

Device APIs

W3C TPAC 2022

Vincent Scheib (Google)

goo.gle/tpac2022-device-apis

Goal:

People can accomplish their daily computing tasks with the benefits of the web.

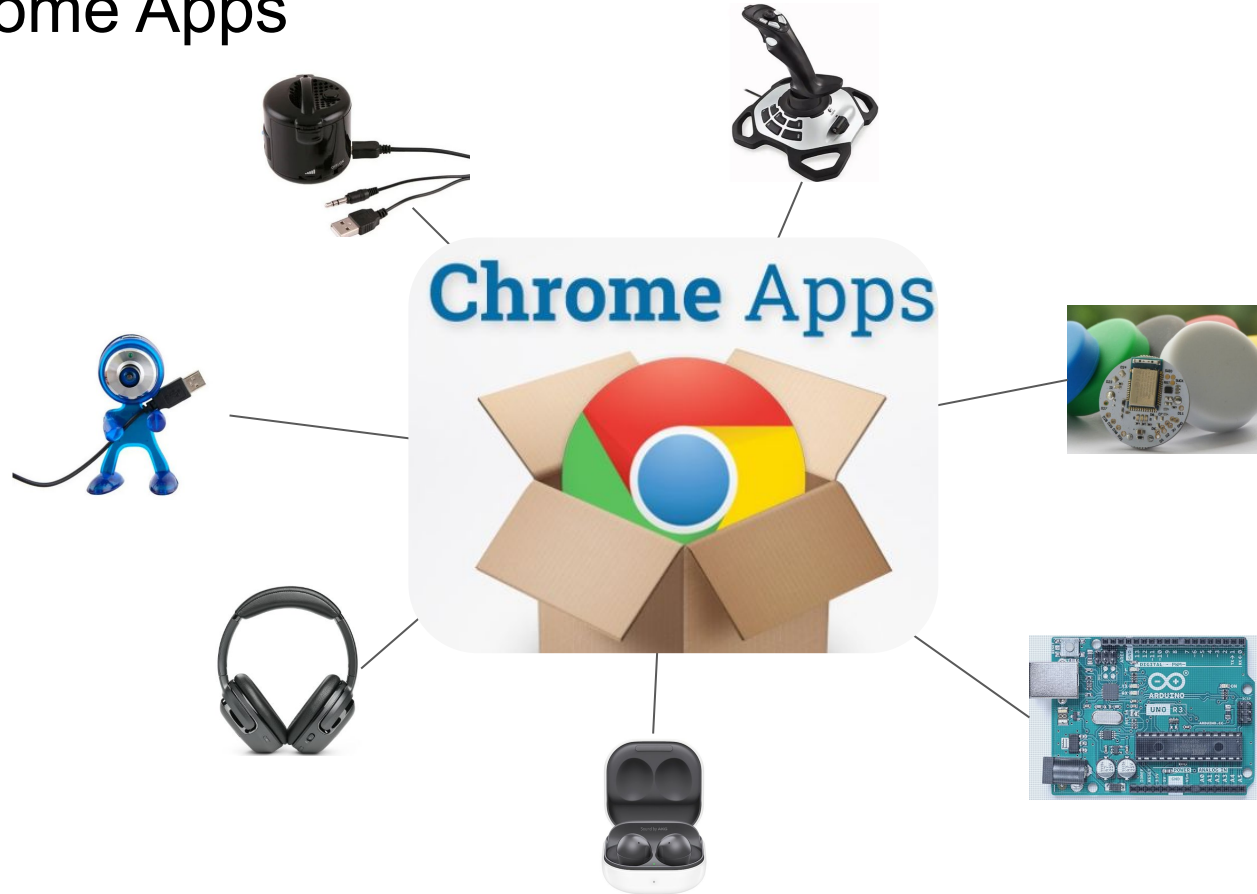
Let's talk about APIs that allow communication with peripherals & other devices using low-level protocols.



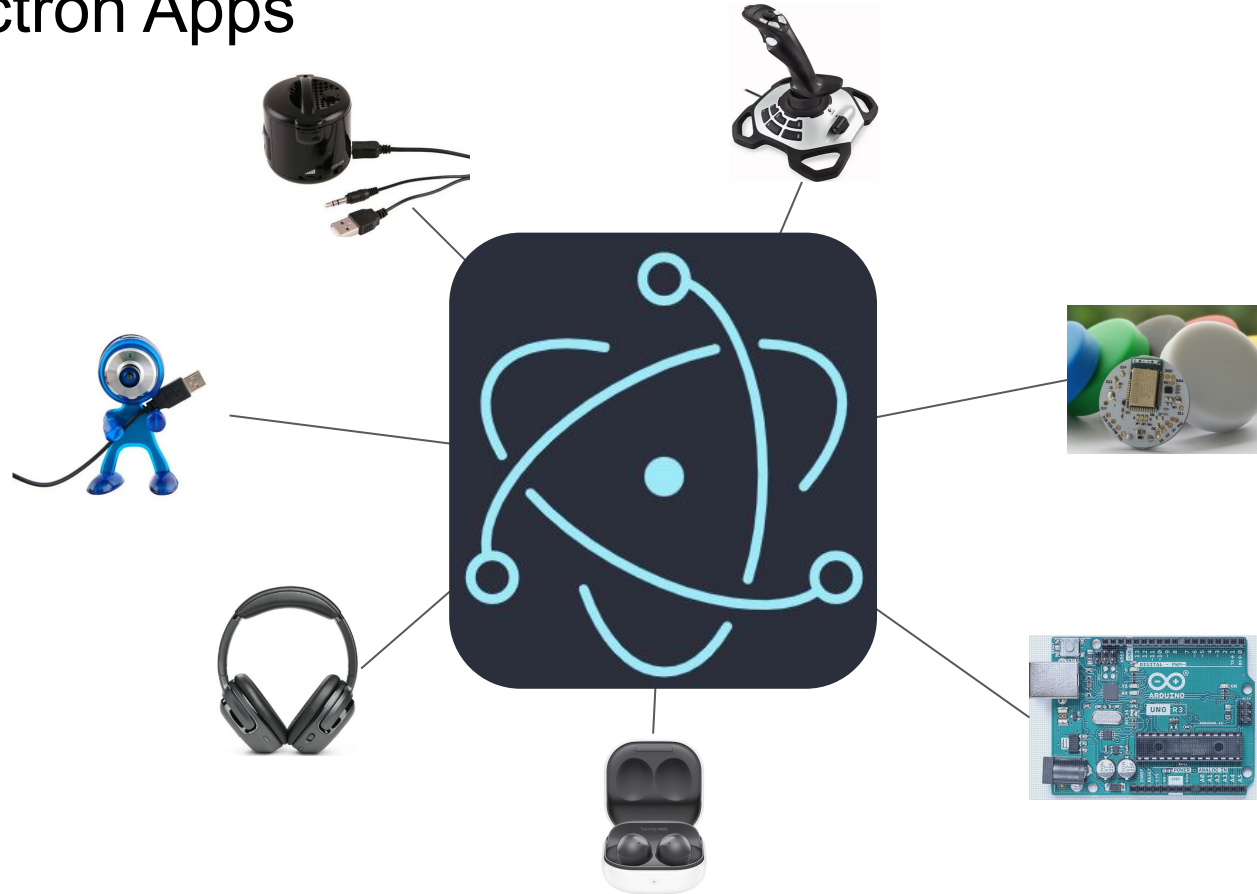
Windows, Mac, etc apps



Chrome Apps



Electron Apps



Web Apps



MDN Web Developer Needs Assessment 2020

“Lack of APIs” is #1 request from “Progressive Programmers” segment.

