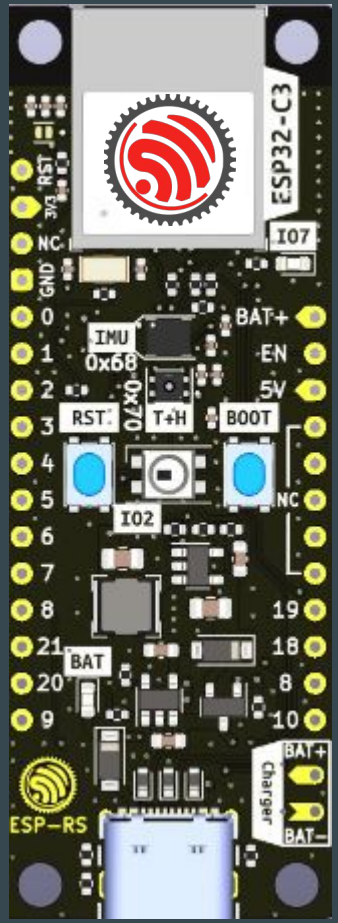
14 tips for Makers

2024-05-17
Espressif Community event
Impact Hub - Brno

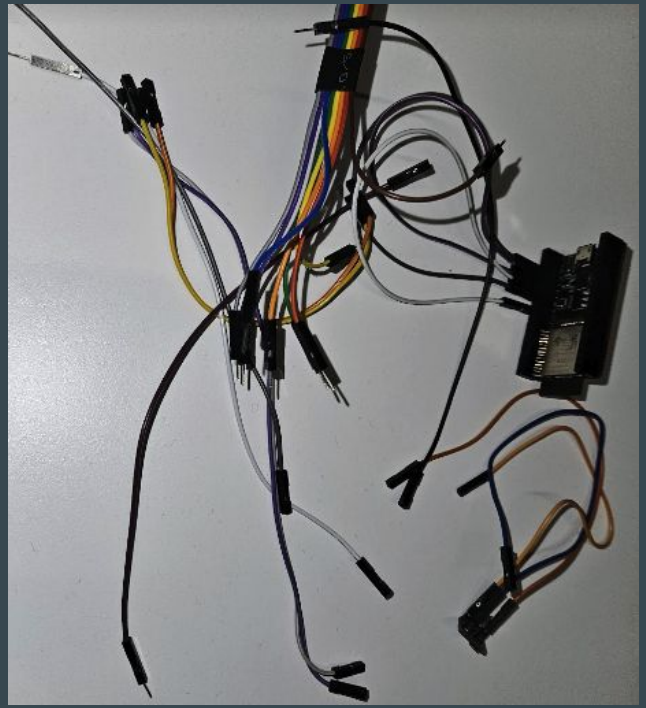
Juraj Michálek - Espressif Systems



Tip #1

Connecting pins

Duponts?



Wire wrap

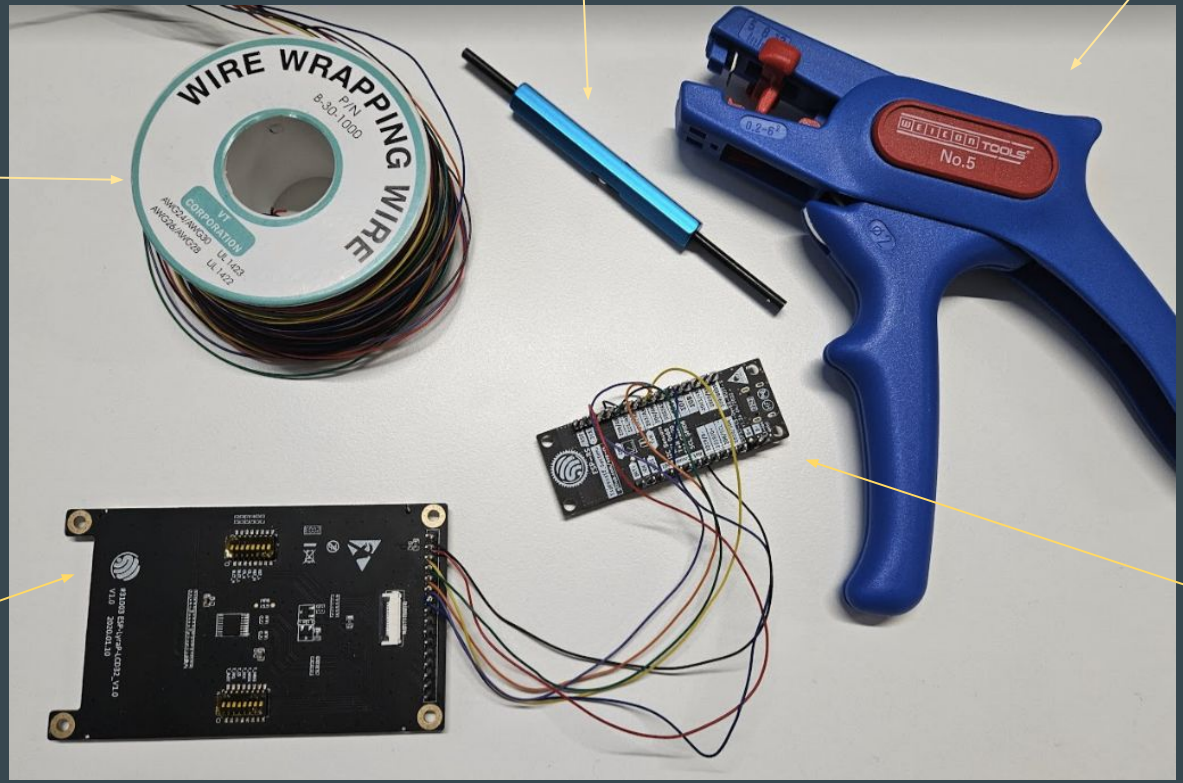

WIRE WRAPPING WIRE
P/N
8-30-1000
XT
CORPORATION
AWG24/AWG30
AWG28-AWG29
UL 1423
UL 1422
0.2-6²
No.5

Wire wrap

Wire Wrap Tool

Weicon No 5.

