Designing Interfaces

February 21, 2021

INTERACTION FIRST

S K E T C H - A - M O V E

Anab Jain and Louise Klinker. 2004. https://www.youtube.com/watch?v=muktpr3z

MATRIX PING PONG

Kasou Taishou 2003. *https://superflux.in/index.php/work/sketch-a-move/#*

THIS SLIDE IS HERE

TO REMIND WENDY

TO START ZOOM RECORDING

AND TRANSCRIPTION

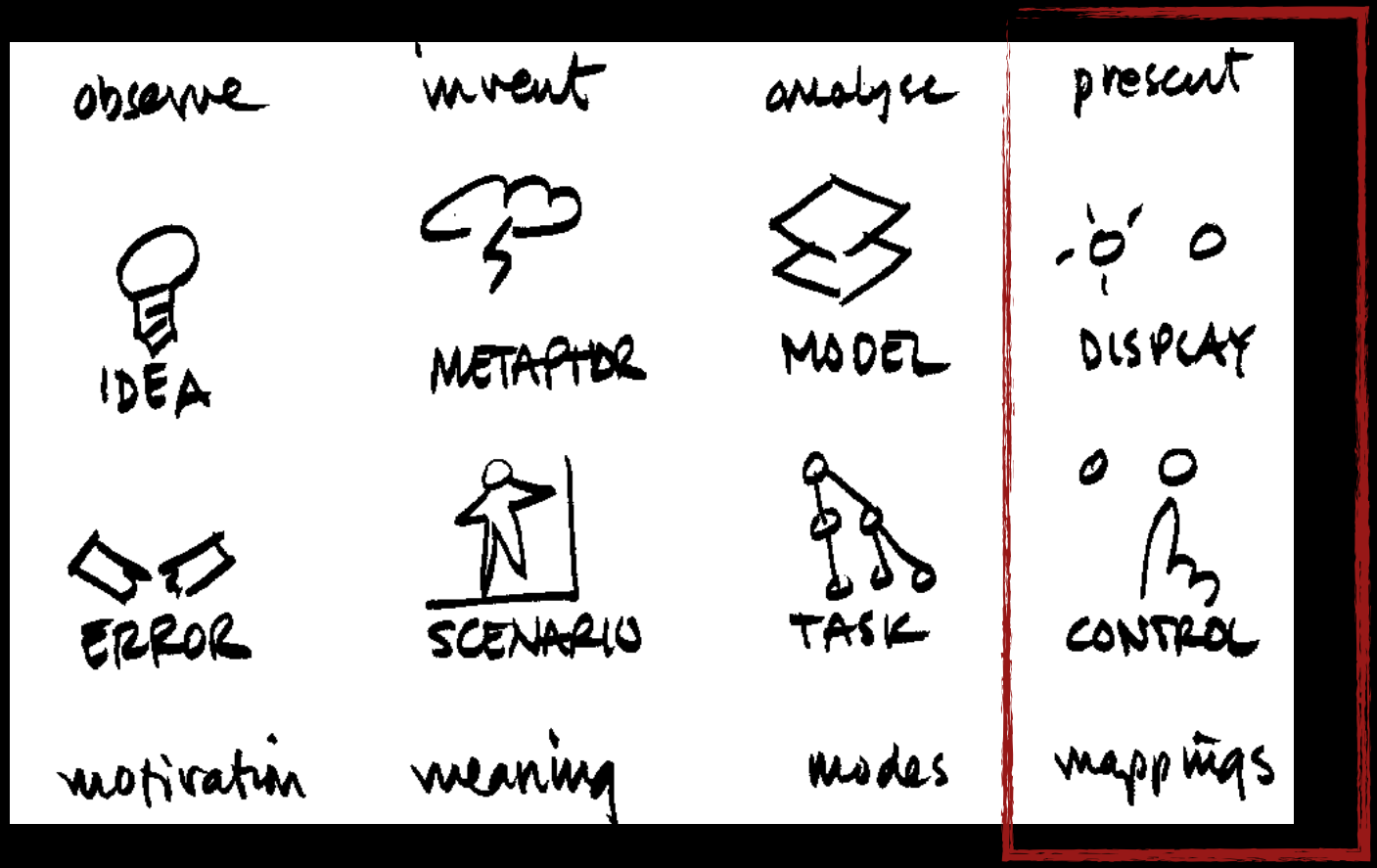
SOME VIDEOS FOR INSPIRATION

LAB STAR NOMINATIONS?

DESIGNING INTERFACES

WHAT COLOR SHOULD THE LEDS ON THIS INTERFACE BE?

INTERFACES ARE THE MOST VISIBLE ASPECTS OF THE INTERACTION DESIGN



Verplank Diagram, from Klemmer, S.R., Verplank, B., & Ju, W. (2005). Teaching embodied interaction design practice. Designing User Experiences '05.

ACTORS, HAIRDOS & VIDEOTAPE - INFORMANCE DESIGN

Using performance techniques in multi-disciplinary, observation based design

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ABSTRACT

We have been developing a visualisation technique that we call *Informance Design*. We render scenarios as plays and interactive environments. Designer "actors" role-play as users with simple prototypes employed as "props". These performances open up informed dialogues between designers and an audience, to further explore the design issues raised. The use of performance techniques such as improvisation can promote multi-disciplinary, collaborative design work in ways that are as much visceral and experiential as intellectual and reflective. *Informances*, like user testing, are enactive and evaluative. Unlike user testing, they are intended to explore design ideas in ways that are generative rather than analytic.

KEYWORDS: collaborative design, iterative design, participatory design, user-centred design, user interface design, user observations, Wizard of Oz, role-play, scenarios, storyboards, rapid prototyping

INTRODUCTION

One of the key problems for user interface designers who employ a methodology based on user observations [2] is readers must understand the particular visual shorthand being used. It can be difficult to express complexity in this format, often resulting in simplified, stereotypical portrayals of environments and users.

We are interested in exploring ways in which aspects of performance might help designers develop new techniques that supplement current techniques like storyboarding. In particular, we believe that;

- Performance could allow designers to *imagine* better. Enactive, experiential behaviour might spark imagination and creativity in ways that may not occur "at the drawing board".
- Performance could allow designers to *empathise* better with the people they are designing for. In a re-enactive situation they are faced with having to think through the implications of a new design idea "in someone else's shoes"
- Designers could *communicate* better with *peers*, *clients* and perhaps *users* through the higher bandwidth provided by performance. A shared perspective is offered to the audience members of any performance that can form a common platform for further discussion.
- Improvisation techniques and role-playing are

INTERVAL RESEARCH'S CARTOON HOUSE (CIRCA 1995)