Working with different tracking protection and data storage policies in browsers

3.55

Determining the root cause of a bug

Running end-to-end tests

Lack of APIs to take advantage of device capabilities (e.g. sensors, OS and hardware features, etc)

3.38

Integrating with third parties for authentication

Achieving visual precision on stylized elements (e.g., buttons)

Using web technologies in a native or hybrid context (e.g. using WebViews, Electron, CEF)

2.90

Lack of support for progressive web apps (PWAs)

2.86

Running front-end tests



MDN web docs
moz://a

Bluetooth

	2017 v56
	2020 v79
	2017 v6.0
	2017 v43

from caniuse.org

USB

	2017 v61
	2020 v79
	2017 v8.0
	2017 v48

from caniuse.org

HID

	2021 v89
	2021 v89
	2021 v75

from caniuse.org

Serial

	2021 v89
	2021 v89
	2021 v75

from caniuse.org

2017

2021

Bluetooth

	2017 v56
	2020 v79
	2017 v6.0
	2017 v43

from caniuse.org

- [Overview](#)
- [W3 community group](#)
- [MDN Docs](#)
- [Specification](#)

USB

	2017 v61
	2020 v79
	2017 v8.0
	2017 v48

from caniuse.org

- [Overview](#)
- [MDN Docs](#)
- [Specification](#)

HID

	2021 v89
	2021 v89
	2021 v75

from caniuse.org

- [Overview](#)
- [MDN Docs](#)
- [Specification](#)

Serial

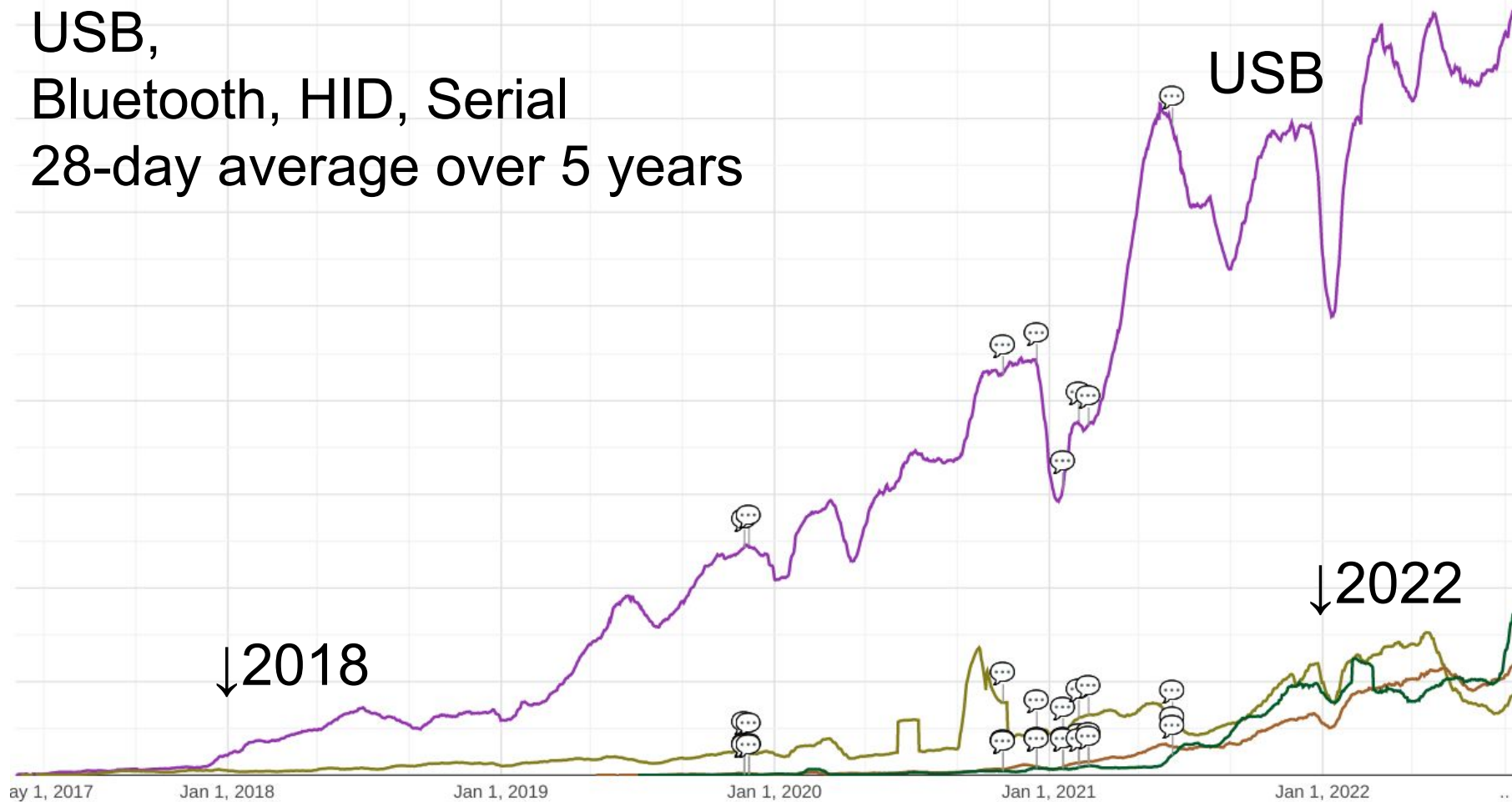
	2021 v89
	2021 v89
	2021 v75

from caniuse.org

- [Overview](#)
- [MDN Docs](#)
- [Specification](#)

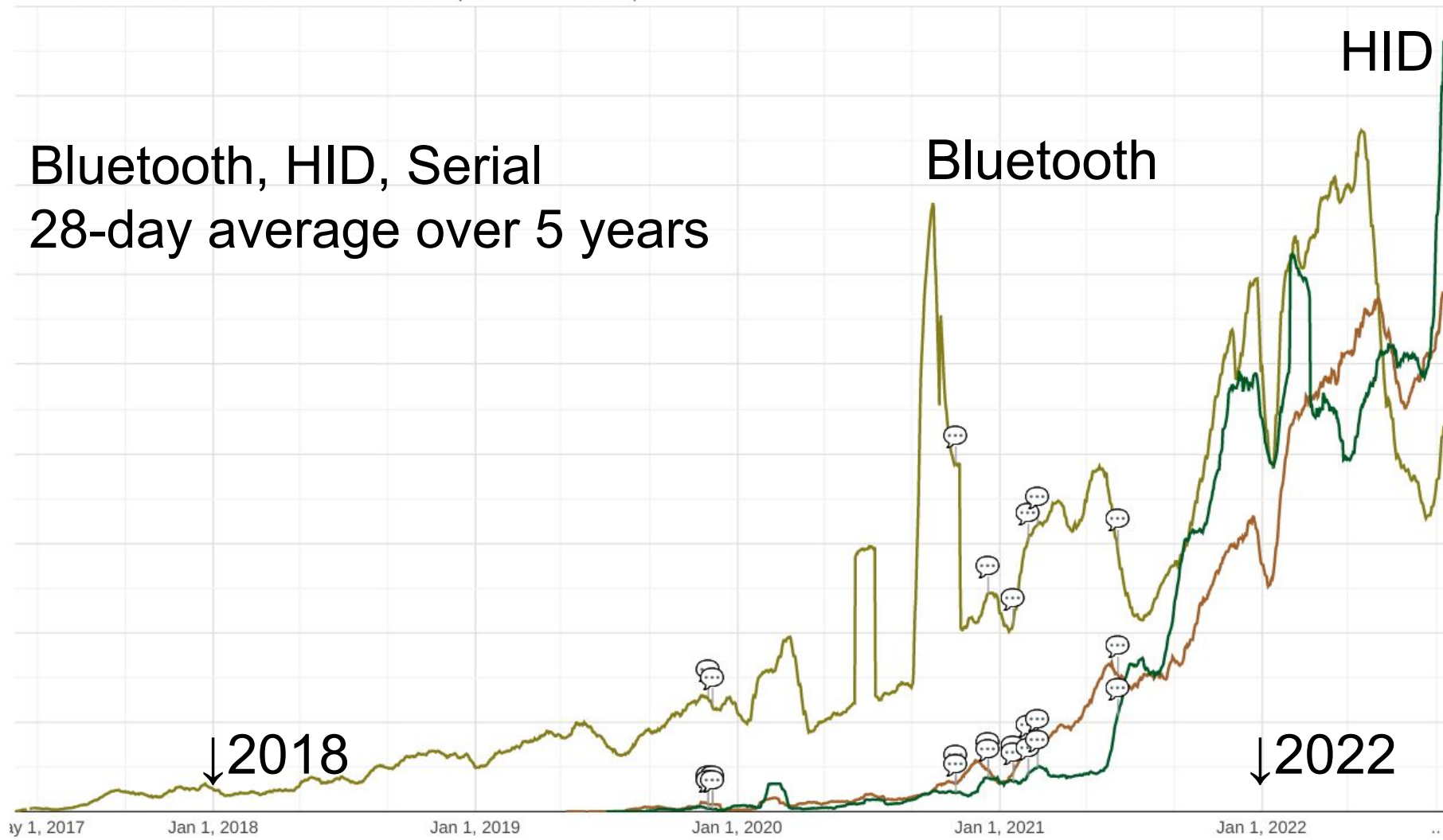
UsbDeviceOpen WebBluetoothRemoteServerConnect SerialPortOpen HidDeviceOpen