30AWG Wire Wrapping



LCD ILI9341

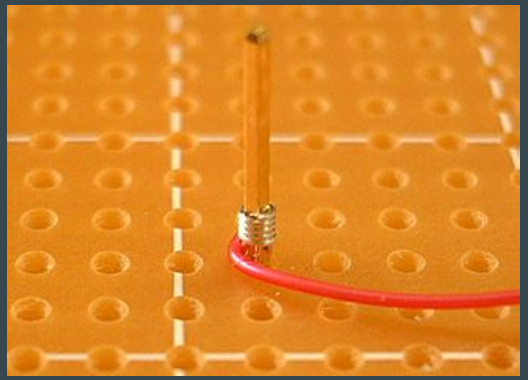
ESP32-C3 Rust Board

Wire wrap

Quick, safe way how to connect pins and wires

Wire Wrapping for our Projects by Andreas Spiess:

https://youtu.be/L-463vchW0o?si=U96aLAwIsLpsPGTW



picture from Wikipedia: https://en.wikipedia.org/wiki/Wire_wrap

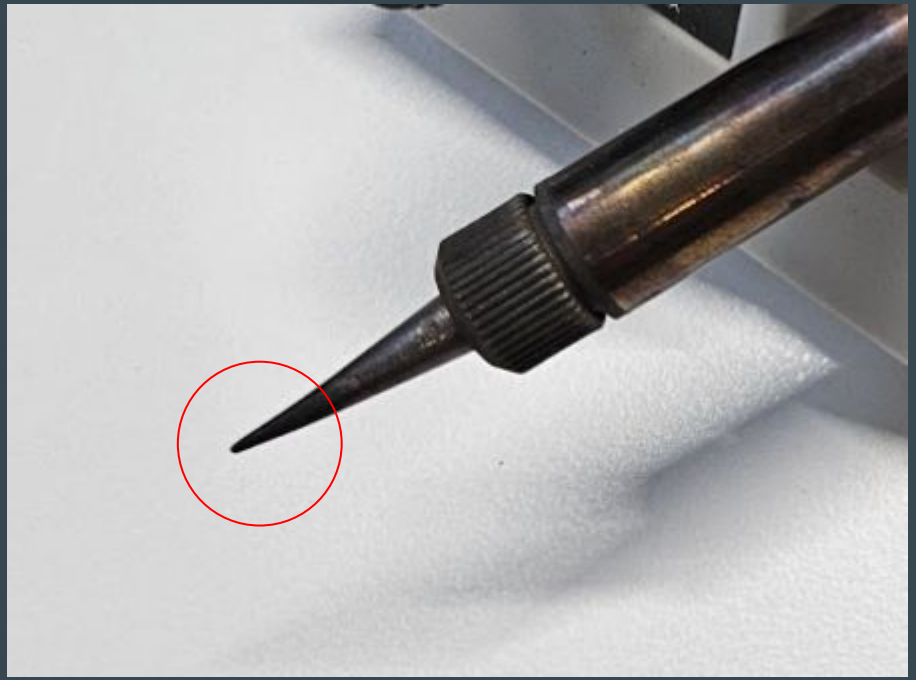
Tip #2

Soldering

Soldering iron?

Clean oxidized tip

Thin oxide layer is blocking heat transfer.