INTERACTION IS IMMATERIAL

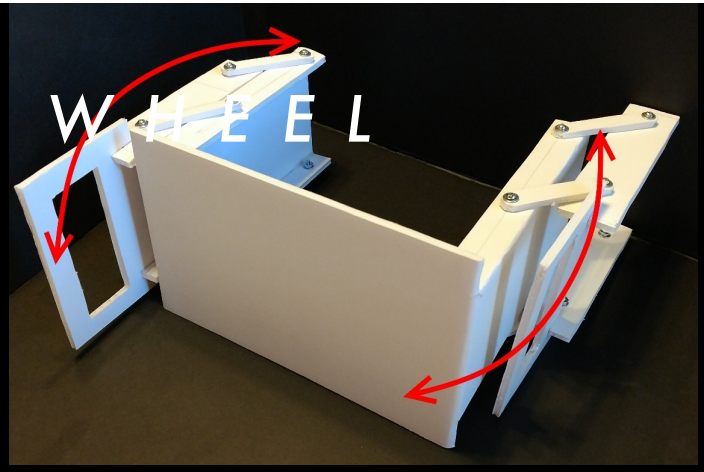
BUT INTERFACES AREN'T

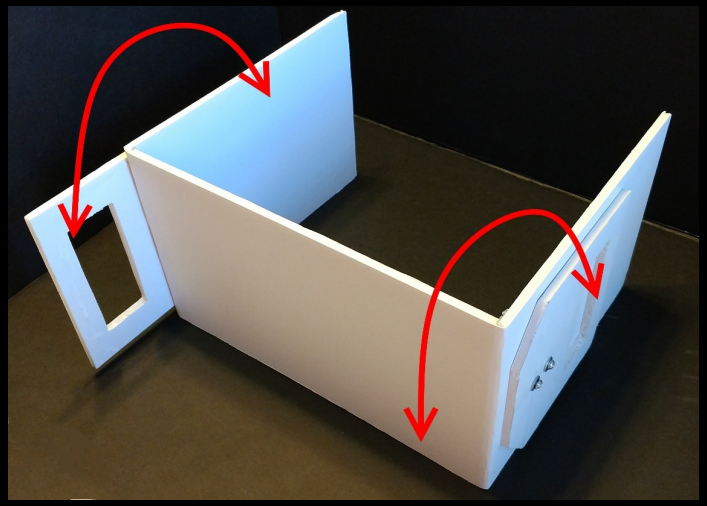
INTERACTION IS IMMATERIAL

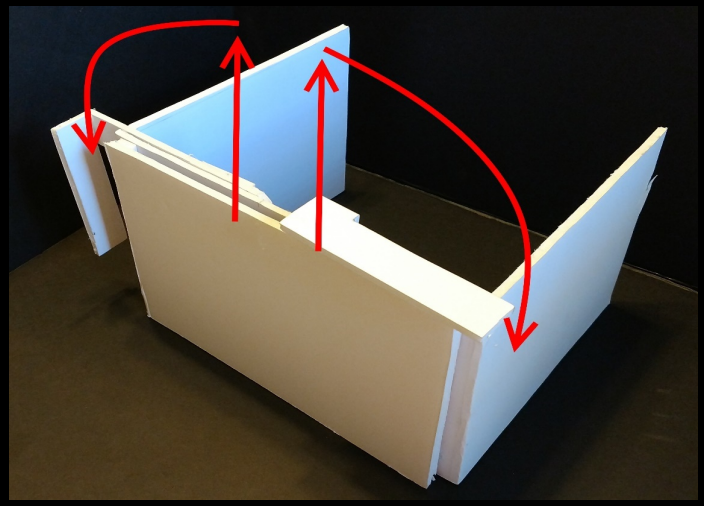
BUT INTERFACES AREN'T

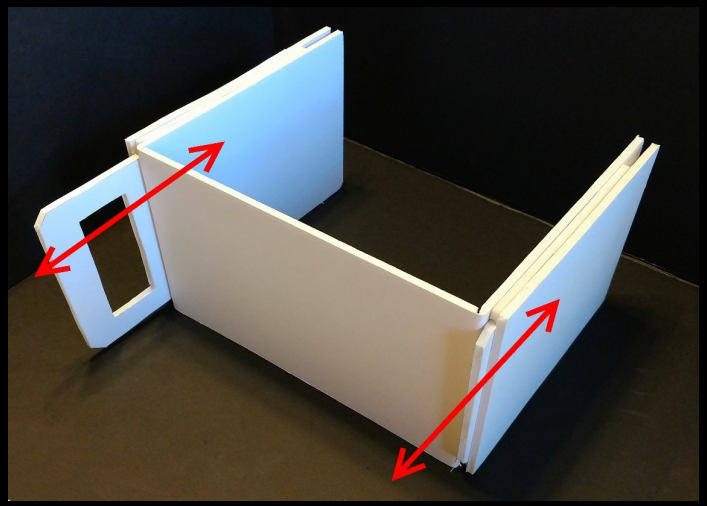
ROBOT STEERING WHEEL

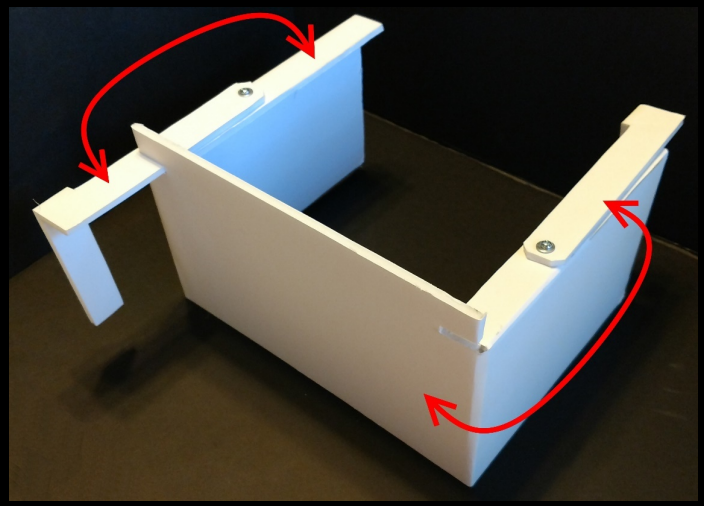
ROBOT STEERING WHEEL











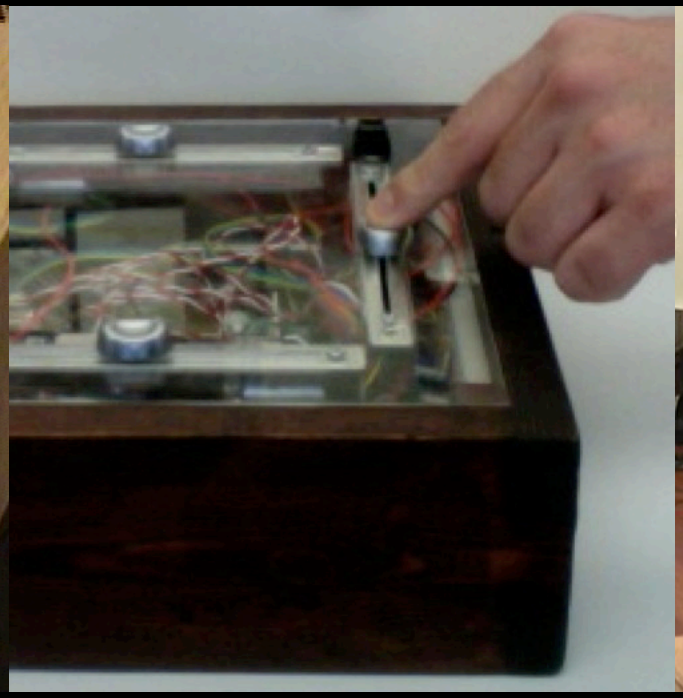
ROBOT STEERING WHEEL

S A T E L L I T E C C R M A

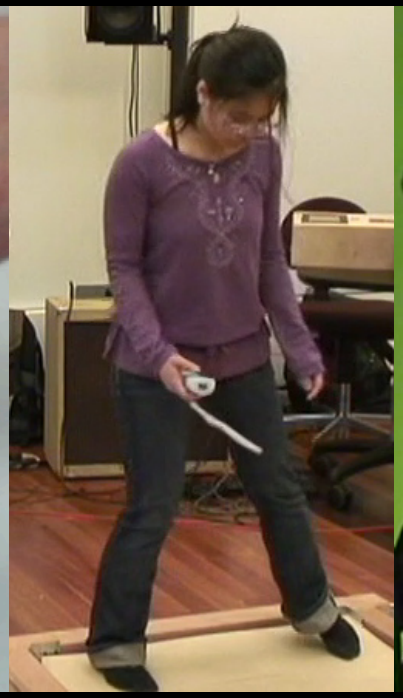
Berdahl, E. & Ju, W. (2017) Satellite CCRMA: A Musical Interaction and Sound Synthesis Platform. In Jensenius, A. & Lyons, M. (eds.) New Interfaces for Musical Expression Reader. Springer-Verlag 2017.

S A T E L L I T E C C R M A

Quadrofeelia



Sound Flinger



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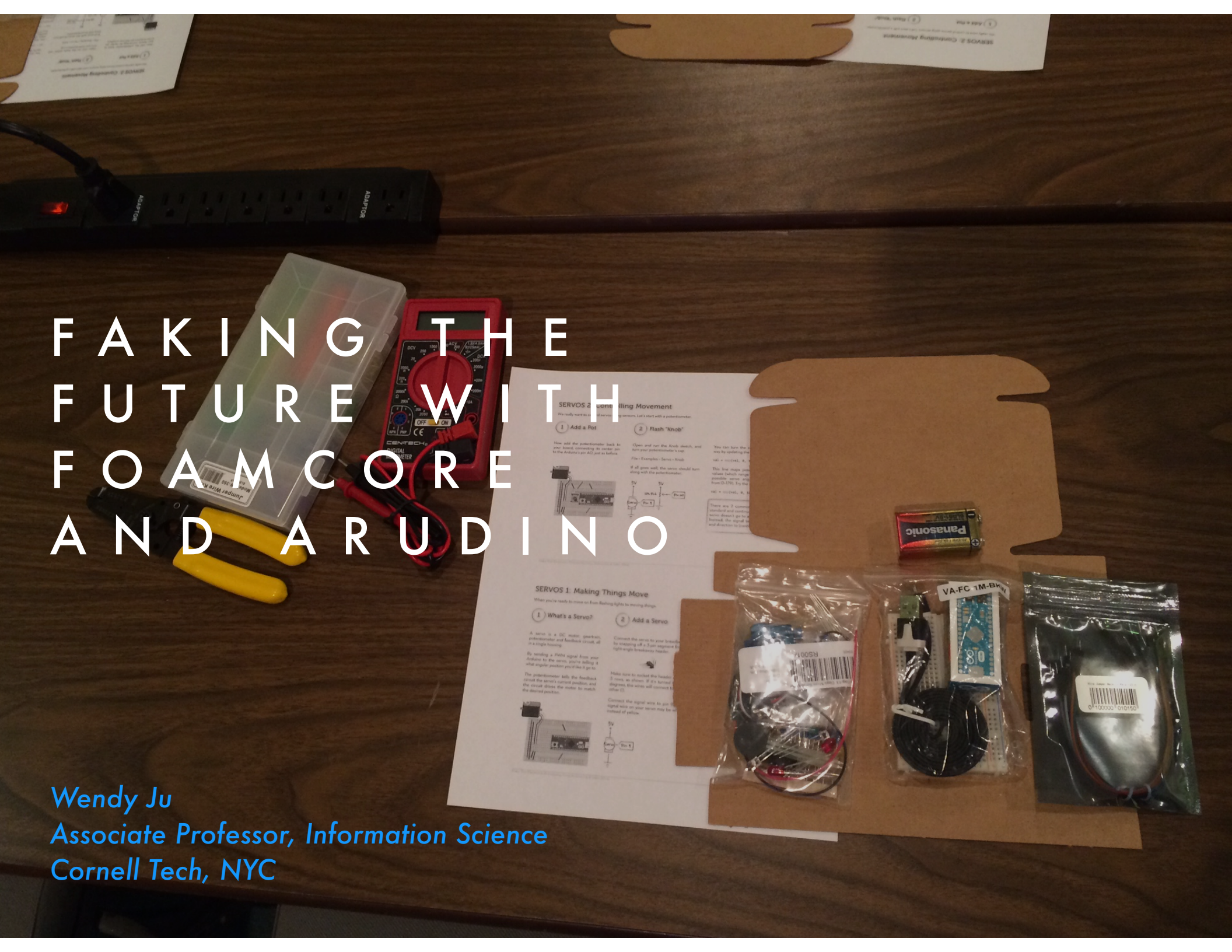

FAKING THE FUTURE WITH FOAMCORE AND ARUDINO

Wendy Ju
Associate Professor, Information Science
Cornell Tech, NYC

FAKING THE FUTURE WITH ~~FOAMCORE~~ CARDBOARD AND ~~ARUDINO~~ RASPBERRY PI

Wendy Ju
Associate Professor, Information Science
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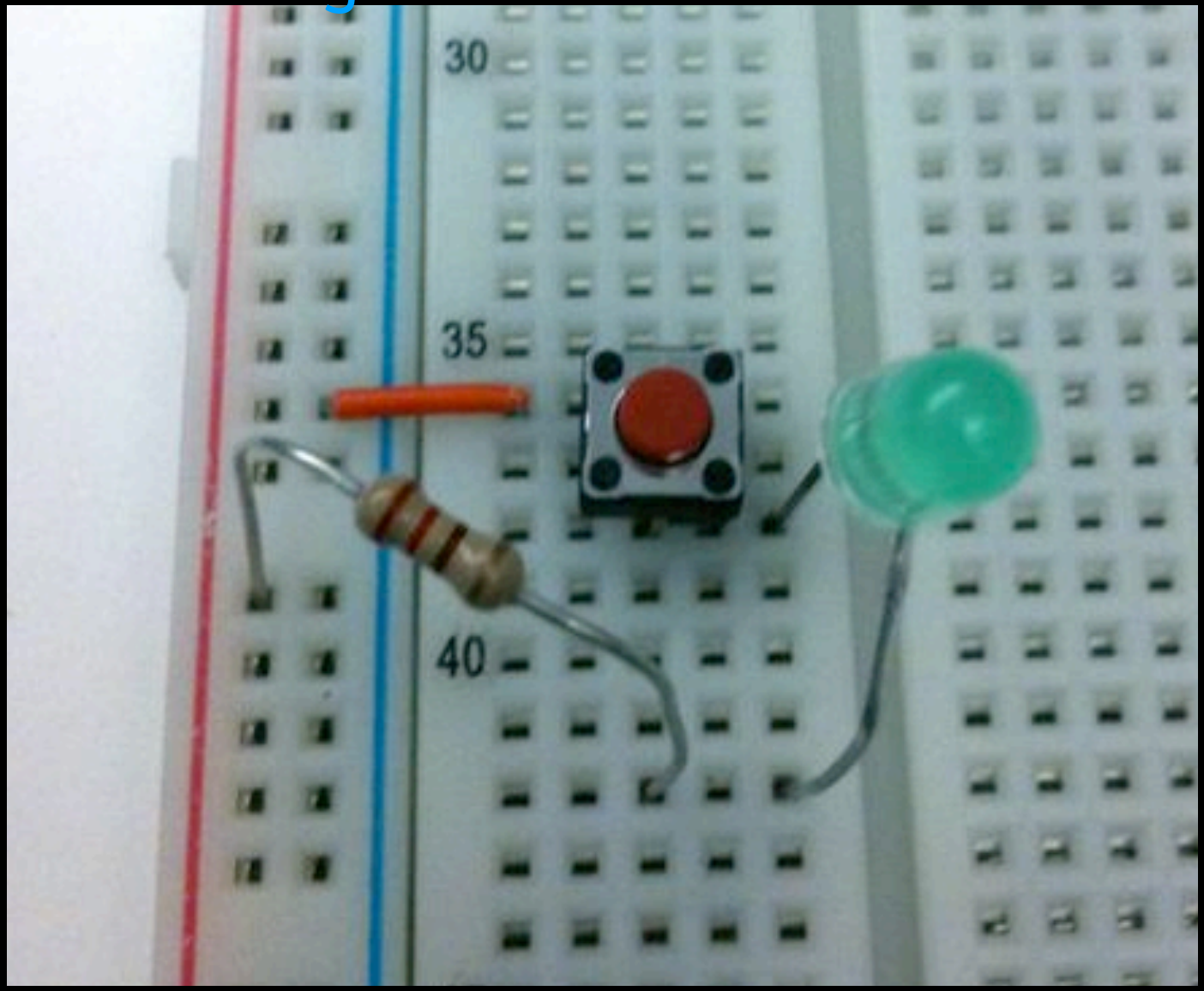
A Tour through a Pushbutton LED circuit