USB,
Bluetooth, HID, Serial
28-day average over 5 years



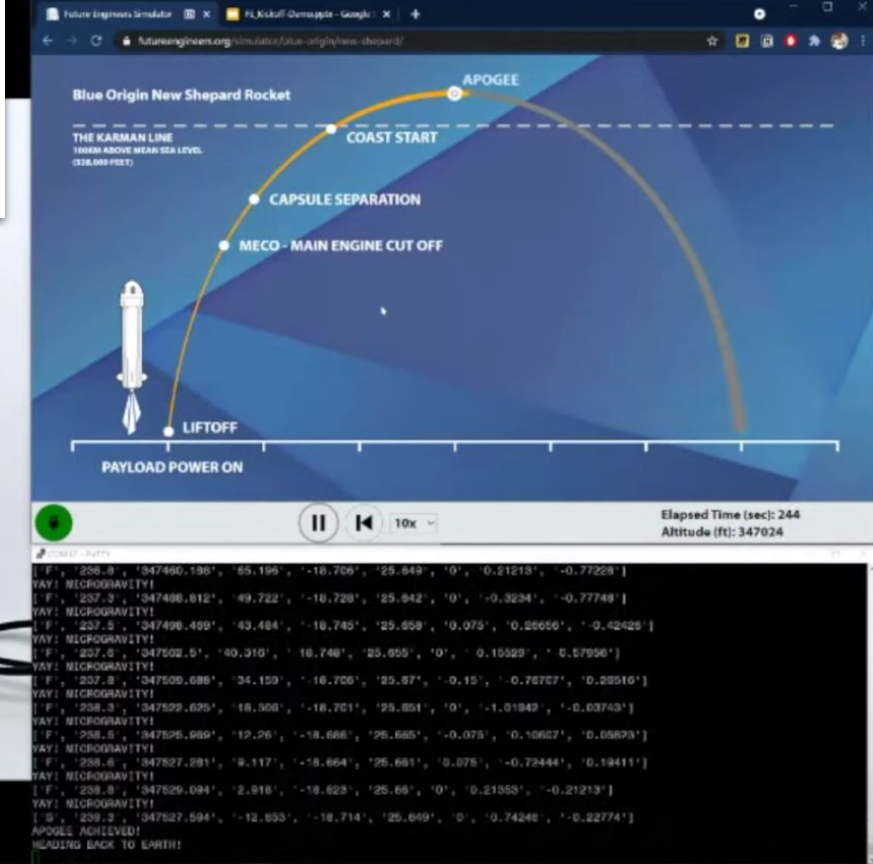
WebBluetoothRemoteServerConnect SerialPortOpen HidDeviceOpen

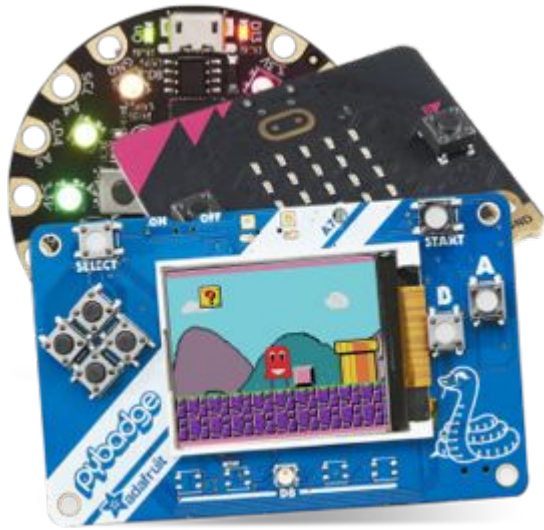
Bluetooth, HID, Serial 28-day average over 5 years



Areas of Use

Education: NASA Tech Rise Telemetry Simulator





Education: Microsoft MakeCode

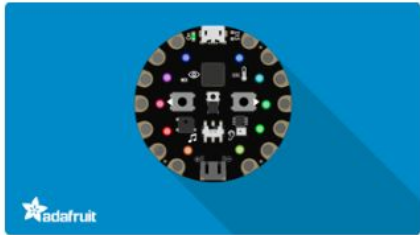
"Download your code onto physical hardware devices"



Education: Microsoft MakeCode

"Download your code onto physical hardware devices"

Who else is using the MakeCode Editor?



Adafruit: Circuit Playground Express

Learn to code electronics, with an all-in-one board that has sensors and LEDs built in.

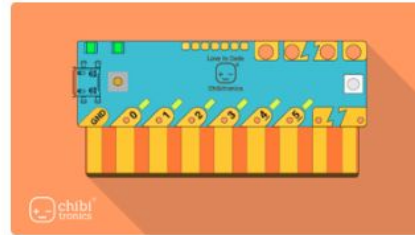
[Start coding >](#)



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Program robots to walk, talk and much more

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Chibi Chip

Blend circuit building and programming with arts and crafts

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Cue

Use MakeCode to instruct the Cue robot to complete creative problems solving tasks

[Learn more >](#)

LEGO Education
Bluetooth
Serial

Select your **SPIKE™** solution



SPIKE
Essential



SPIKE
Prime



Education: VEX Robotics, The Pocket Lab, more...




Flash Tools: TI & NumWorks Graphing Calculators

TI-*nspire*™ CX II Connect

Let's Get Started

- 1 Connect your TI-Nspire™ CX II graphing calculator to your computer using the USB cable.
- 2 **CONNECT TO CALCULATOR**

A black TI-Nspire CX II Connect cable is shown plugged into the top of a black TI-Nspire CX II graphing calculator. The calculator's screen is blue. The background is a light gray with a faint blue circular graphic element.

TEXAS INSTRUMENTS

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Flash Tools: Android / GrapheneOS



Welcome to Android Flash Tool

You can use this tool to **flash Android builds** to your device as well as **side load APKs**, **transfer files from your device** and **other Android device utilities**.

This tool allows you to flash Android onto recent Pixel phones and Android development devices ([view full list](#)). This tool doesn't support flashing Android onto Chrome OS devices.