Steel Wire Dish Pot Cleaning Scourer

Pinecil

PINE64

Tip #3

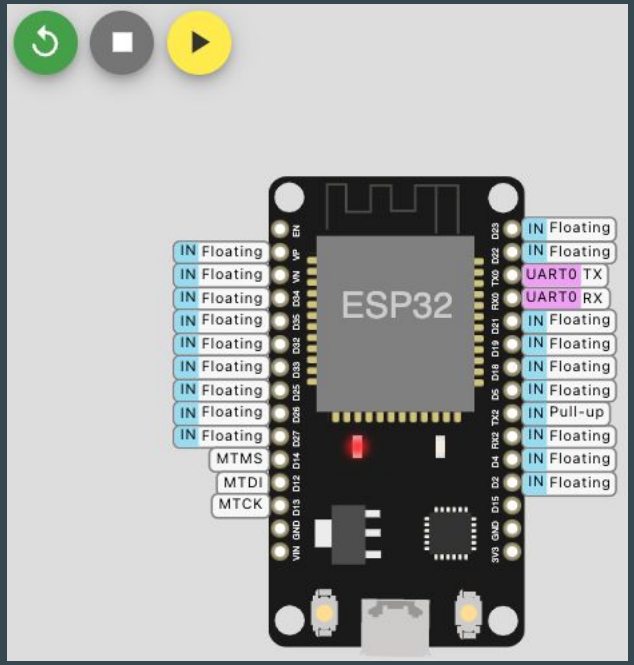
Start playing in browser

wokwi.com/esp32

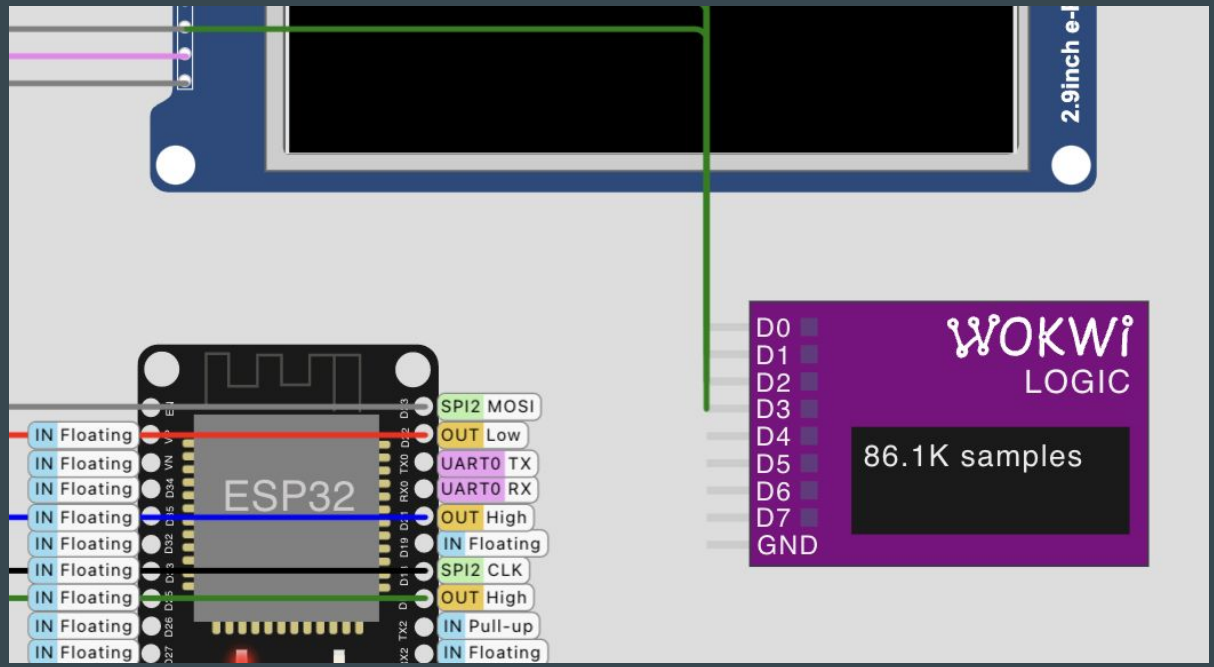
Contribute: https://github.com/wokwi

EDC22 Day 1 Talk 9: Your browser is ESP32 - Wokwi - https://youtu.be/TKe4MgD6O8o

Pause button - see state of GPIOs

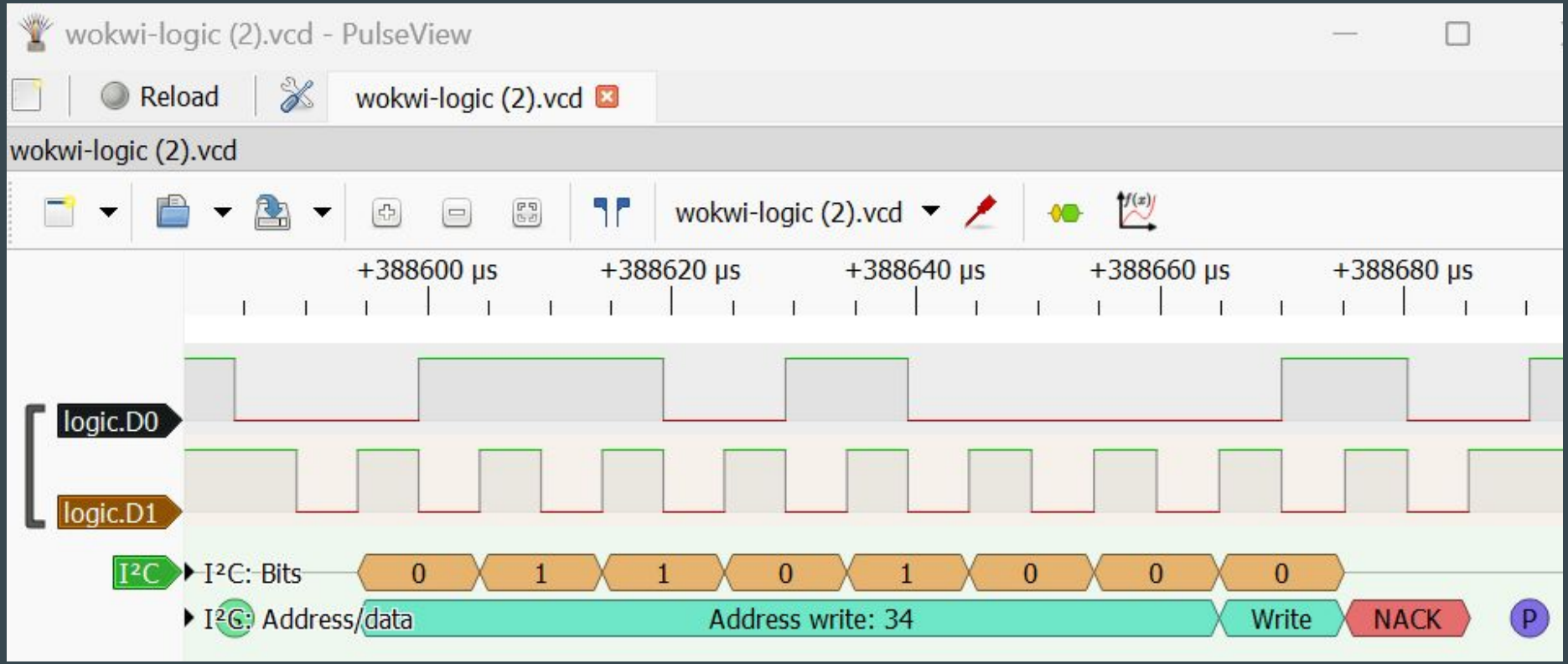


Wokwi Logic Analyzer



Hit Stop to download VCD file for PulseView