Pushbutton LED circuit breadboard drawing

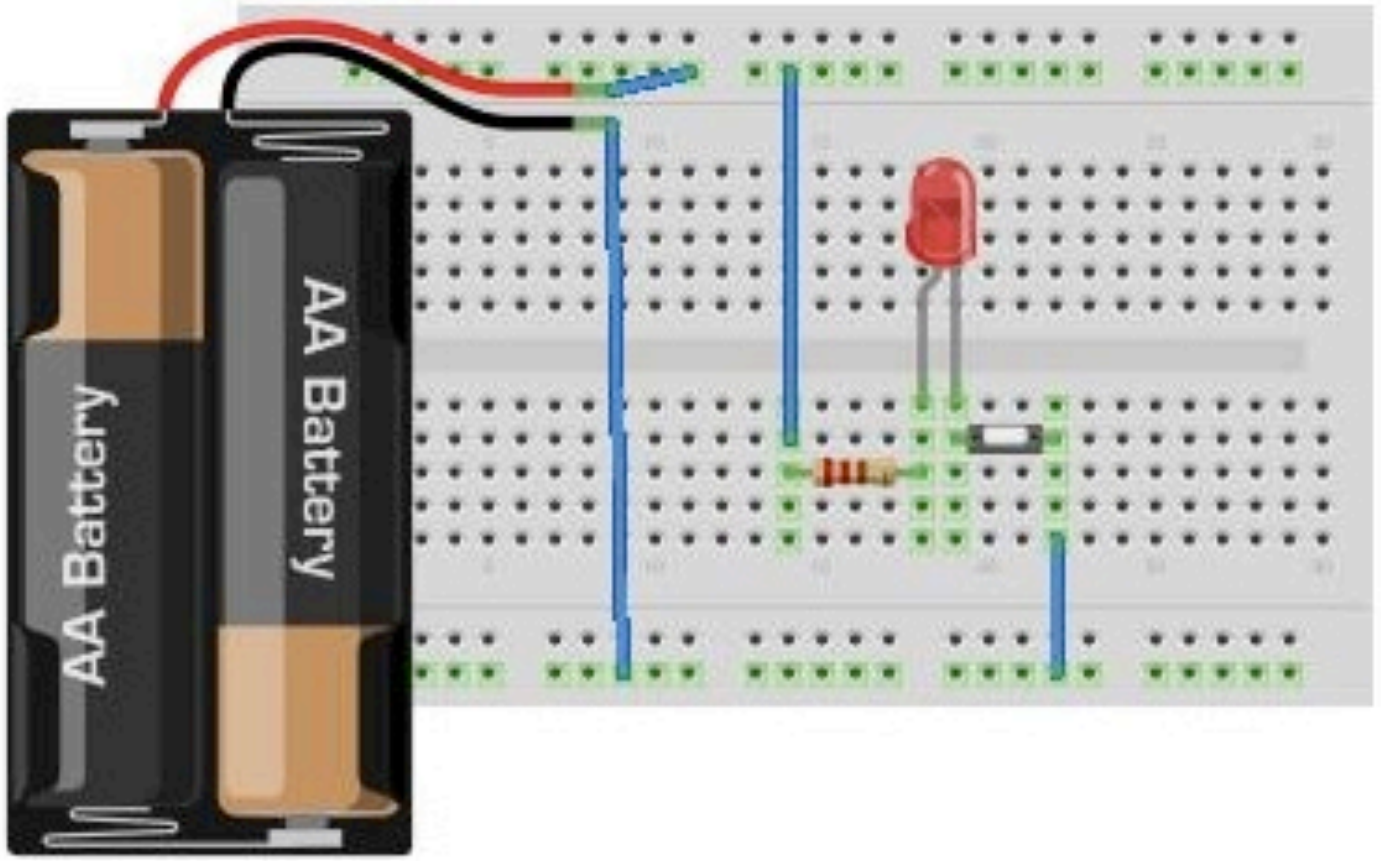
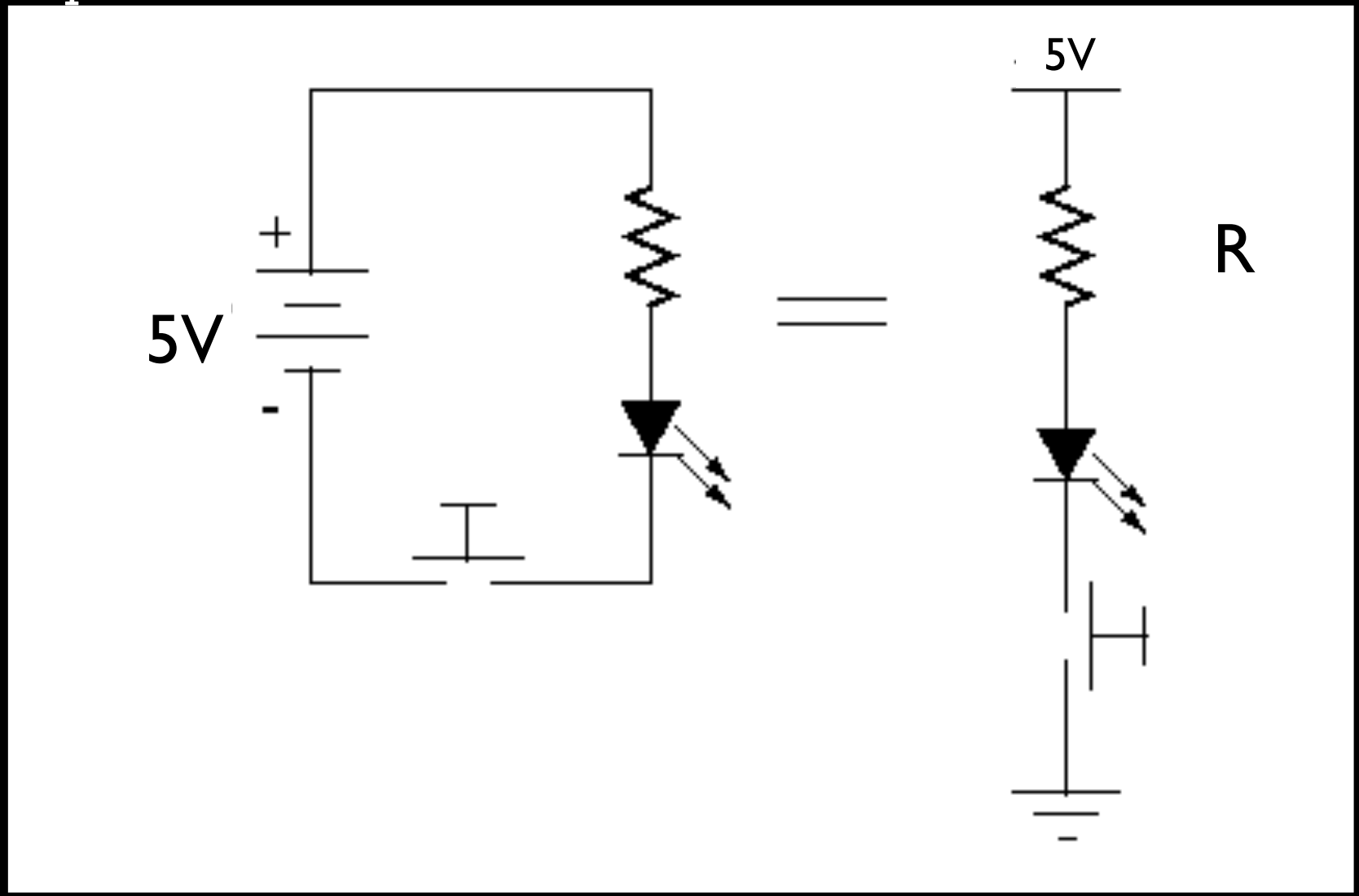
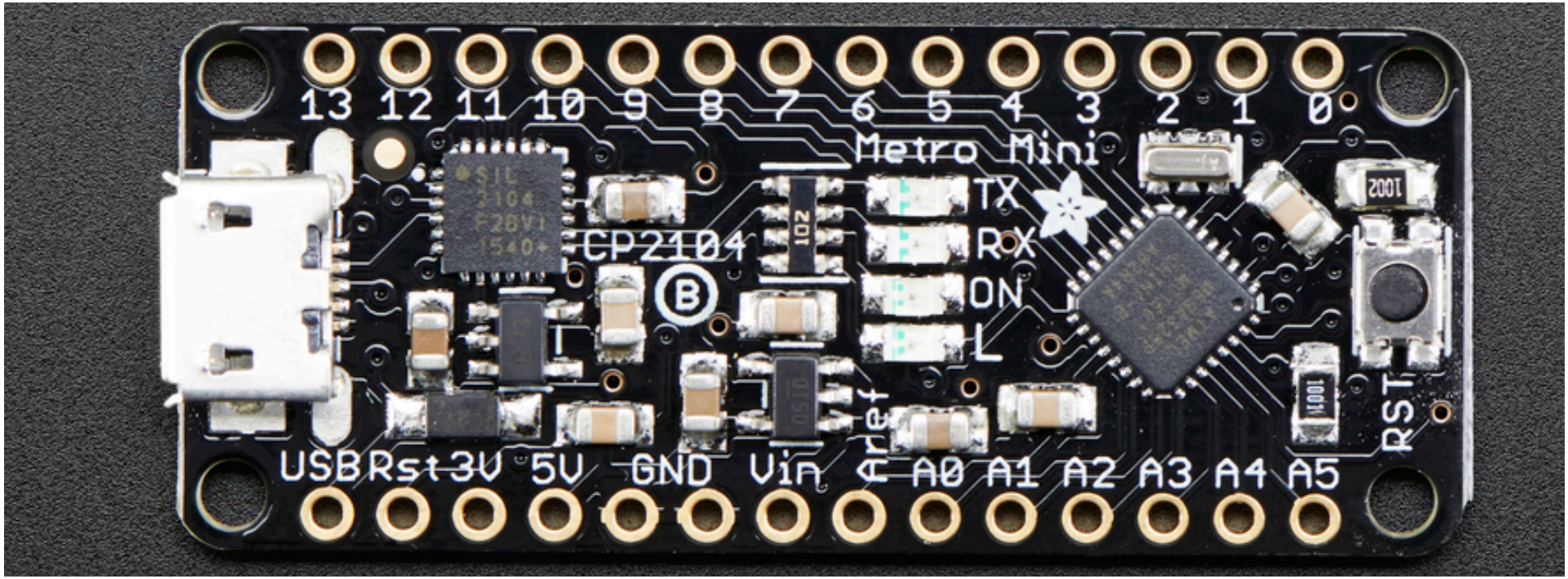


