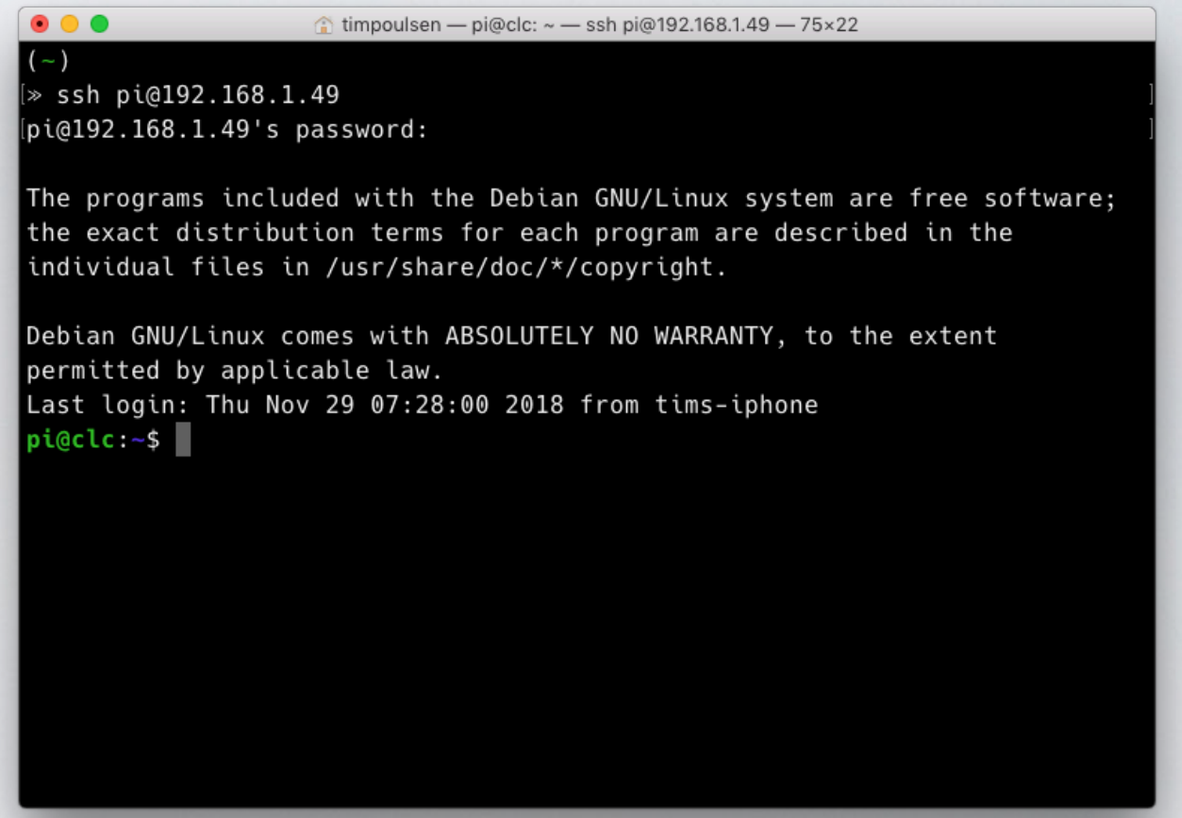


Etcher app - https://www.balena.io/etcher/

3. Insert in Pi and boot

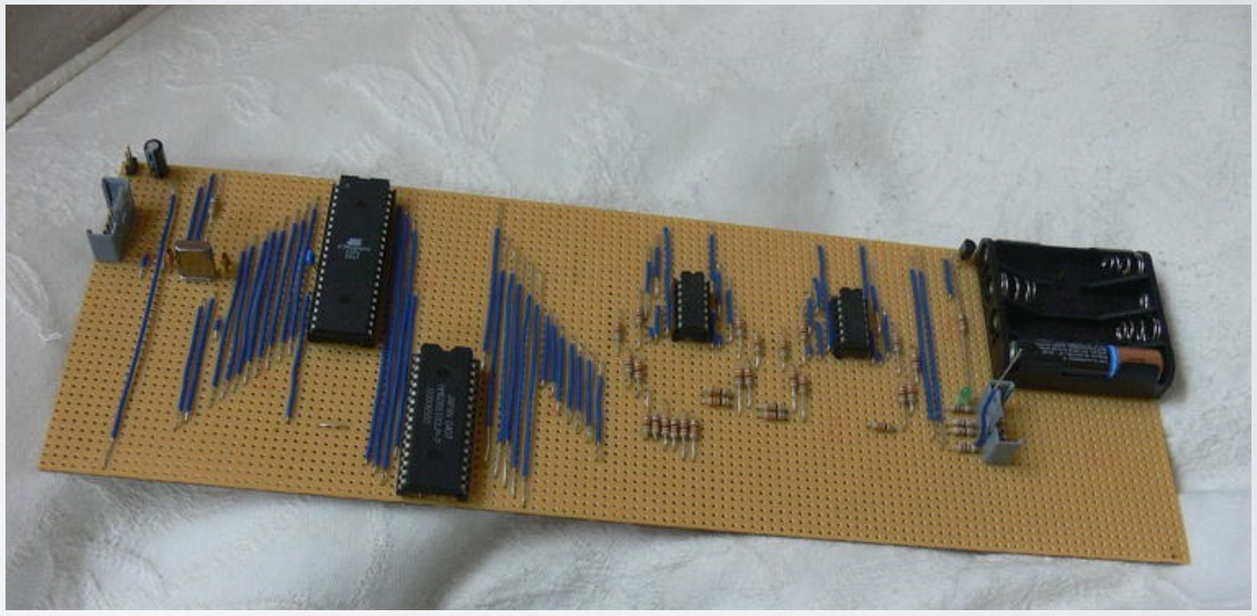
HARDWARE ACCESS

- Local
  - USB keyboard & mouse, HDMI monitor
- Remote / headless
  - ssh
  - Enabled by default in current Raspbian builds



EARLY VISION

- Computer on which kids could learn programming
- Inspired by Acorn's BBC Micro
- Meant to boot directly to a Python prompt
- The "Pi" actually comes from "Python"
- Thus, some bias towards Python in the ecosystem



DEV ENVIRONMENT

(BUILT-IN)

- Python 2.x / 3.x
- C
- C++
- Java
- Scratch
- Ruby
- Wolfram language
- SonicPi
- Git

DEV ENVIRONMENT

(OTHERS)

- Node
- Go
- Kotlin
- Haskell
- Smalltalk

  (Squeak built-in, but needs some add-ons)
- others…

IDEs

Pre-installed:

- Thonny (Python)
- Geany (multiple)
- BlueJ (Java)
- Greenfoot (Java)
- Mathematica
- Node-RED
- Scratch

Installable:

- VS Code - https://code.headmelted.com/
- Spyder
- Ninja-IDE
- Lazarus
- lots more…

PYTHON LIBRARIES

Pre-installed:

- RPi.GPIO
- GPIO Zero
- PiCamera

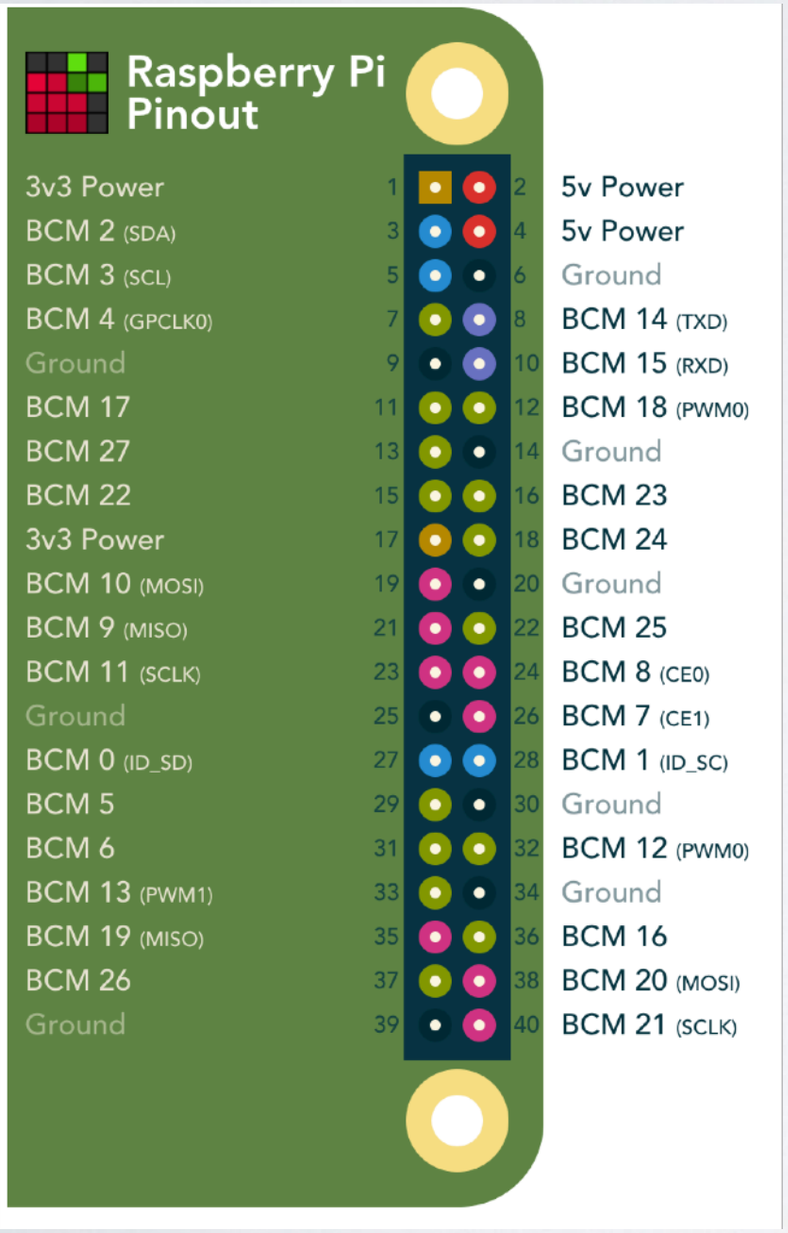
On Raspbian