Wokwi + PulseView - examples of I2C



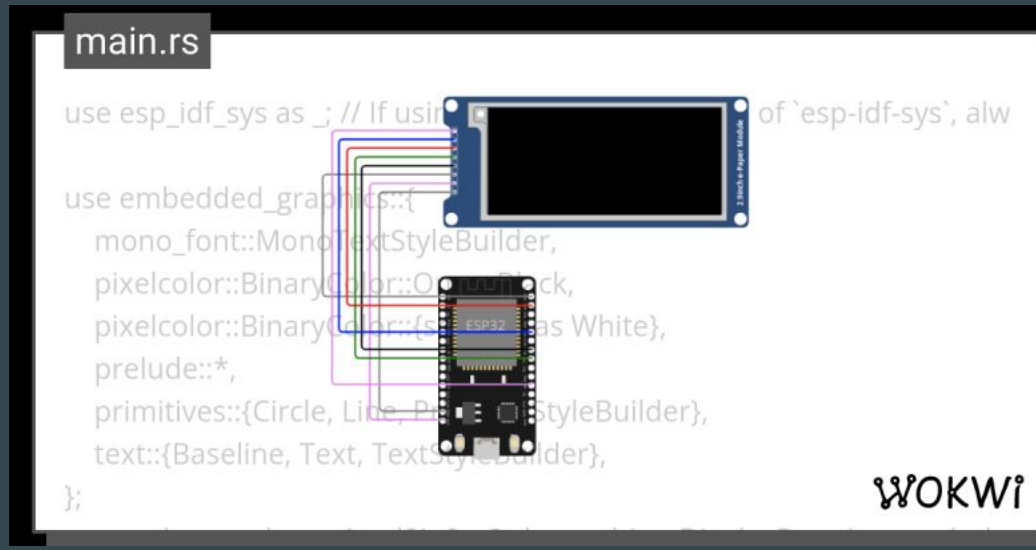
Create Custom chips like e-Paper

Simulate your own HW

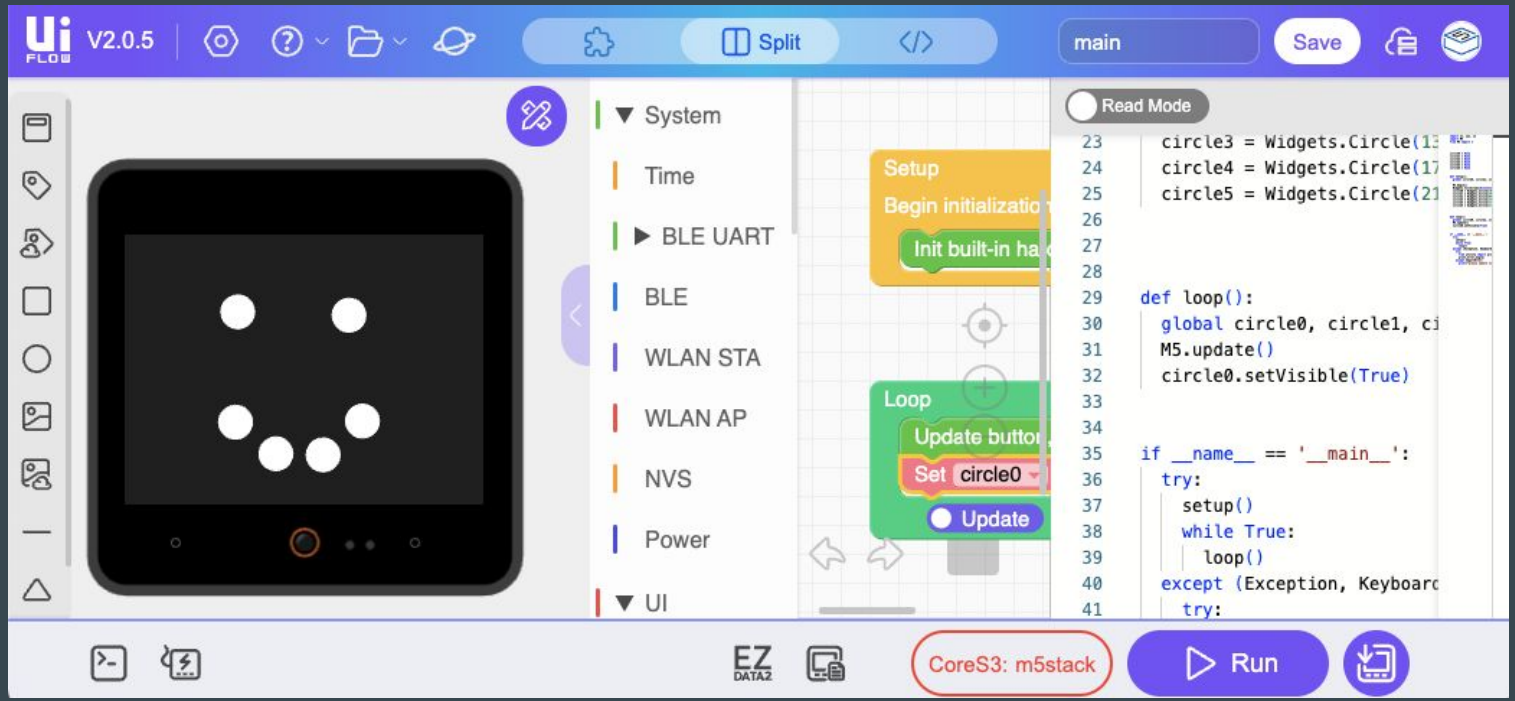
Wokwi: Getting Started with the Wokwi Custom Chips C API

https://docs.wokwi.com/chips-api/getting-started

https://wokwi.com/projects/366167936725307393



UIFlow2.M5Stack.com



Tip #4

Explore DevKits

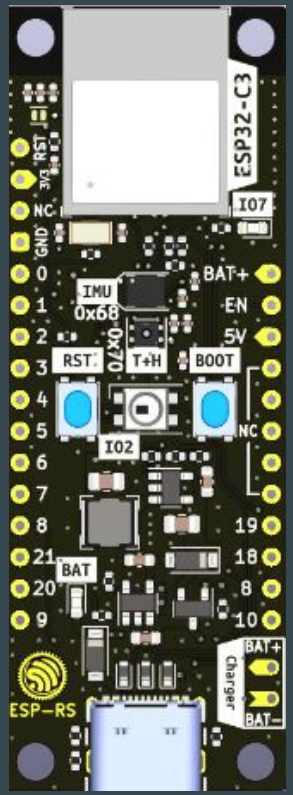
Designing Open Hardware - esp-rust-board