diagram made in Fritzing

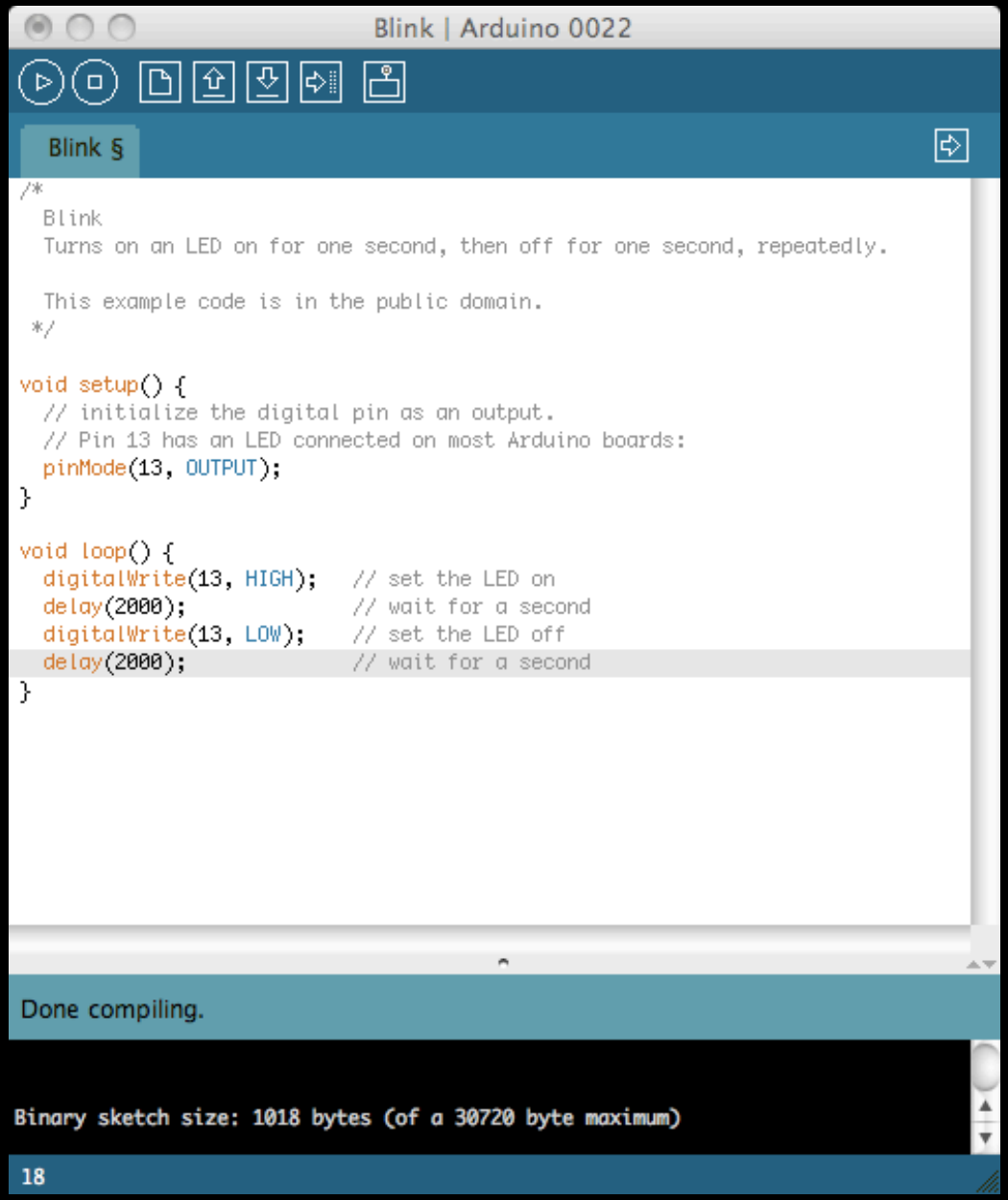
Equivalent Pushbutton LED circuit



Physical Hardware

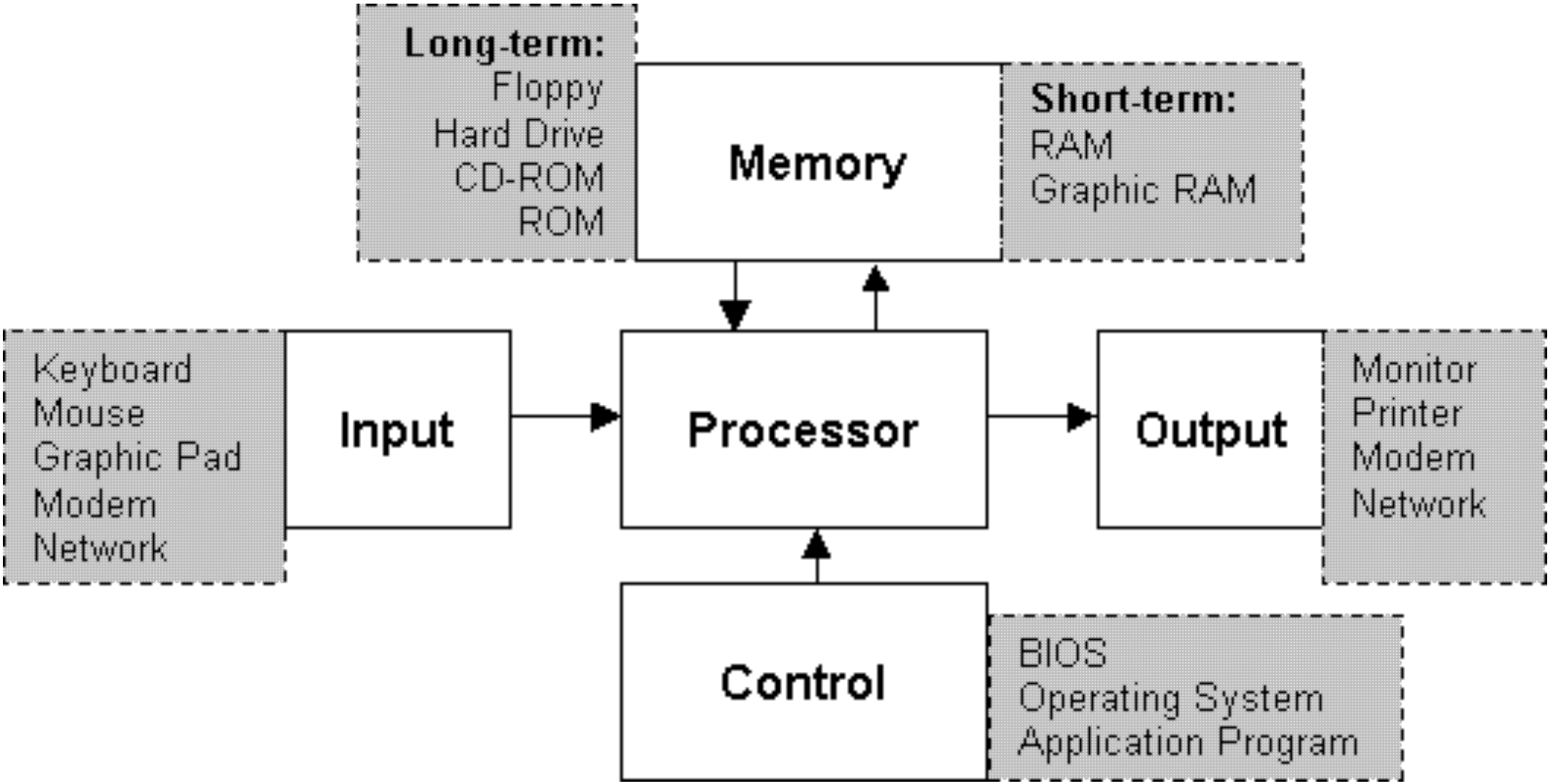


Sketch


Blink | Arduino 0022
Blink §
/*
Blink
Turns on an LED on for one second, then off for one second, repeatedly.
This example code is in the public domain.
*/
void setup() {
// initialize the digital pin as an output.
// Pin 13 has an LED connected on most Arduino boards:
pinMode(13, OUTPUT);
}
void loop() {
digitalWrite(13, HIGH); // set the LED on
delay(2000); // wait for a second
digitalWrite(13, LOW); // set the LED off
delay(2000); // wait for a second
}
Done compiling.
Binary sketch size: 1018 bytes (of a 30720 byte maximum)
18


Arduino
Raspberry Pi

Microcontrollers



What is in a computer?