Stretch pip looks here before PyPI

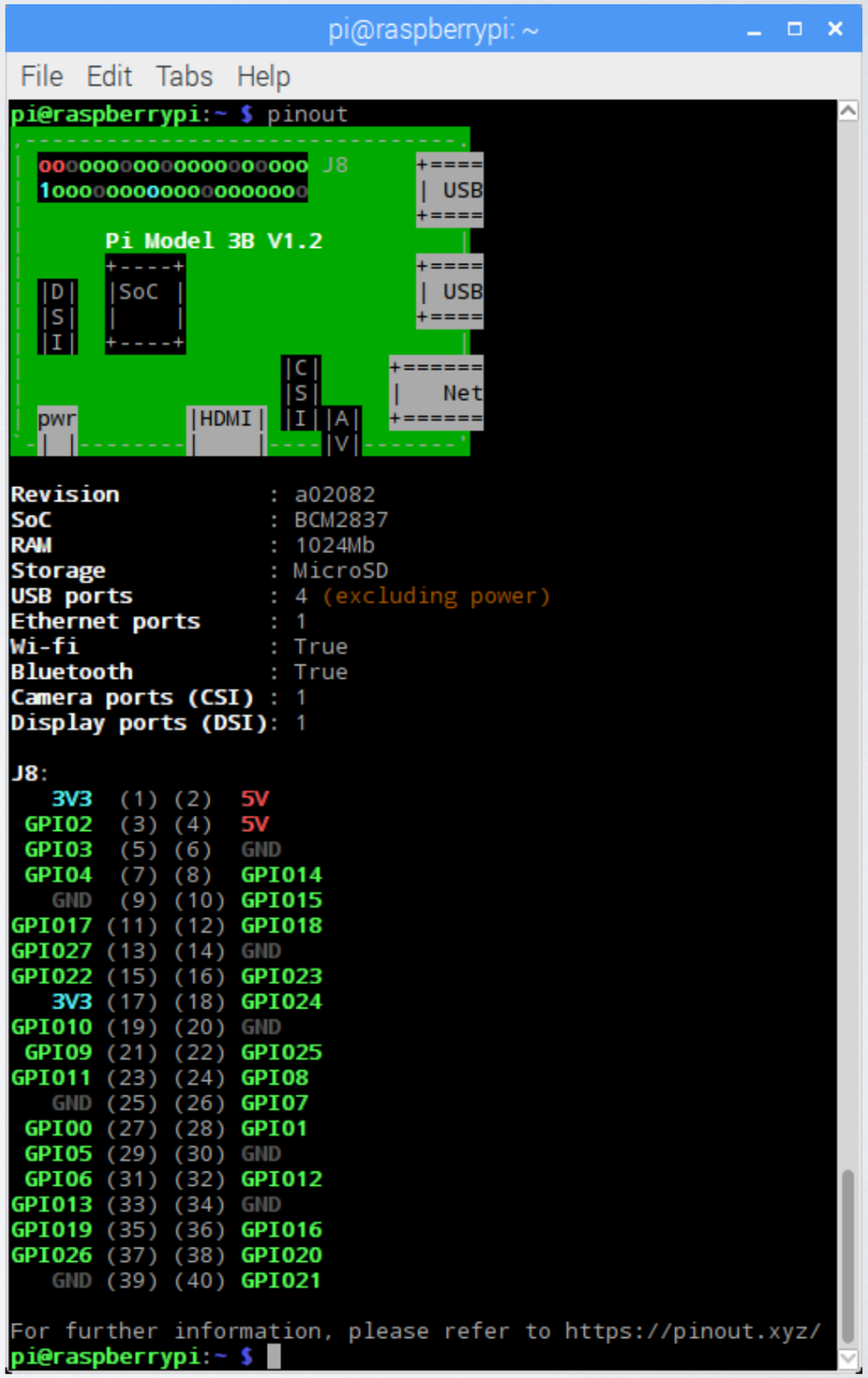
Installable:

- Any Python-only library
- Or, any that will compile for ARM
- www.piwheels.org - precompiled packages
  - e.g. OpenCV, Tensorflow, WiringPi, etc.

GPIO / I2C / SERIAL

https://pinout.xyz/



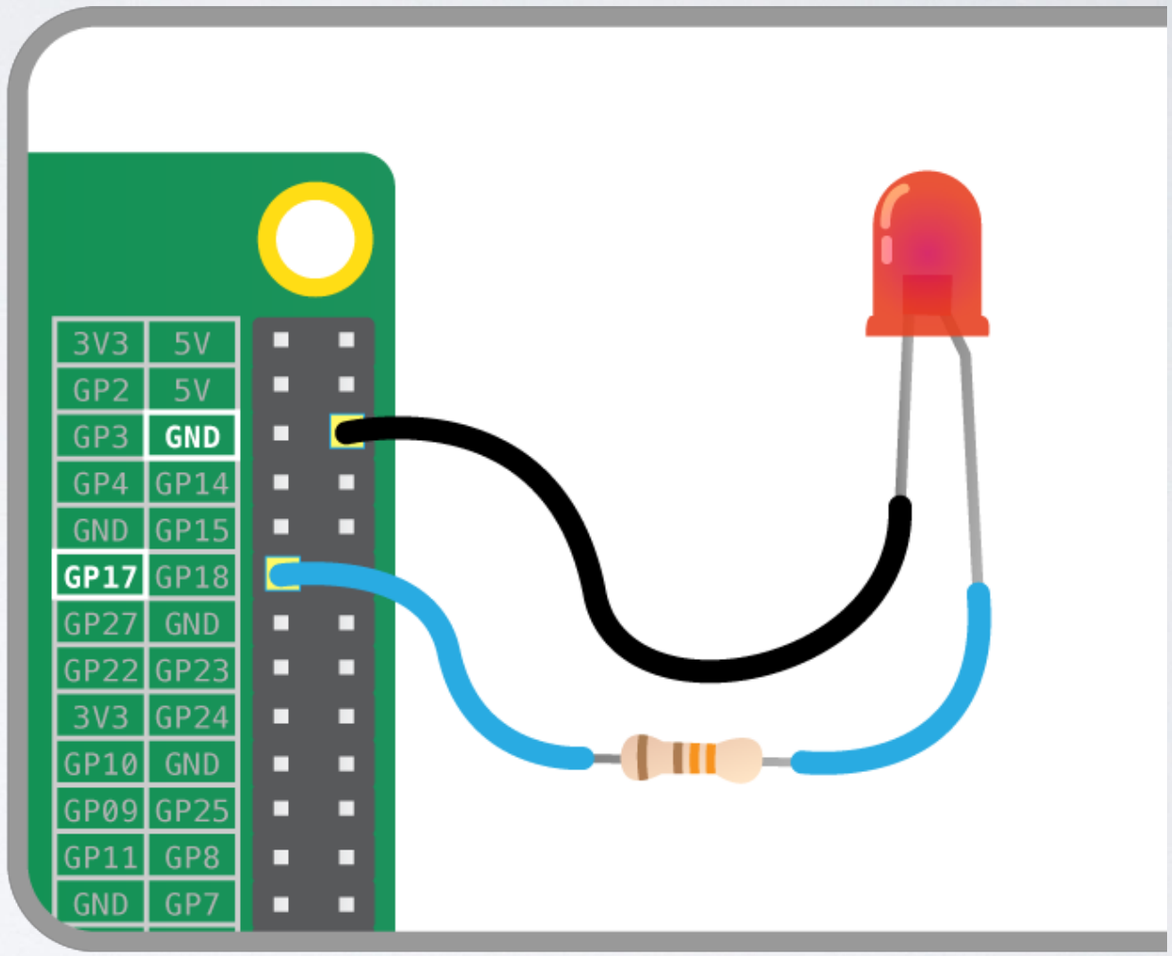


GPIO BASICS

```
from gpiozero import LED
from time import sleep