KiCad templates

https://github.com/esp-rs/esp-rust-board

ESP32-C3-DevKit-RUST-1

https://www.espressif.com/en/products/devkits



Open Hardware - ESP32-S3-BOX-3

https://github.com/espressif/esp-box

Joystick controller

https://github.com/espressif/esp-box/tree/master/examples/esp_joystick/joystick_controller

M5Stack

m5stack.com

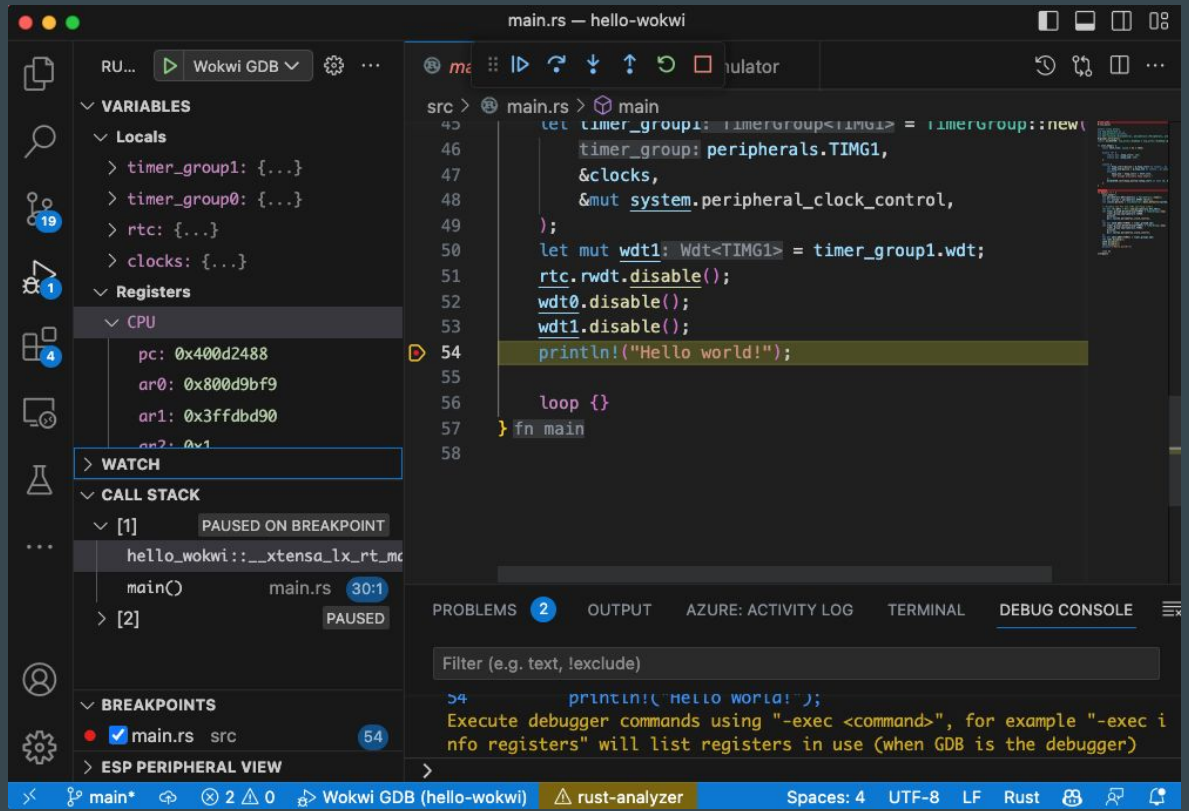
NANO_D++

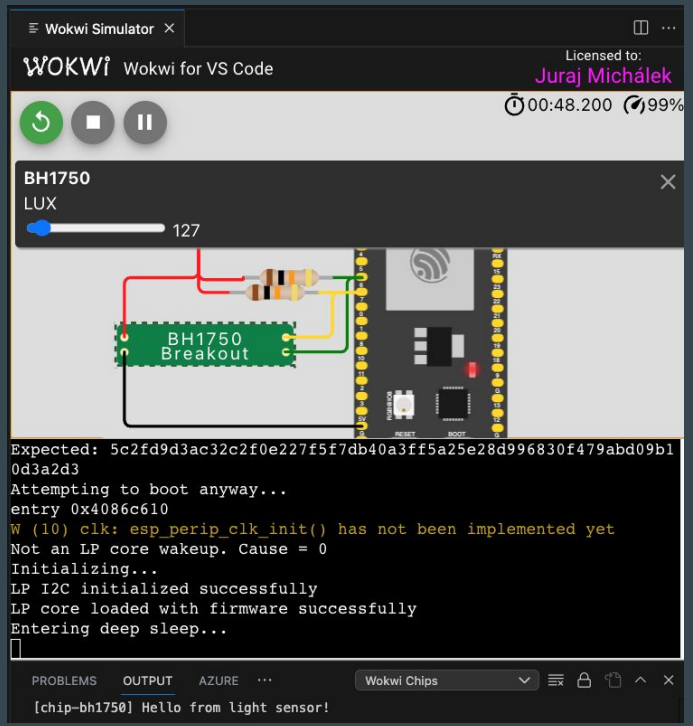
https://store.binaris.io/

Tip #5

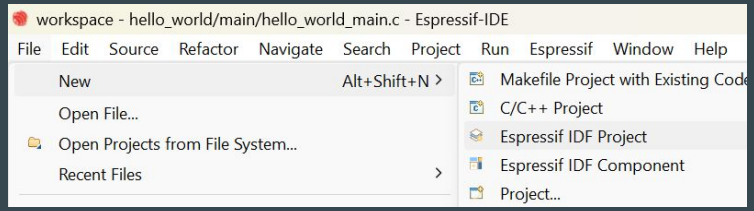
Learn IDEs, have no fear from CLI

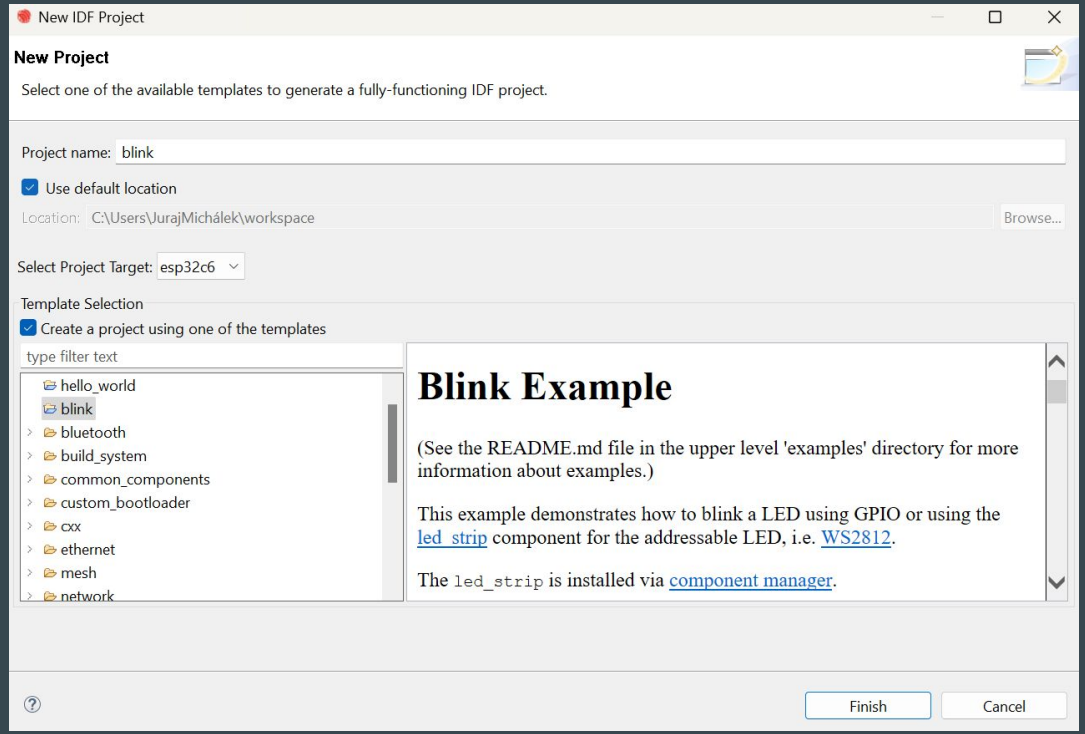
VS Code + Espressif Extension + Wokwi



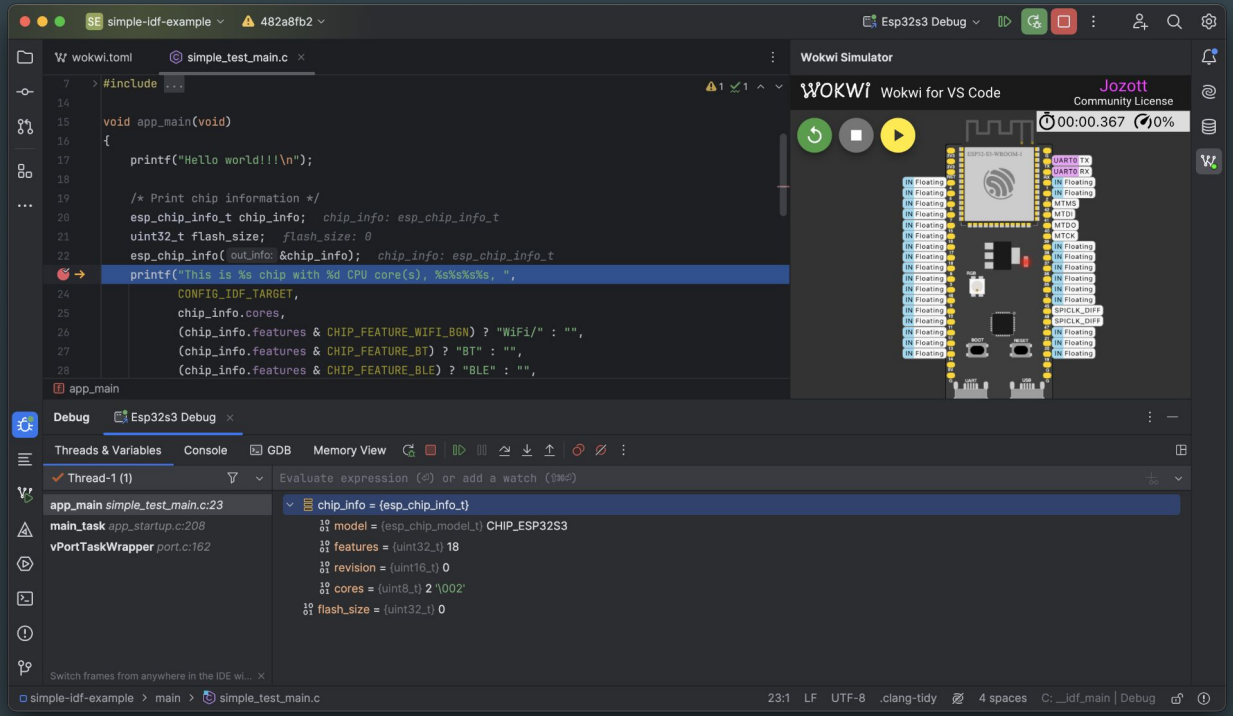


Espressif IDE (based on Eclipse)