CPU
Memory
I/O controllers
External storage

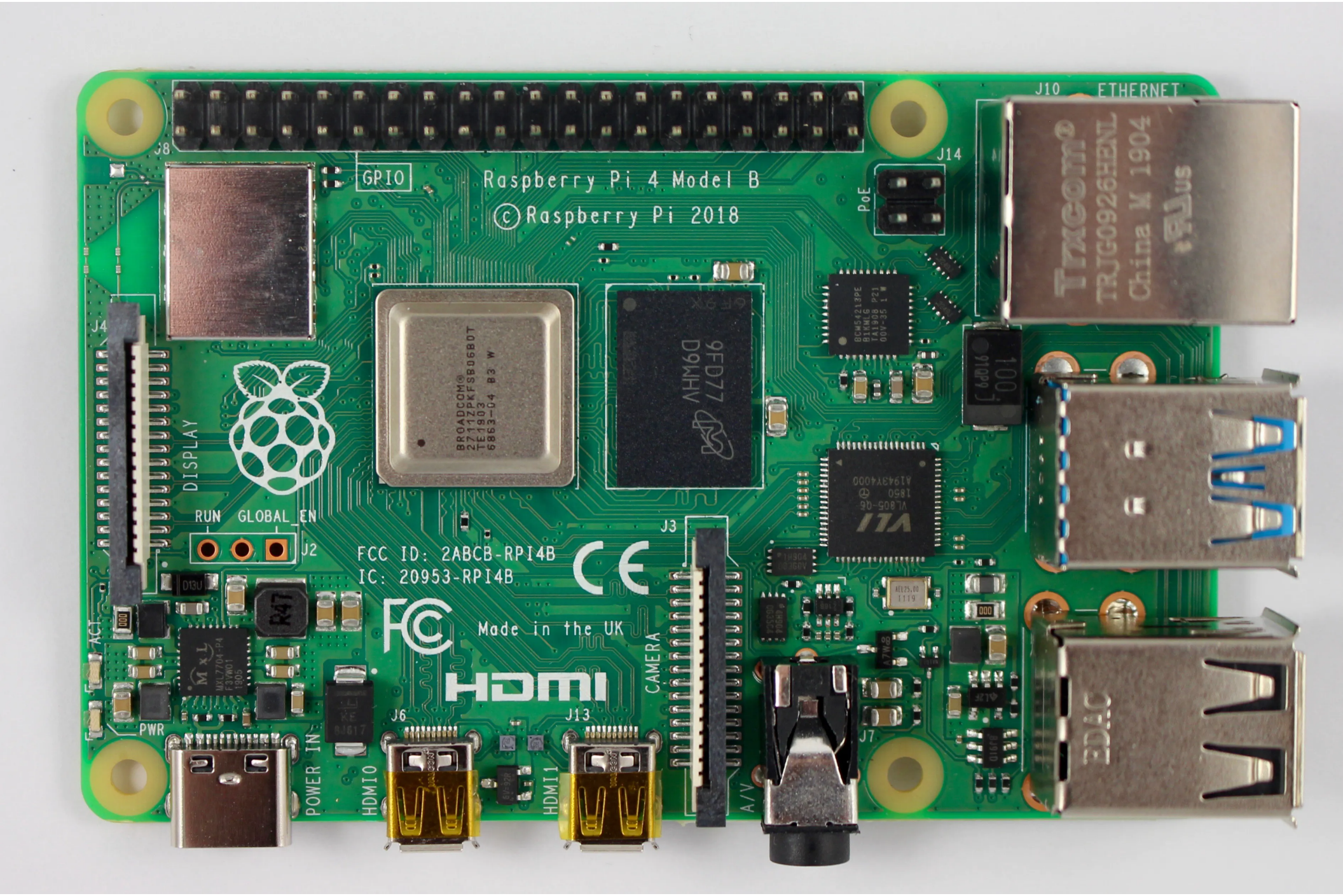


photo from https://www.hackster.io/news/meet-the-new-raspberry-pi-4-model-b-9b4698c284

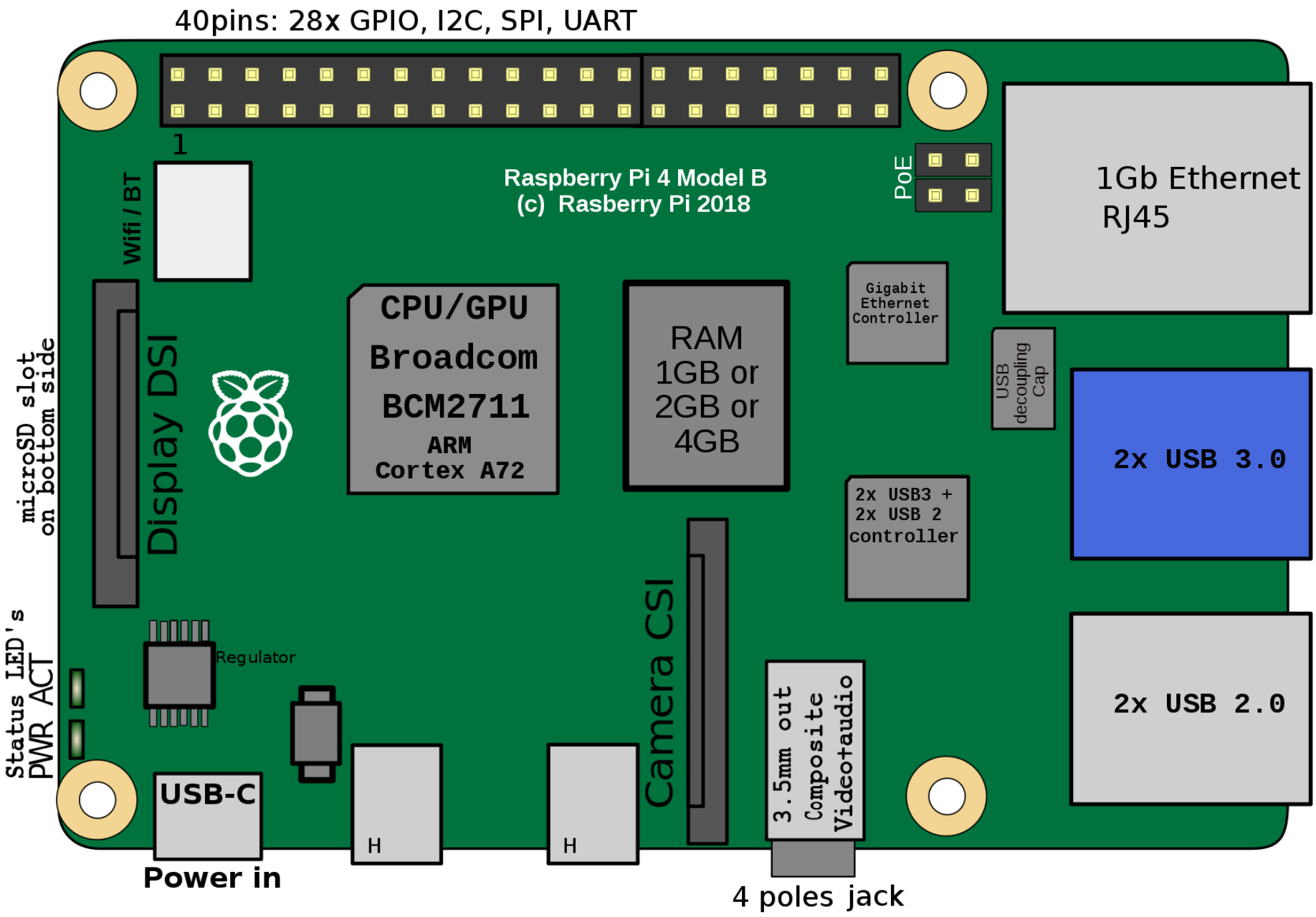
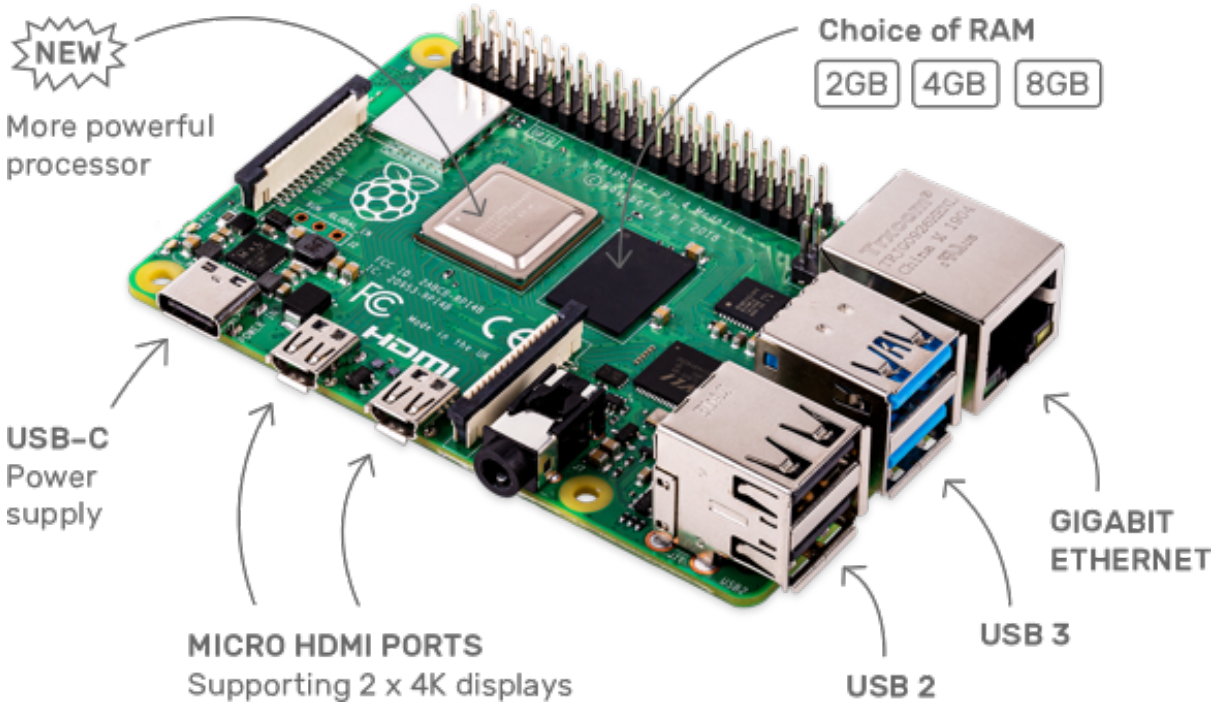