To flash a device the tool requires 10GB of available storage on your computer.

Install an Android build in three easy steps



Connect your device
via USB cable



Select the software
you want to install



Install the software
on your device

Enterprise: Call Control



Google Meet

Settings



Audio



Video



General



Captions

Microphone

Default - Poly Blackwire 8225 Series ...

Noise cancellation

Filters out sound from your mic that isn't speech

Speakers

Default - Poly Blackwire 8225 Series ...

Call control

Control Meet using your USB device



CONNECTED DEVICES

+ Poly Blackwire 8225 Series

+ Connect device

Entertainment: Stem Player

Web App using WebUSB is the single application option.

Kanye West & Kano Computing

Exclusive distribution of Donda 2 album



STEM PLAYER

200

ADD TO CART

VIDEO

INFO

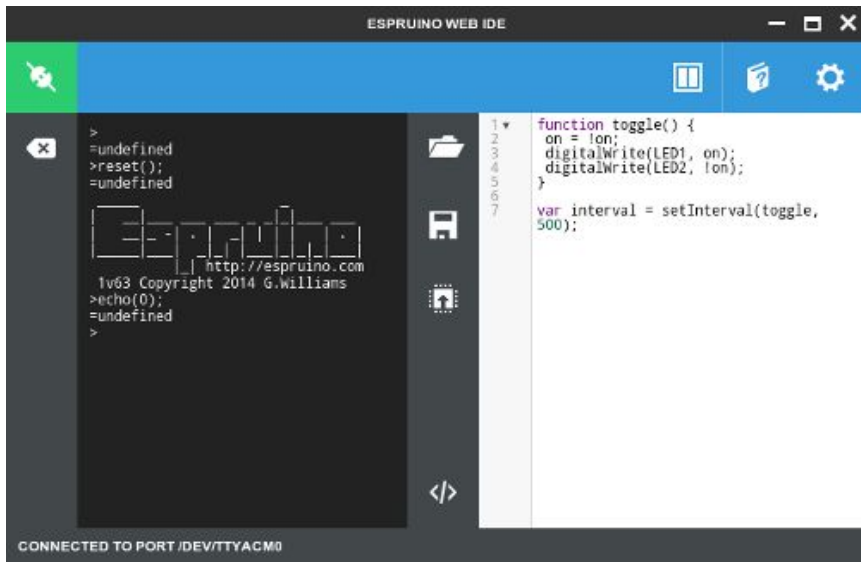
COMMUNITY

PLATFORM

FAQ T&C

REGION US UK WORLD

Hobbyist: Microcontrollers Esprino & ESP Web Tools



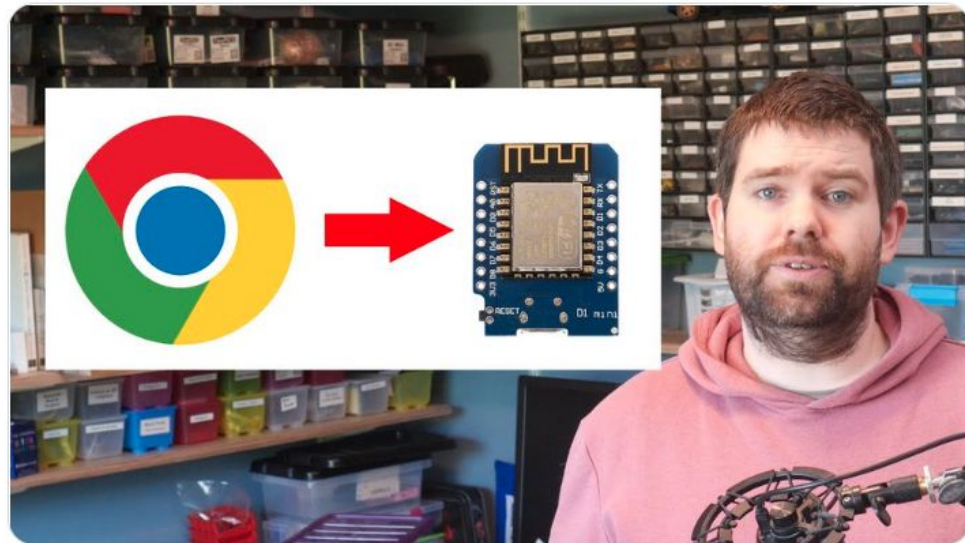
Javascript interpreter on microcontroller.
[Web IDE](#)



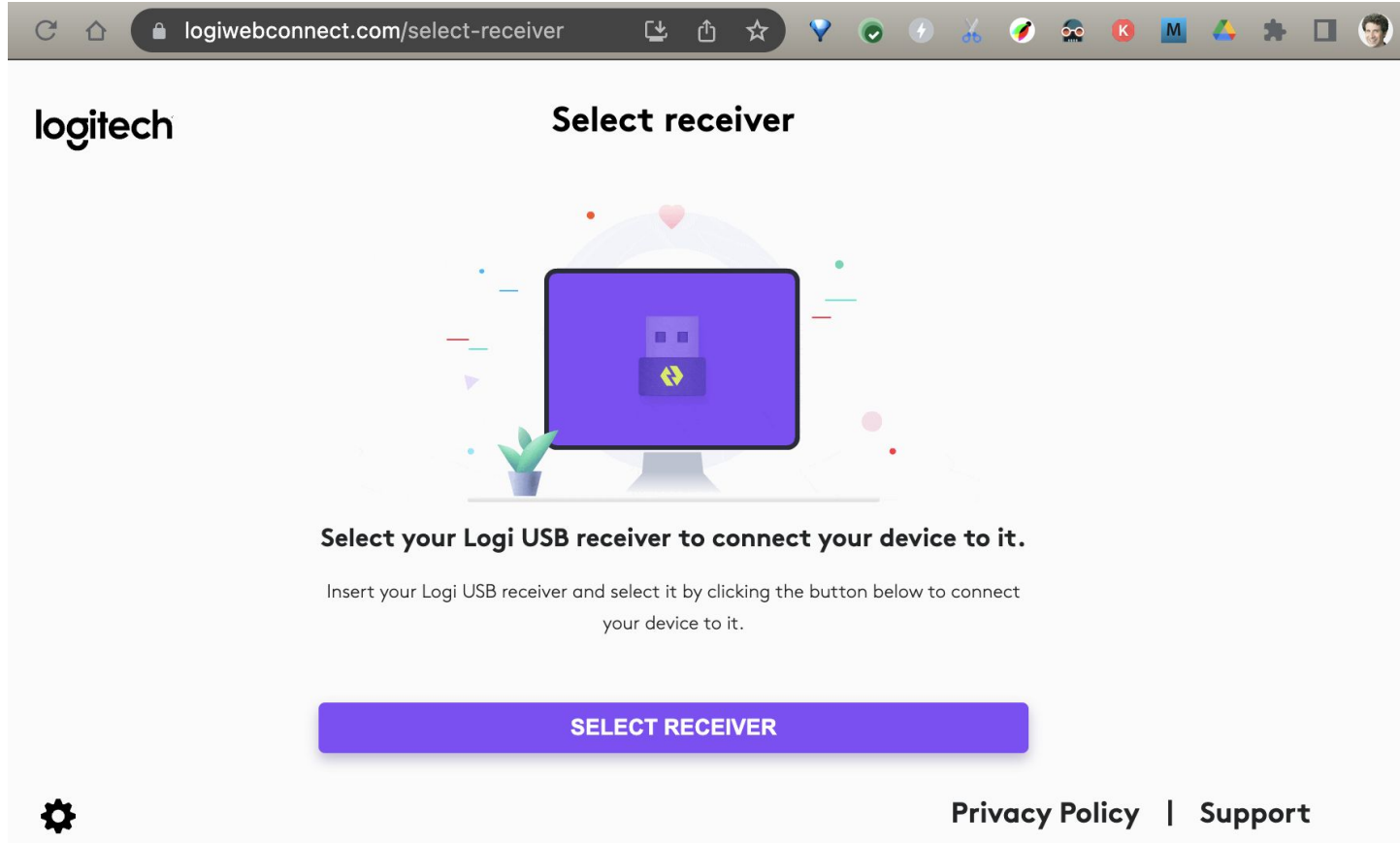
Brian Lough
@witnessmenow

I've just released a video about the Esp web tools, which allow you to flash full projects to your Esp in about a minute without installing any software (not even the Arduino IDE) or downloading any code.