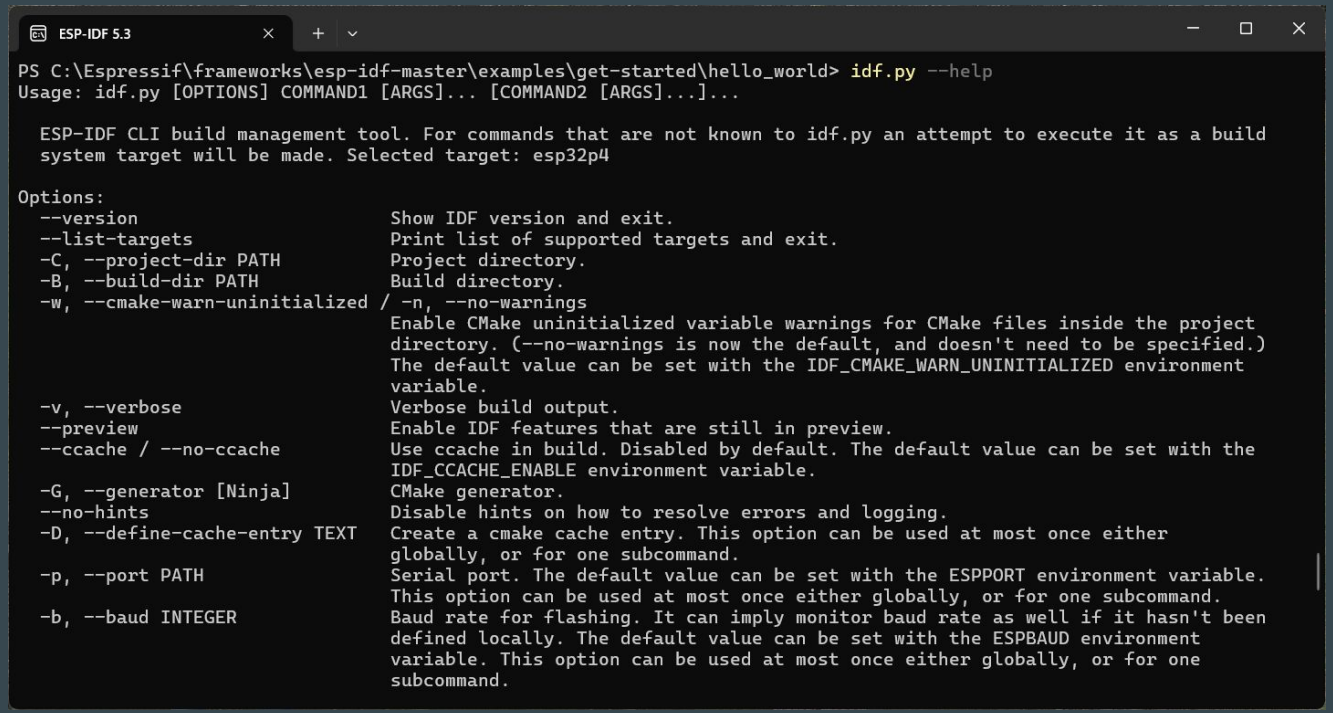


JetBrains - CLion + Wokwi simulator



[Jozott00's plugin]

idf.py --help



idf.py build flash monitor

idf.py uf2

Tip #6

Have more USB cables

Tip #7

Know the limits

Desktop vs. Embedded development

Memory: GB (TB) vs. kB (MB bytes of PSRAM)

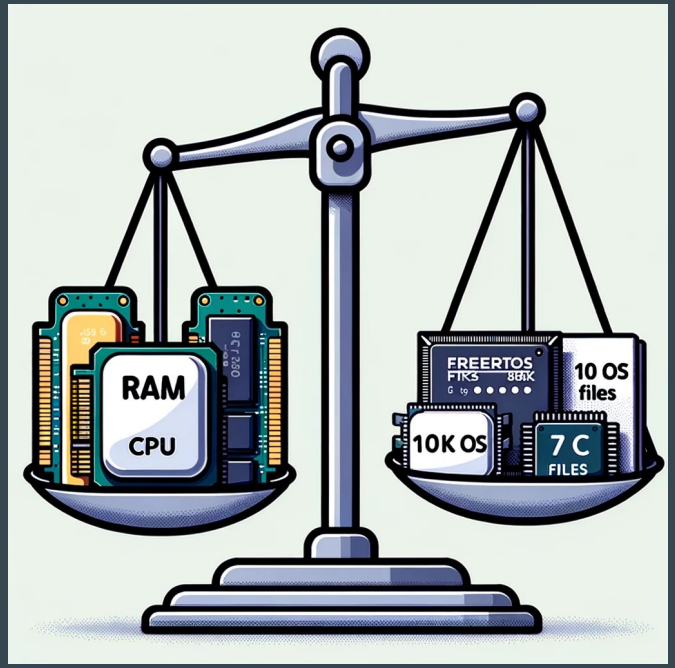
CPU Cores: 8 - 64 vs. 1 - 2

CPU Frequencies: GHz vs. 20-240 MHz

Power consumption: 100s of Watts vs. Milliwatts

OS kernel: 61k files vs. 10k files in ESP-IDF

(FreeRTOS kernel: 7 C files)



ESP32 Lang lab - Free heap - no PSRAM

https://github.com/georgik/esp32-lang-lab

	ESP-IDF C	Arduino	CircuitPython	MicroPython	Rust no_std	Rust std	ZIG + ESP-IDF
ESP32	300892	237568	113424	164064	179200	296028	300476
ESP32-S3	386744	369920	150432		332800	388016	389976
ESP32-C6	468852				440316	471068	471208