diagram from WikiMedia, user jstrom99



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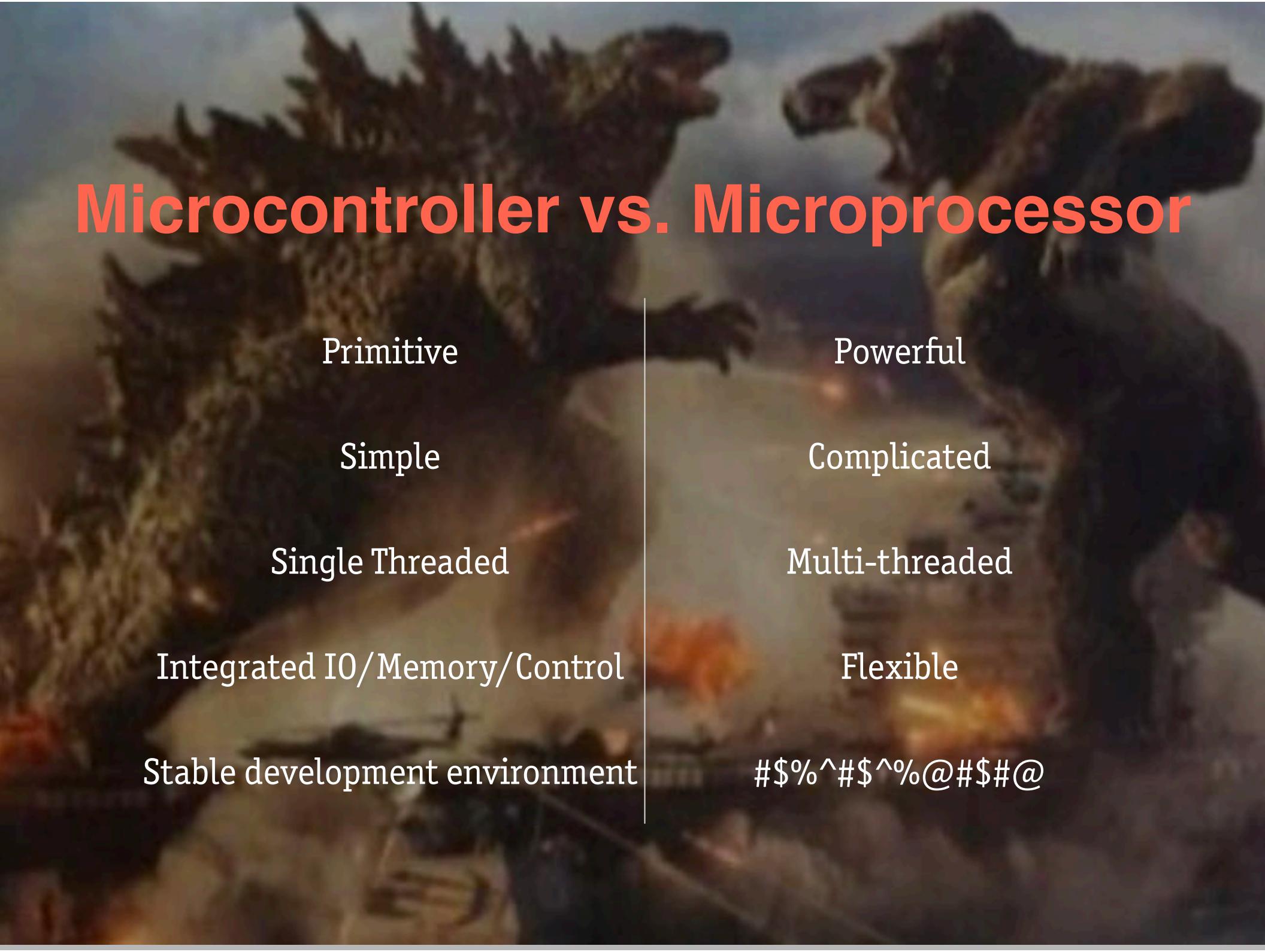


Microcontroller vs. Microprocessor

Primitive	Powerful
Simple	Complicated
Single Threaded	Multi-threaded
Integrated IO/Memory/Control	Flexible
Stable development environment	#$%^#$^%@#$#@

Operating Systems

Another key difference between microcontroller development and microprocessor development is the operating system.

An operating system (OS) is system software that manages computer hardware, software resources, and provides common services for computer programs.

Operating Systems

Arduino

- single-threaded, with some provision for hardware-driven timer and interrupt processes.
- Functions and commands are executed in a predescribed number of clock cycles.

RTOSes, or Real Time Operating Systems,

- multi-threaded for both microcontrollers and microprocessors
- RTOSes are designed to guarantee execution of external signalling and response in a deterministic amount of time
- for industrial equipment and devices where timing is critical

Operating Systems

Windows, MacOS and Linux are general purpose operating systems, and they are designed to manage the interaction with the user.

They handle multiple threads (internet packets, graphical display, user input, generation of sound) simultaneously, but the timing is non-deterministic.

This is good enough for interaction, however; the differences in execution time between a RTOS and a general purpose OS are too small for people to really notice.

Raspberry Pi

From the UK, specifically for education
15 million sold (as of July 2017) * Raspberry Pi Foundation,
3rd best-selling general purpose computer

Raspberry Pi B+

Microprocessor: ARM-based CPU, on-chip GPU
Storage: microSD card
Uses normal computer connectors, peripherals
  Audio, Video output: 3.5mm headphone, HDMI
  Peripheral IO: 4 USB
  Networking: 802.11n, Ethernet, Bluetooth
Target price: $35
Community

Raspberry Pi

Family	Model	Form Factor	Ethernet	Wireless	GPIO	Released	Discontinued
Raspberry Pi	B	Standard[a]	Yes	No	26-pin	2012	Yes
	A		No			2013	Yes
	B+		Yes		40-pin	2014	
	A+	Compact[b]	No			2014	
Raspberry Pi 2	B	Standard[a]	Yes	No		2015	
Raspberry Pi Zero	Zero	Zero[c]	No	No		2015	
	W/WH			Yes		2017	
Raspberry Pi 3	B	Standard[a]	Yes	Yes		2016	
	A+	Compact[b]	No			2018	
	B+	Standard[a]	Yes			2018	
Raspberry Pi 4	B (1 GiB)	Standard[a]	Yes	Yes		2019[31]	Yes[1]
	B (2 GiB)						
	B (4 GiB)						
	B (8 GiB)					2020	

Linux

- Based on UNIX command set
  - Began in 1991 as personal project of Finnish student Linus Torvalds to make a free OS kernel based on the x86
- Free
- Open source

image: December 2002 issue of Linux Magazine, retrieved from Wikipedia

Raspberry Pi vs. Laptop

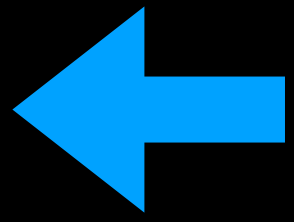
RPi has normal computer connectors, and you can hook it up to a monitor and keyboard.

It has networking capability, you can put it on your home or office WiFi.

Raspberry Pi is smaller and cheaper, & easier for us to experiment and play with.

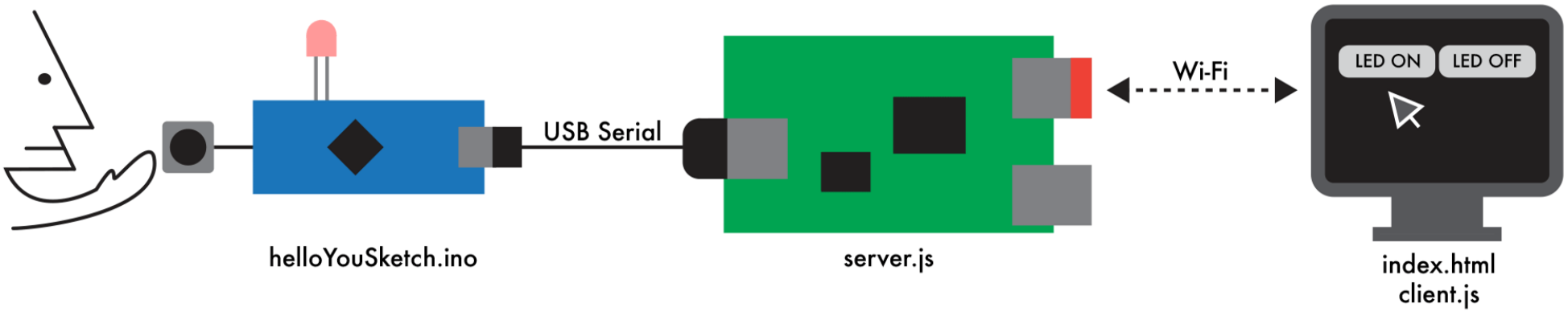
Replaceable: the microSD card that has the operating system and memory, or even the whole computer if you need to.

Dedicated: assign a computer per application



Interaction Engine

Microcontroller+Microproccesor!!!

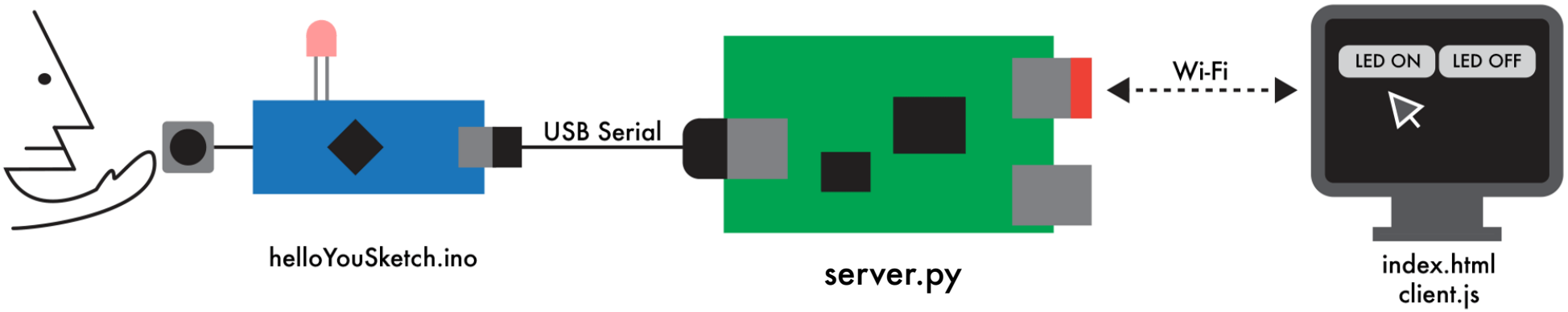


The Interaction Engine is a framework for prototyping web-connected hardware.

We use a set of widely supported tools to create a system to help interaction designers quickly realize new, multimodal interactive experiences.

Interaction Engine

Microcontroller+Microproccesor!!!



The Interaction Engine is a framework for prototyping web-connected hardware.

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Interaction Engine

Microcontroller+Microproccesor!!!

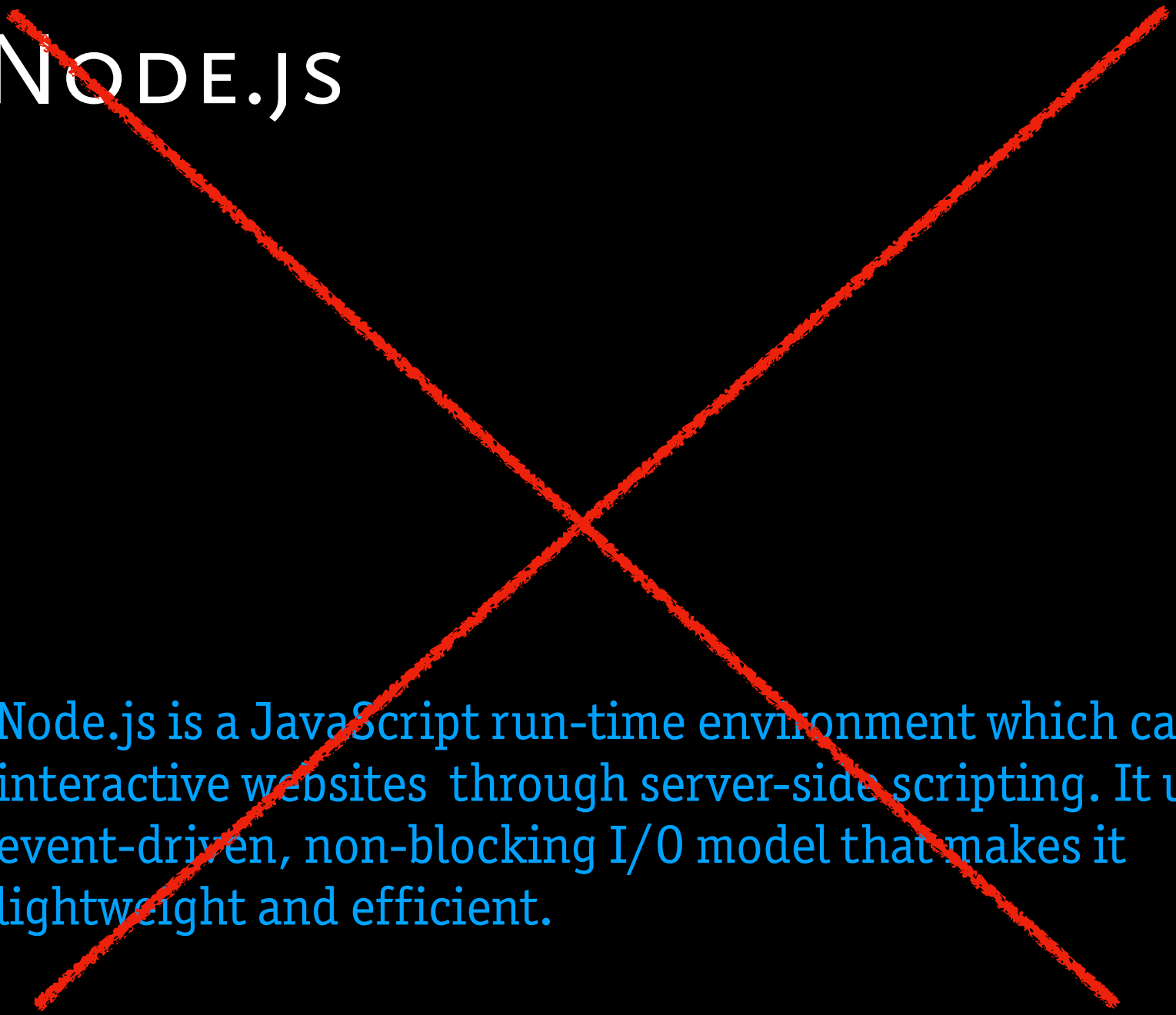
Pros:

- GPIO on Pi is not easily usable
- Libraries more plentiful for the Arduino than Pi GPIO
- Enables modular development
- Upgrade computation, not IO
- Firewalls power and electronics issues from Pi

Cons:

- A bit expensive
- Revision control complicated
- (Now is the moment that we need Git)

Node.js



Node.js is a JavaScript run-time environment which can make interactive websites through server-side scripting. It uses an event-driven, non-blocking I/O model that makes it lightweight and efficient.

NPM

Packages people 'npm install' a lot

browserify
browser-side require() the node way
16.1.0 published 3 weeks ago by goto-bus-stop

grunt-cli
The grunt command line interface
1.2.0 published 2 years ago by vladikoff

bower
The browser package manager
1.8.2 published 6 months ago by sheerun

gulp
The streaming build system
3.9.1 published 2 years ago by [illegible]

grunt
The JavaScript Task Runner
1.0.2 published 4 weeks ago by vladikoff

express

Express
Fast, unopinionated, minimalist web framework
4.16.2 published 5 months ago by dougwilson

npm
a package manager for JavaScript
5.7.1 published a week ago by zkat

cordova
Cordova command line interface tool
8.0.0 published 2 months ago by stevegill

forever
A simple CLI tool for ensuring that a given node script runs continuously (i.e. forever)
0.15.3 published a year ago by indexzero

Node.js' package ecosystem, npm, is the largest ecosystem of open source libraries in the world. (https://www.npmjs.com)

We've moved to python

Cons:

- Now you need C++ (for Arduino), Python (for the Pi) and Javascript+HTML (for the webpages)

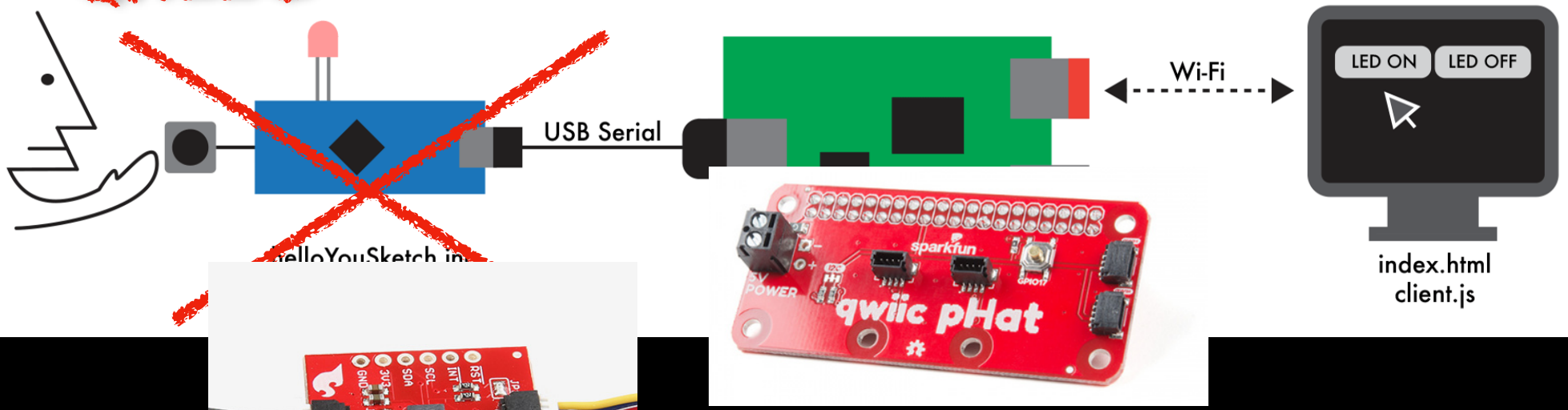
Pros:

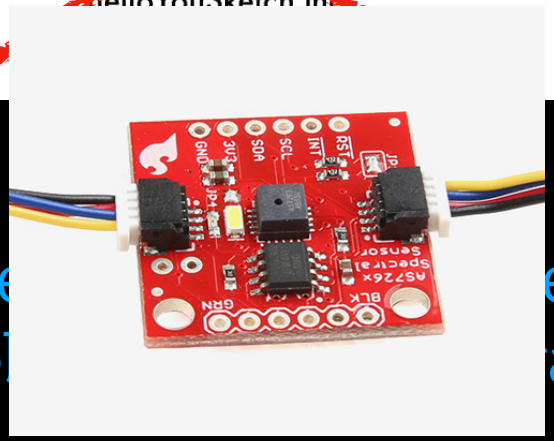
- There are lots of cool libraries
- They actually work
- They get updated when they don't work
- Now we can do a lot of ML

Interaction Engine

~~Microcontroller~~+Microproccesor!!!

QWIIC



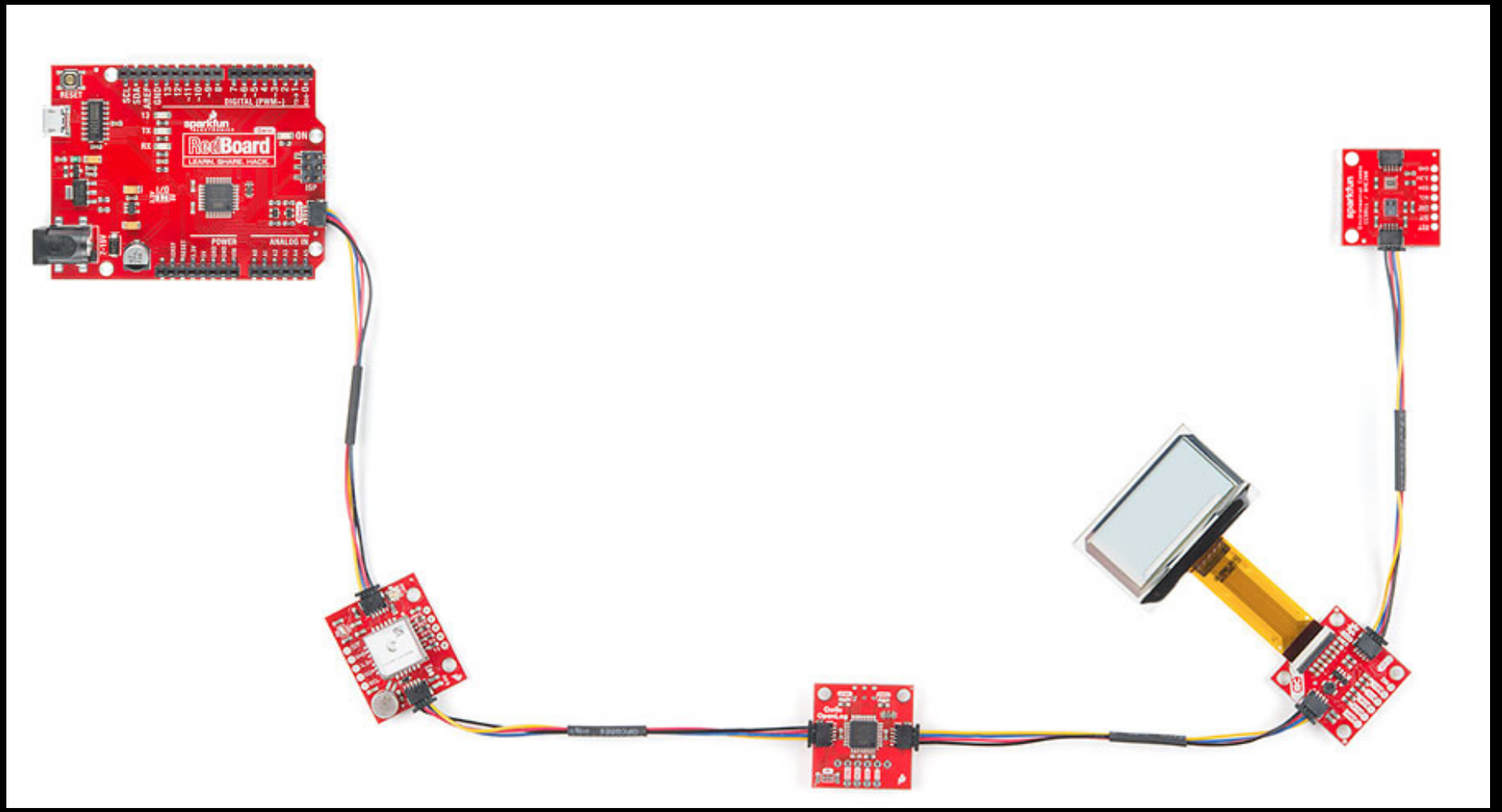


The e is a framework for prototyping we are.

We use a set of widely supported tools to create a system to help interaction designers quickly realize new, multimodal interactive experiences.

QWIIC & STEMMA QT

I2C bus interface to interface dev boards with sensors, displays, etc.