I think this an amazing way of sharing projects with people!

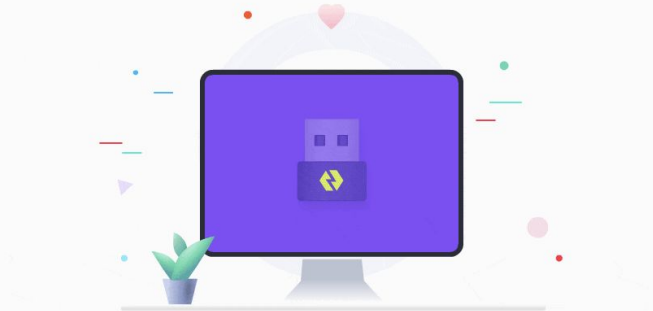


Personal Electronics: Logitech Receiver



logitech


Select receiver



Select your Logi USB receiver to connect your device to it.

Insert your Logi USB receiver and select it by clicking the button below to connect your device to it.

SELECT RECEIVER

 [Privacy Policy](#) | [Support](#)

Personal Electronics: Wooting Keyboard Tooling

● **Digital Profile** Digital Profile



Save to Keyboard



Set actuation point

Set the point to activate a keypress.
This change will affect: **all keys**



Set per key actuation

Rapid Trigger



Rapid trigger dynamically actuates and resets your key based on your intention to press or release the key. Rapid trigger starts and ends after the actuation point.

Tachyon mode



Tachyon mode optimizes your keyboard for input speed. When enabled, every keypress responds as fast as possible. The RGB effects are disabled for an optimal result. Analog stability might be affected.

Current speed: **~3.4 ms**



Personal Electronics:

remap-keys.app

REMAP



Handyman MACROPAD

Designed by Hayashi

Macro Integrated Backlight LED Underglow LED Kailh Choc V1
Kailh Choc V2 Column Staggered



cocot46

Designed by aki27kbd

40% Integrated Column Staggered Underglow LED Cherry MX
Hotswap Wireless



mc2s lp

Designed by abitkeys

40% Split Column Staggered Kailh Choc V1



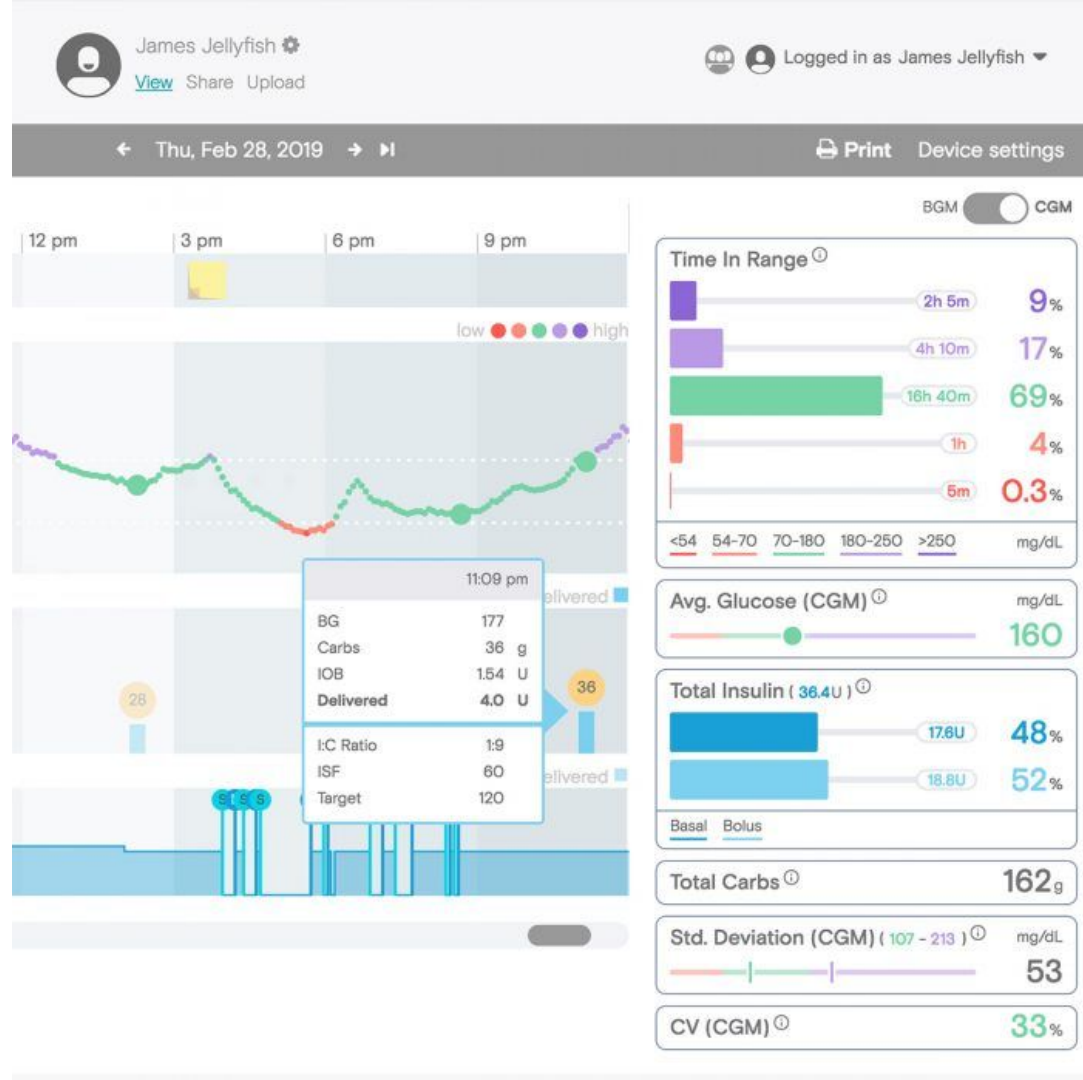
REVIUNG5

Designed by gtips

Macro Integrated Underglow LED Cherry MX

Health: Tidepool

Electron app to upload diabetes data from devices.



Health: Xchart



Record any needed entry from
multiple devices in real-time

People are getting tasks done.