red = LED(17)

while True:
    red.on()
    sleep(1)
    red.off()
    sleep(1)
```



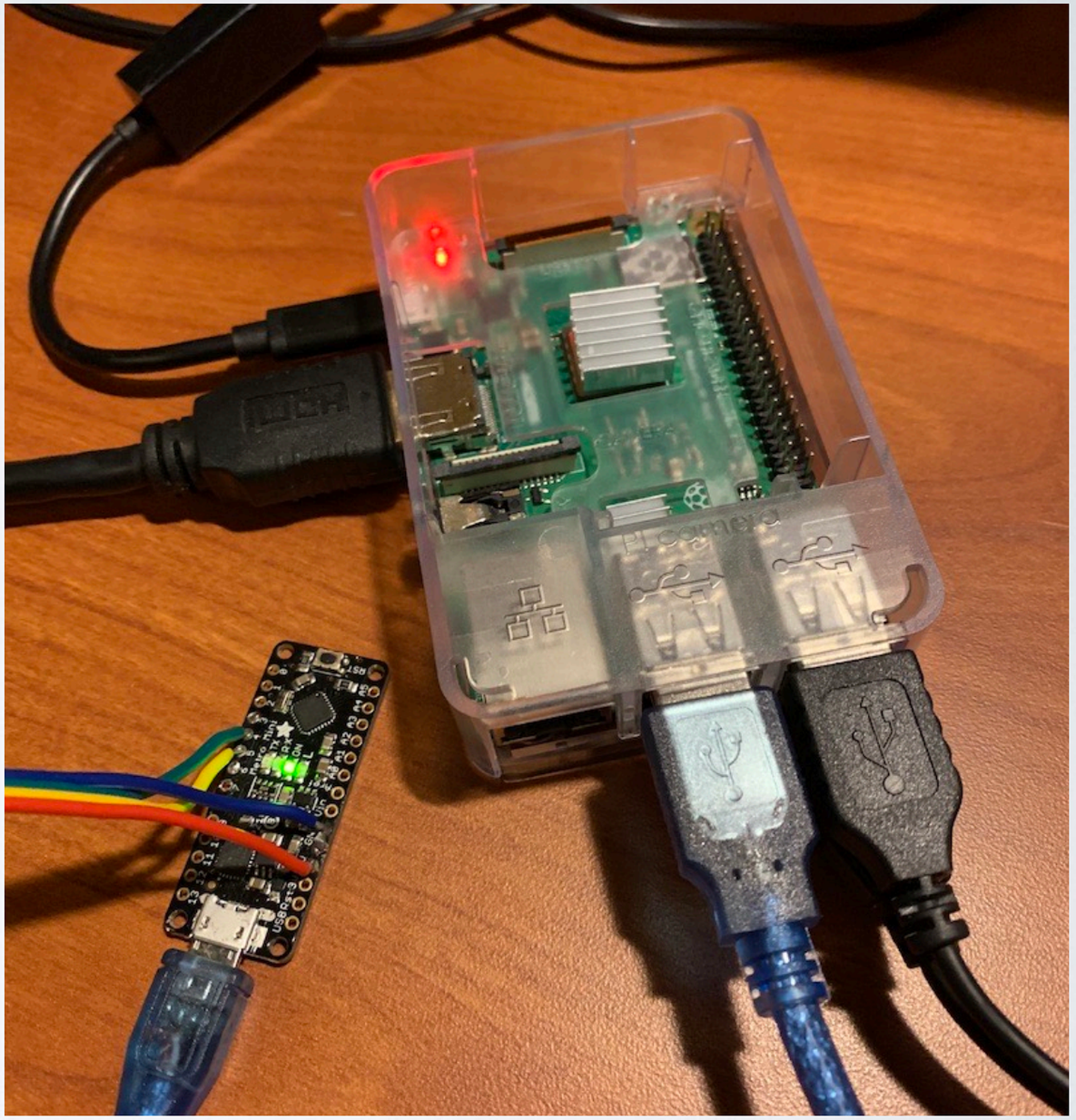
SERIAL OVER USB

```
import serial

# open serial port
ser = serial.Serial('/dev/ttyUSB0')

# write a string
ser.write(b'hello')

# close port
ser.close()
```