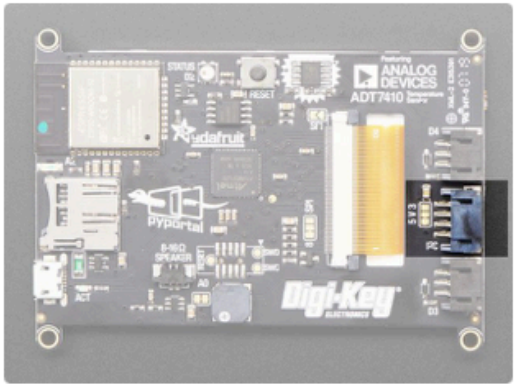
DO NOT CONFUSE STEMMA WITH STEMMA QT

From https://learn.adafruit.com/introducing-adafruit-stemma-qt

STEMMA connector types

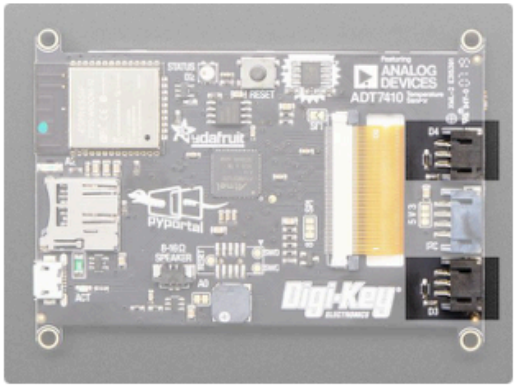
There are THREE different STEMMA connectors you will see:

- **STEMMA 4 Pin JST PH** - These are larger 2.0mm pitch connectors
- **STEMMA 3 Pin JST PH**



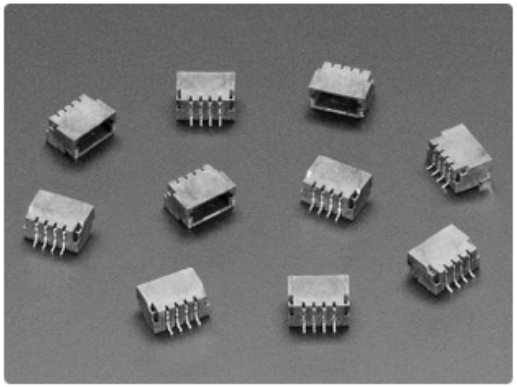
STEMMA 4 Pin JST PH - These are larger 2.0mm pitch connectors

They are for **I2C use!**



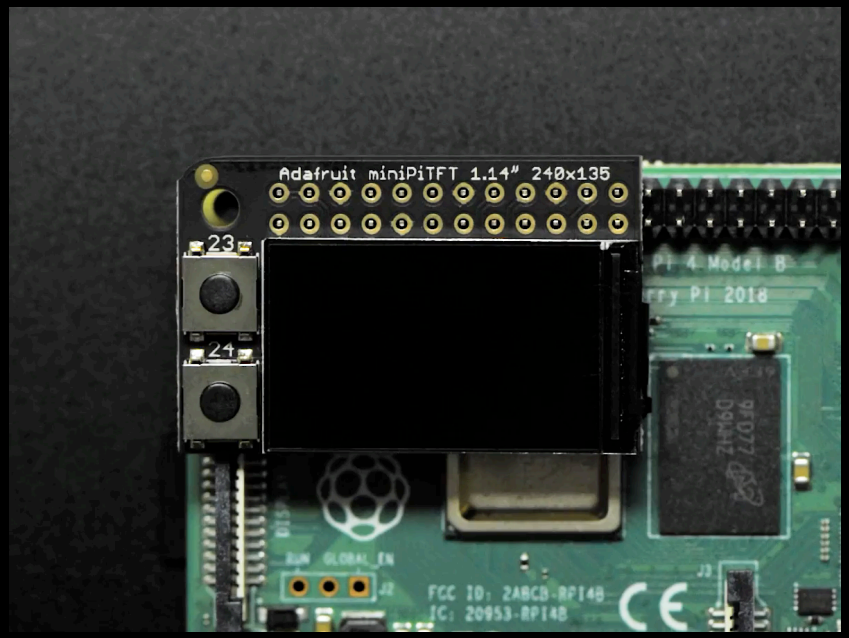
STEMMA 3 Pin JST PH - These are larger 2.0mm pitch connectors

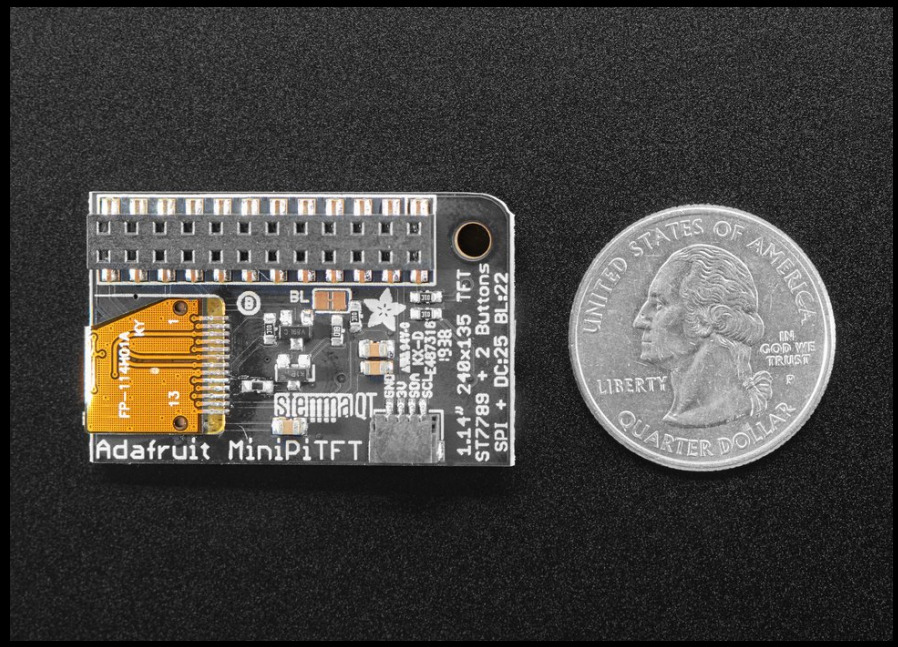
They are for **PWM/Analog/Digital use!**



STEMMA QT ('cutie') 4 Pin JST SH - These are smaller 1.0mm pitch connectors

They are for **I2C use when the larger JST PH connectors won't fit on a small sensor board!**


Adafruit miniPiTFT 1.14" 240x135
23
24
Pi 4 Model B
FCC ID: 2ABCB-RPI4B
IC: 20953-RPI4B


Adafruit MiniPiTFT
stemma QT
1.14" 240x135 TFT
ST7789 + 2 Buttons
SPI + DC:25 BL:22
LIBERTY
IN GOD WE TRUST
QUARTER DOLLAR


sparkfun


PWR
Qwiic Button

Lab 2: The clock of Pi

Adaptation of Timer Lab

Takes advantage of OS' awareness of time
Try out new displays
Test out I/O using QWIIC/STEMMA QT

Pick up kits

Prep lab is hefty this week

Software Best Practices

Start early
- bugs are best resolved with time rather than intensity
- time enables collaboration

Make a plan, keep the plan updated
- a plan will help you when you get lost
- a plan will help you remember what you did
- a plan helps others see where you went wrong

Software Best Practices

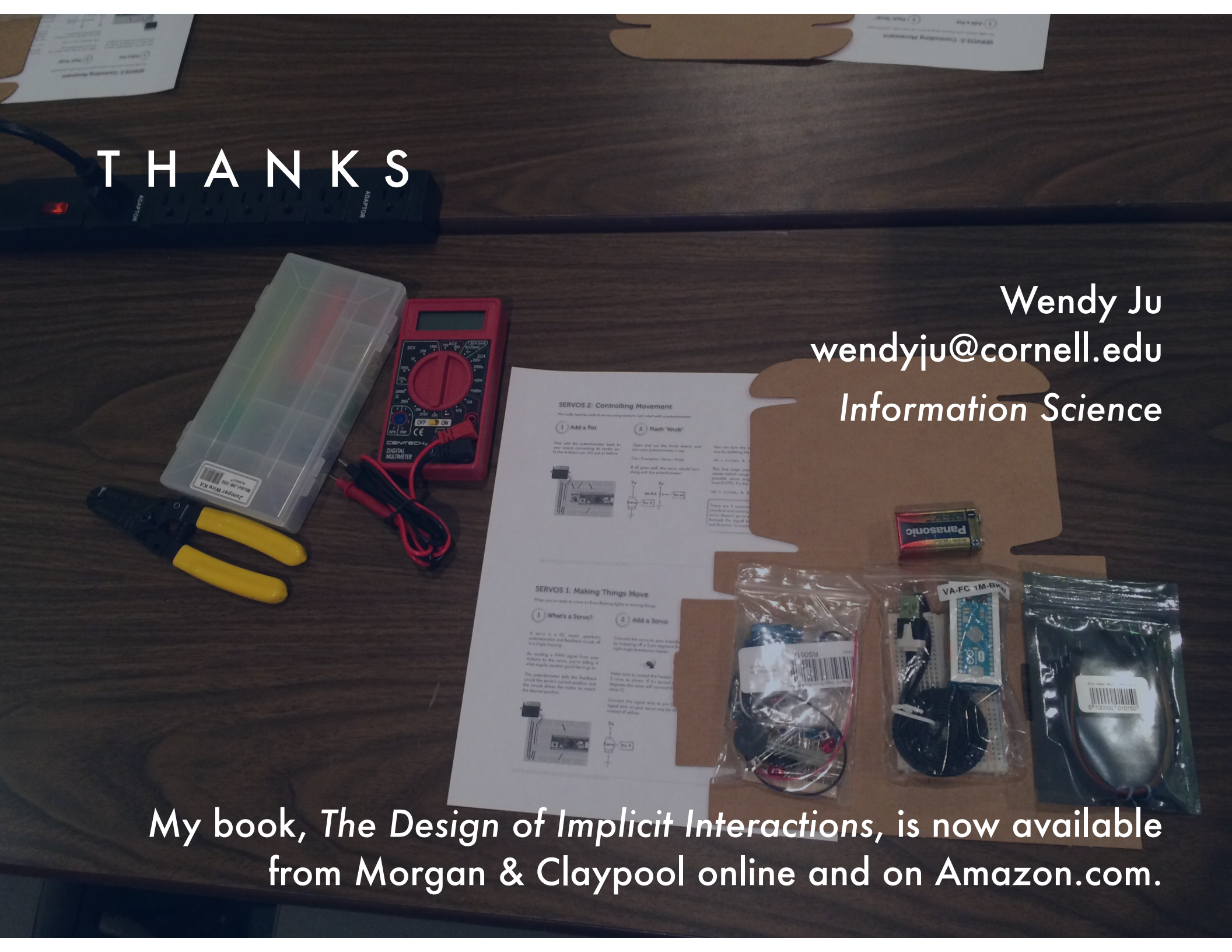
Don't code alone
- do not beat your head on problem for more than 1 hour
- see if anyone else has had your problem
- use Discord to get help

Documentation
- write down your sources
- when you hit an error and resolve it, write it down YOU WILL SEE IT AGAIN

Commit & Push often

THANKS

Wendy Ju
wendyju@cornell.edu
Information Science



My book, *The Design of Implicit Interactions*, is now available from Morgan & Claypool online and on Amazon.com.