Developer Experimentation
opportunity and potential



Awesome micro:bit

@awesomemicrobit



Developer Experimentation

@Vincent_Scheib
[Twitter collection](#)



micro:bit Tools - Fab Connect

Online tool & dashboard to bridge multiple [#microbits](#) together via the internet using a WebUSB connection to the browser.



beta.tfabconnect.com

Developer Experimentation

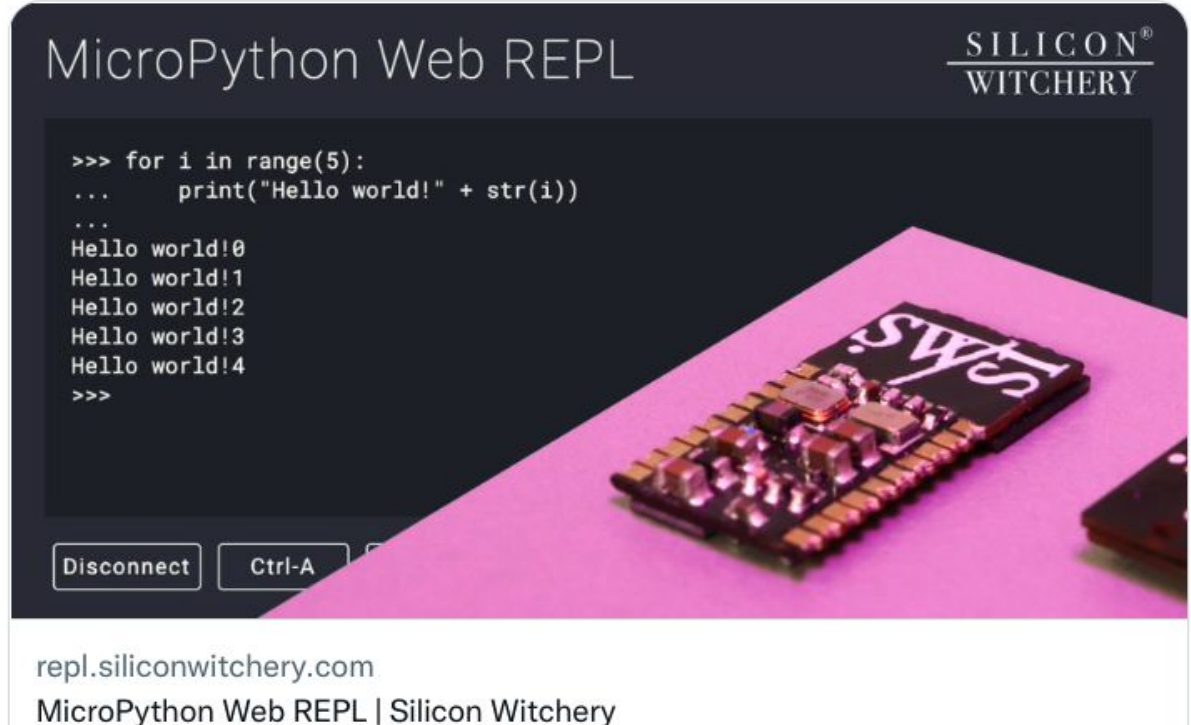
@Vincent_Scheib
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Raj Nakarja
@siliconwitch



Made a Web Bluetooth REPL that works with
[@micropython](#) and [@CircuitPython](#) 🐍 Supports Ctrl
keys, history, indents, and tab completion 😊



repl.siliconwitchery.com

MicroPython Web REPL | Silicon Witchery

Developer Experimentation

@Vincent_Scheib
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nico.dev
@nic_o_martin



Thats so cool! I created a webapp, that accepts an image, downsamples and crops it down to 16*16px, gets the RGB values from each px and sends it via [#WebUSB](#) to the [#Pico](#), which passes it to the RGB [#pixelMatrix](#).





verylowfreq
@verylowfreq



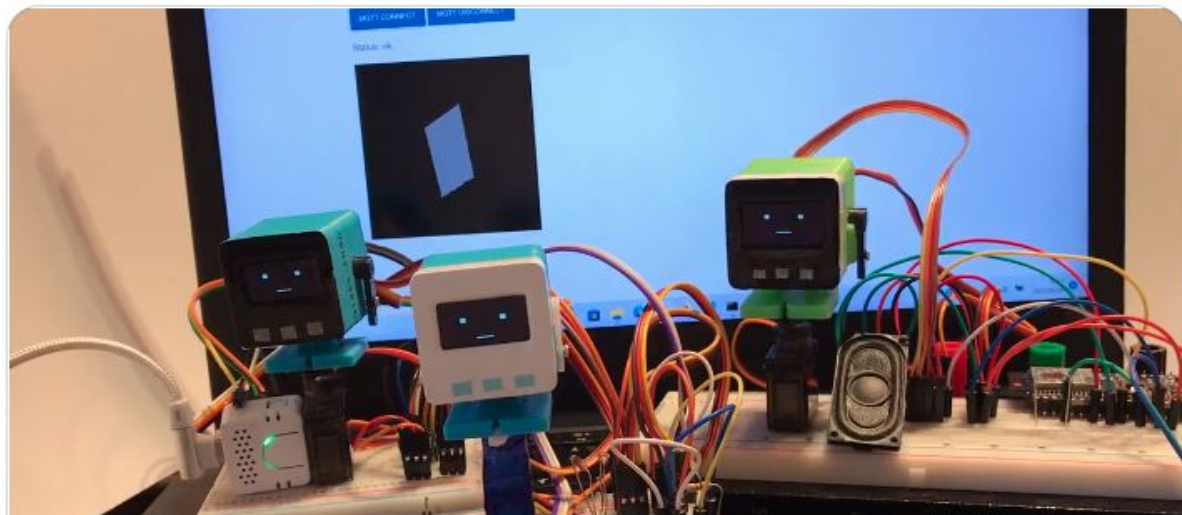
Developer Experimentation

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[Twitter collection](#)

小さいスタックちゃんたちをJINS MEMEで一斉に動かしてみるテスト。JINS MEME → ブラウザのWeb Bluetooth API → MQTT over WebSocket → MQTTブローカー → 小さいスタックちゃんという経路。

(個体間の動きの同期は取ってない。横回転は顔の傾きで代用。)

[Translate Tweet](#)



Developer Experimentation

@Vincent_Scheib
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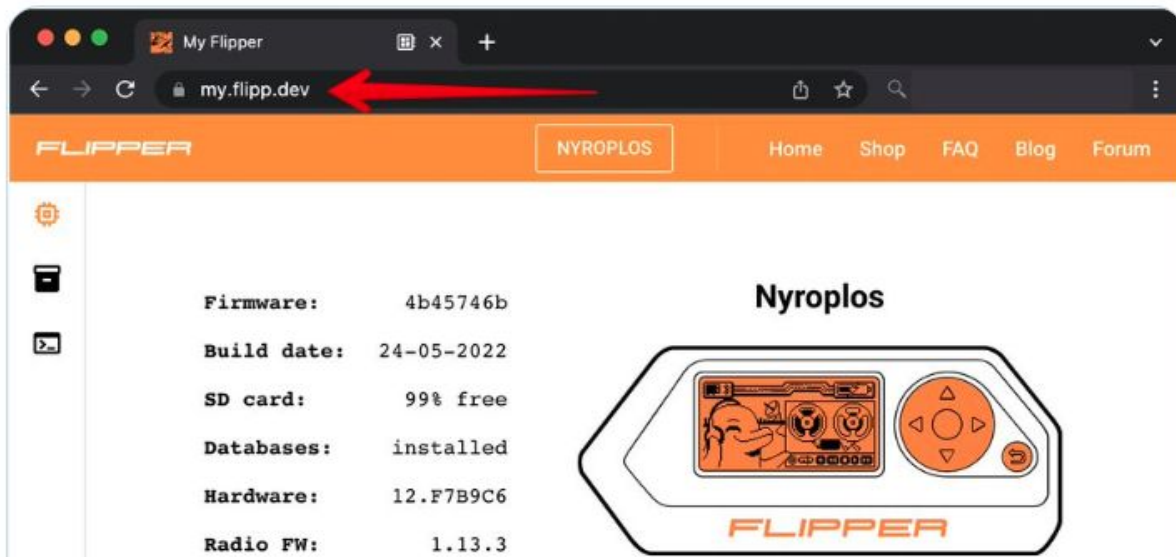


Pavel Zhovner
@zhovner



We have resumed development of [#flipperzero](#) WebUSB application. Now it can update firmware directly from browser using the new updating protocol. Highly experimental demo: my.flipp.dev

Please check it out if you are brave enough.