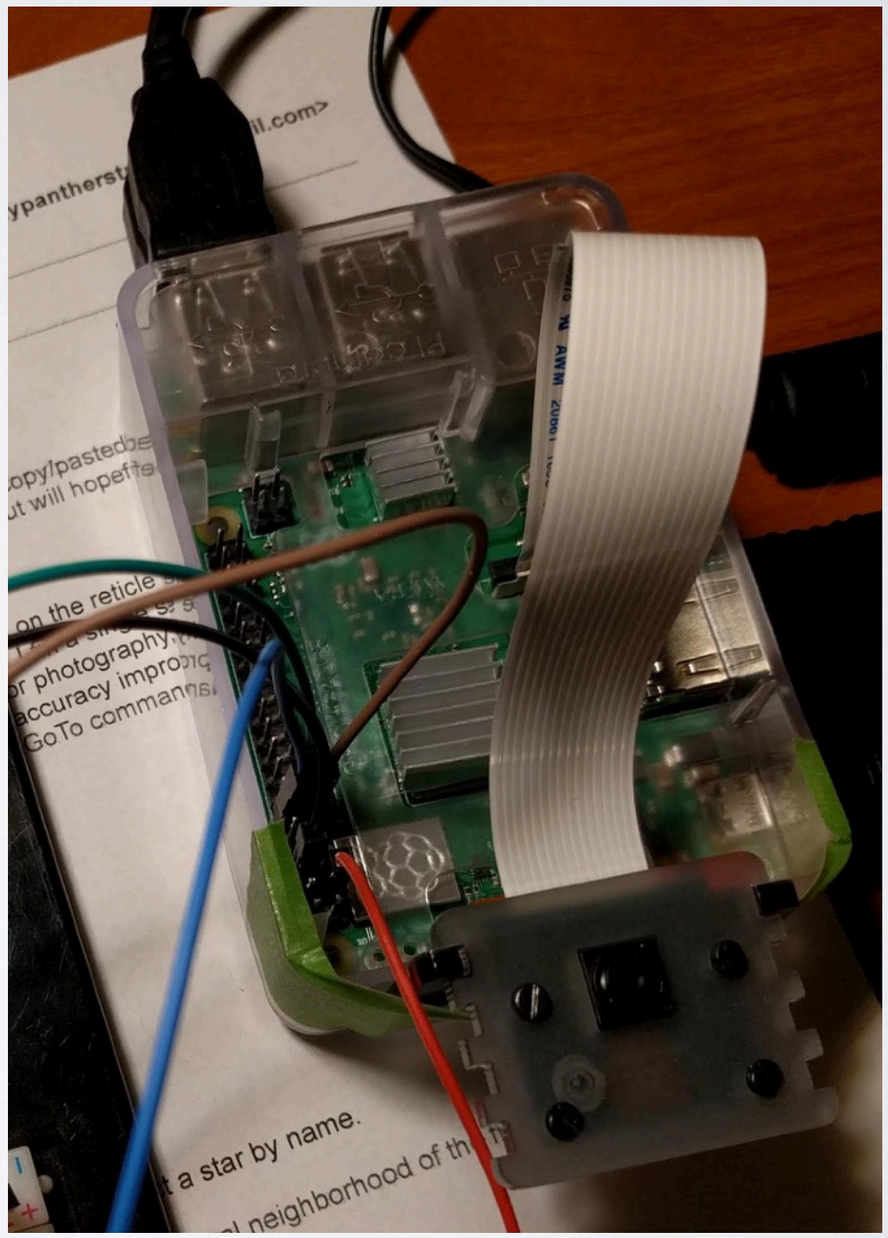


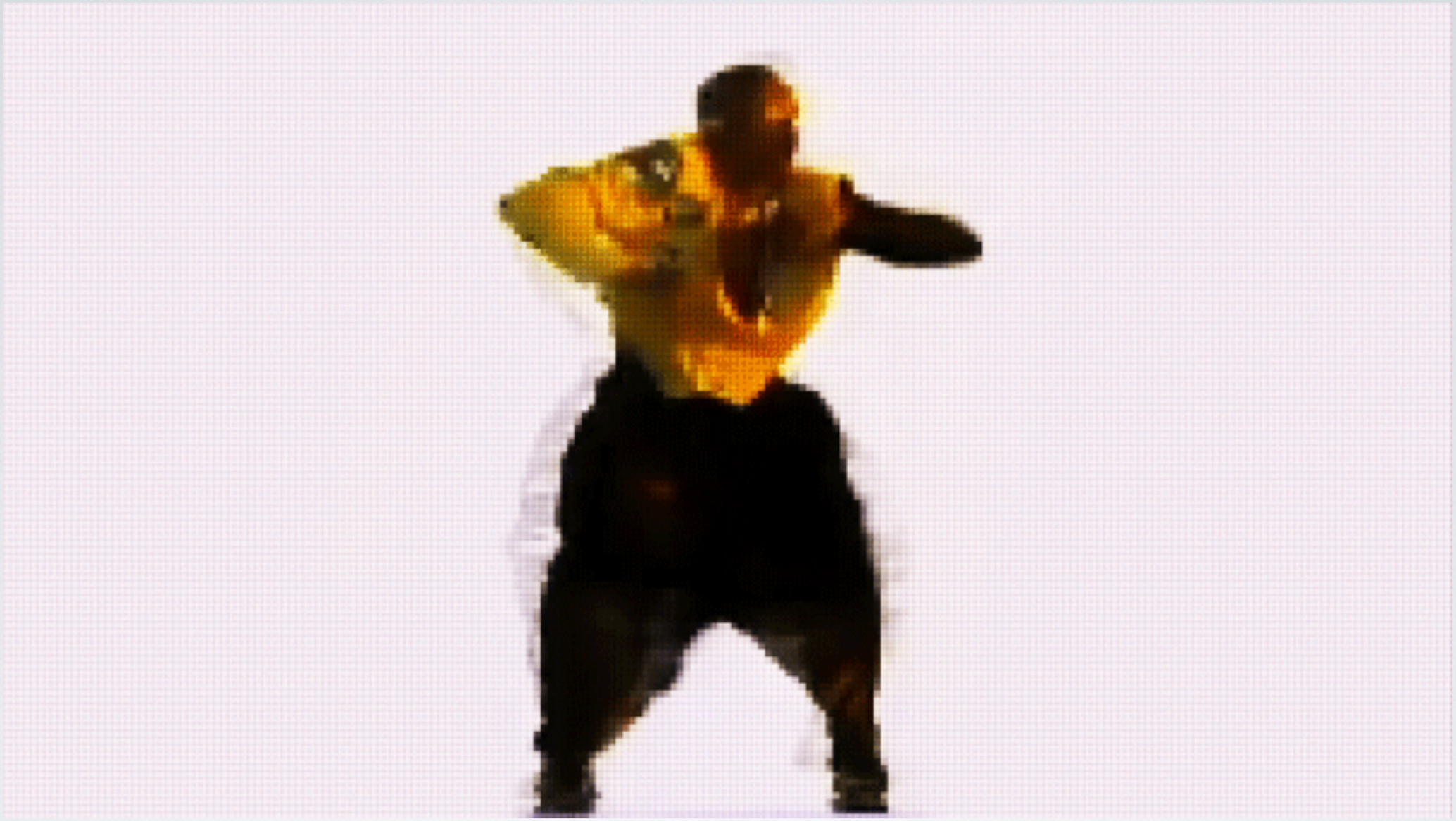
PiCAMERA

```
from picamera import PiCamera
from time import sleep

camera = PiCamera()
camera.resolution = (1024, 768)
camera.start_preview()

# Camera warm-up time
sleep(2)
camera.capture('foo.jpg')
```





DEMO TIME

THANKS!

- timpoulsen.com
- github.com/skypanther
- @skypanther
- www.linkedin.com/in/timpoulsen