Niklas
@Gurkengewuerz



Developer Experimentation

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As [@joebernard](#) said in an interview: "Share your work with the world" 🌍

Inspired by your telemetry view for your rockets i coded a telemetry view for my upcoming drone.

The view is running in the browser and connects via WebUSB to my telemetry receiver.

[#RP2040](#) [#raspberrypi](#) [#FPV](#)





Jonas Beuchert

@JonasBchrt



Developer Experimentation

We handle device configuration, data uploads & firmware updates this way.

@Vincent_Scheib
[Twitter collection](#)

Still amazed how smooth [#WebUSB](#) works. I think it could solve the compatibility issues of many USB devices out there. Also feels safer than downloading drivers from grey corners of the internet. (7/12)





Robin Reiter

@robin7331



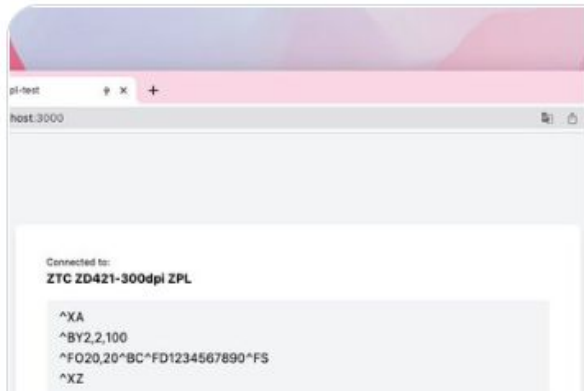
Developer Experimentation

@Vincent_Scheib
[Twitter collection](#)

Today I learned about ZPL.
A simple plain-text commands for Zebra label printers.

No drivers required.
OS independant.
All you need is WebUSB and some simple JS. 🧑🍳

I made a quick demo app to send ZPL to my USB
ZD421 and it works extremely well! 💕





Matti Tahvonen

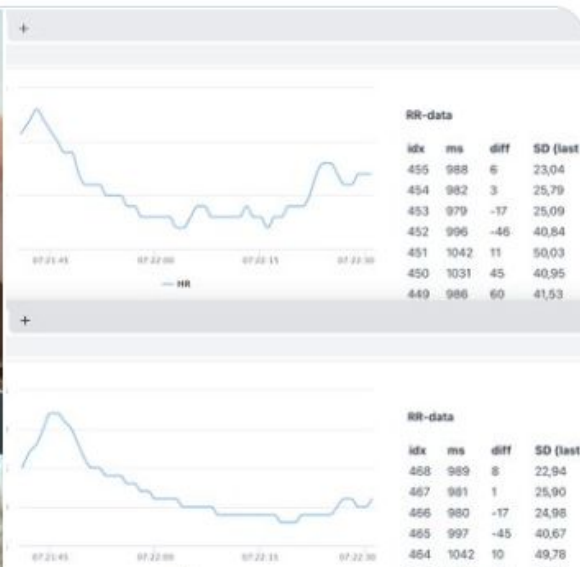
@MattiTahvonen



Developer Experimentation

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Comparing heart rate monitors from the two Finnish vendors using my [#Webbluetooth](#) example. R-R data is surprisingly identical, but Polar H10 probably calculates HR using more R-R intervals as the curve is slightly smoother. Source code: github.com/mstahv/hr-moni... [#java](#) [#vaadin](#)





Michaela Merz

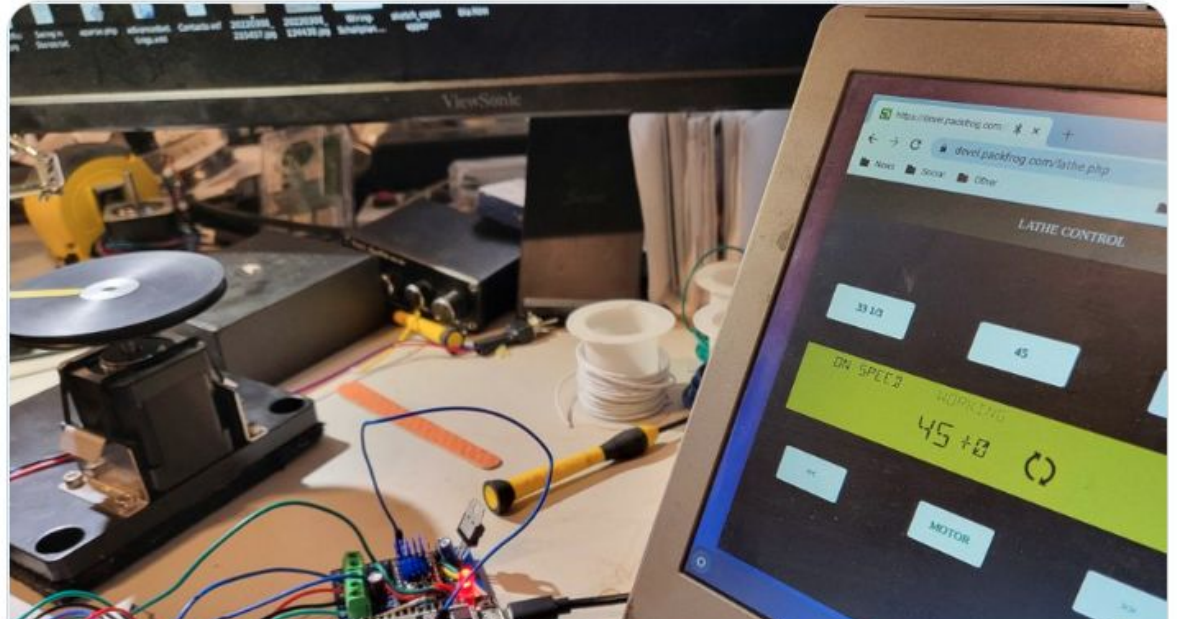
@mischmerz



Developer Experimentation

@Vincent_Scheib
[Twitter collection](#)

How cool is this? [#webbluetooth](#) within a [@googlechrome](#) [#pwa](#) controls a stepper motor via [#esp32](#) SOC for a [#vinylrecords](#) cutting lathe. I experienced the very beginning of the [#web](#) - but stuff like this I never even dreamed of.



Developer Experimentation


@Vincent_Scheib
[Twitter collection](#)

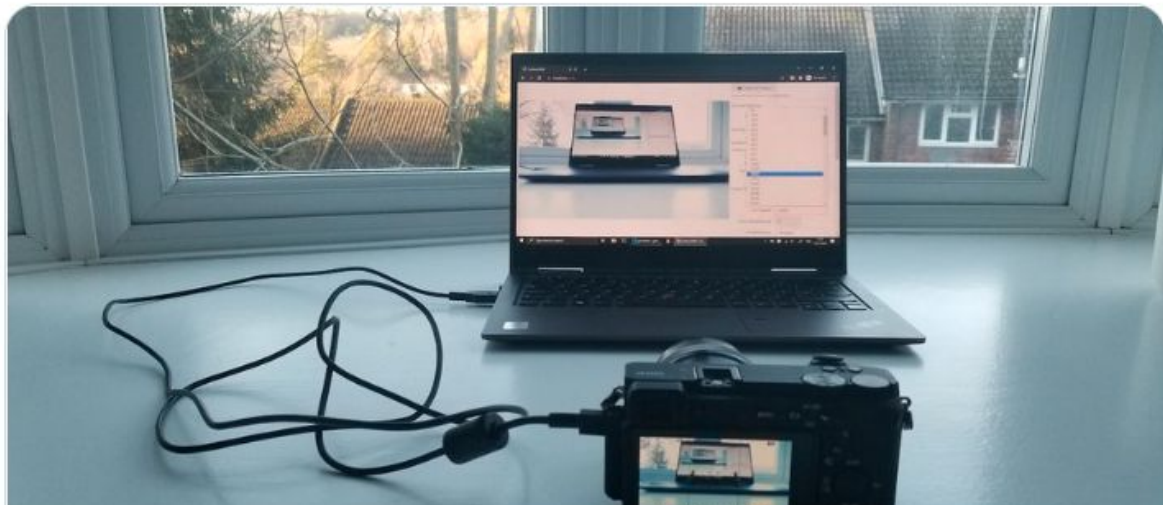


 **extinguished engineer**
@RRverser



 Just published part 2 of the "Porting USB applications to the web". web.dev/porting-gphoto...

 In this part I'm describing how I ported libgphoto2 to WebAssembly to control cameras from a web app, and showing how it was wrapped into a web UI with [@preactjs](#).



Many possibilities.

*Efficient cross platform development,
easy to use APIs,
and distribution are key motivators.*

Discussion

Security

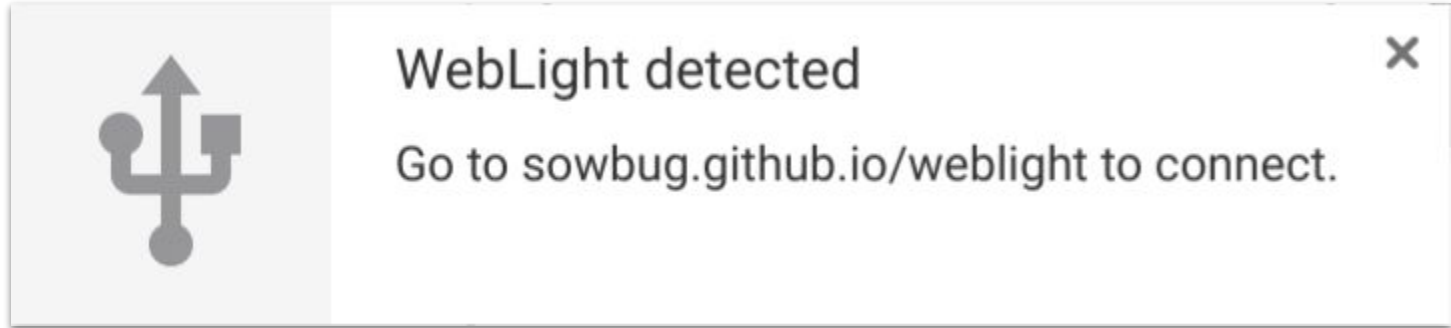
Without Web APIs

- People will still use their devices. But how?
- People will install native apps.
- Pros: install friction reduces how often this is done
(though security research shows it is not a barrier given incentives)
- Cons: Exposes people to security and privacy issues across many APIs, access to all devices

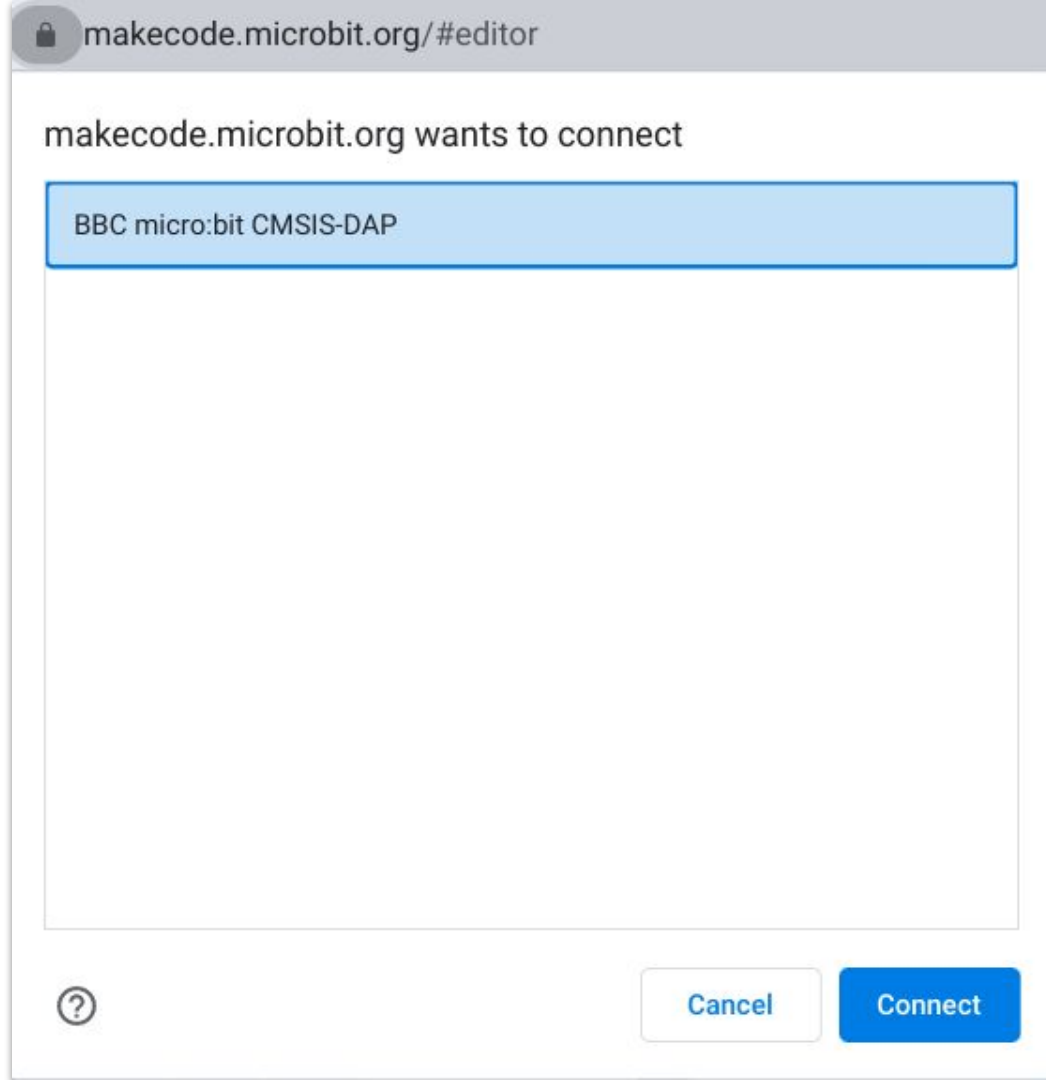
Security Model

- Balancing risk trade offs between
 - Installing Windows/Mac/etc apps with multi-device, multi-api access
 - Web Browser restricted access:
- Requires secure context.
- Permission granted one device to one site. **Least privilege** principle.
- Blocklist device or attributes.
- Users informed when the device is accessed.

WebUSB notification



Chrome's Chooser Dialog



Risk: Exposing information about user's devices

Sites can not access list of user's devices

Access to a device only after a person selects one via a chooser.

Risk: Device can be compromised, e.g. firmware update

Users must select and grant access to a device

Sites do not know ahead of time whether a vulnerable device is available.

Attempting to connect to many devices is very noticeable.

Devices under active attack can be added to a blocklist

Risk: Cross origin data sharing

Users must grant access to device multiple times, for each origin.

Comparable to saving and opening a file between sites.

Risk: Devices not designed to be accessed by any website

'Not designed' or 'fundamentally unsafe to be accessed by browser'?

Native applications also provide any software to access any device

Devices that are fundamentally unsafe can be added to the blocklist

Risk: Users don't understand the permission

Chooser designed to be hard to "just click yes". Must select a device first. Then connect.

User agents can provide in context help

User agents may add more information to the permission dialog