Note: ESP32, ESP32-S3 - supports PSRAM, ESP32-C6 does not support PSRAM

Tip #8

Choose right HW/SW setup

Chip


ESP32
Available: 2016 - 2028
+ ETH
- USB
- CAM
- SPI-ETH
ESP32-S3
Available: 2022 - 2034
+ WiFi6
+ Low-Power
+ RISC-V
- USB
- LCD
- CAM
- PSRAM
- SD/MMC
- Xtensa
ESP32-C6
Available: 2023 - 2035

ESP32-C6

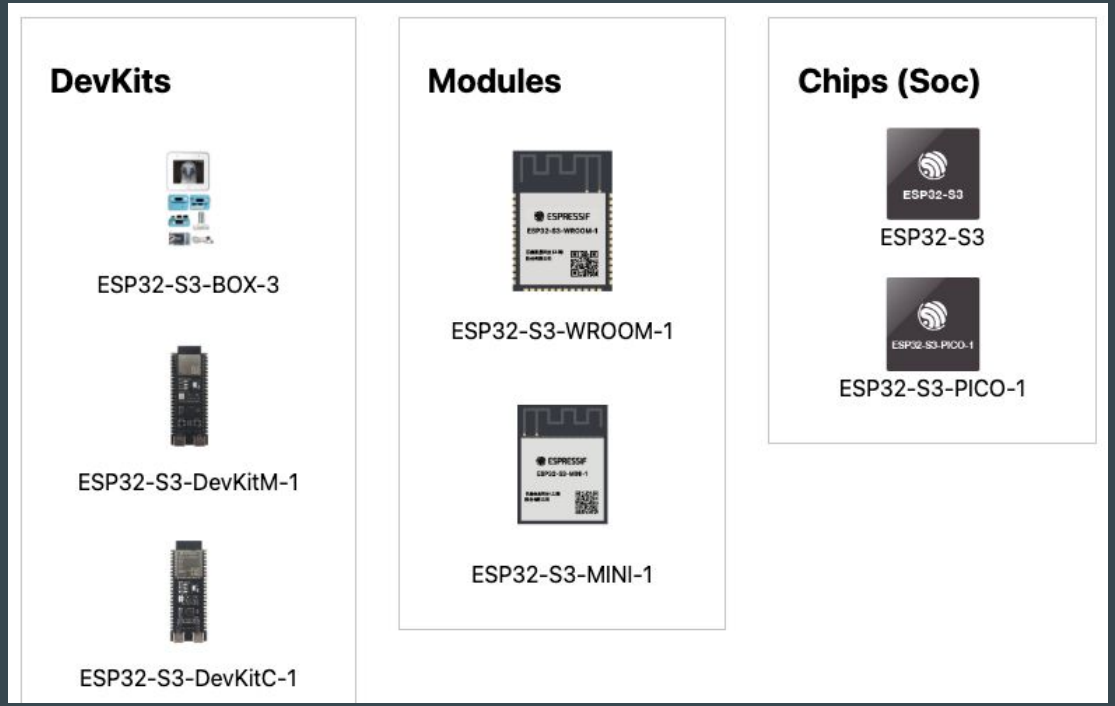
Main feature: WiFi 6 support - reduced power consumption

- https://www.youtube.com/watch?v=FA1jqZLig4s

Second important feature:

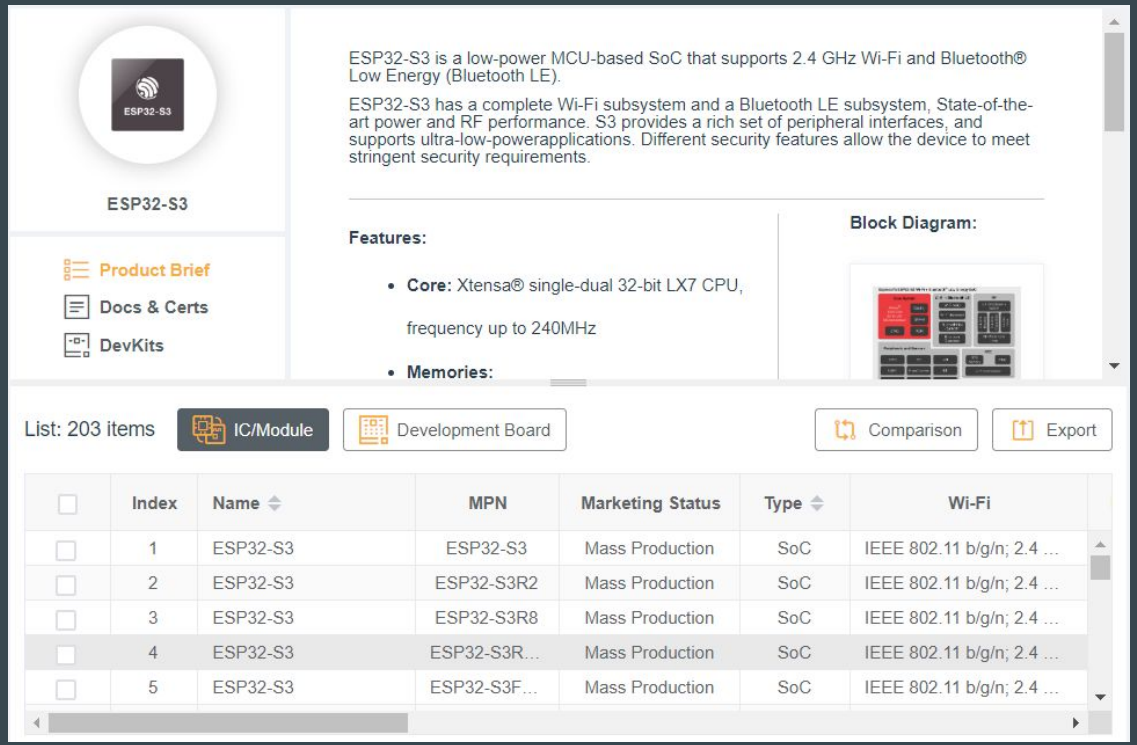
- Low Power Core - 20 MHz

Form Factor

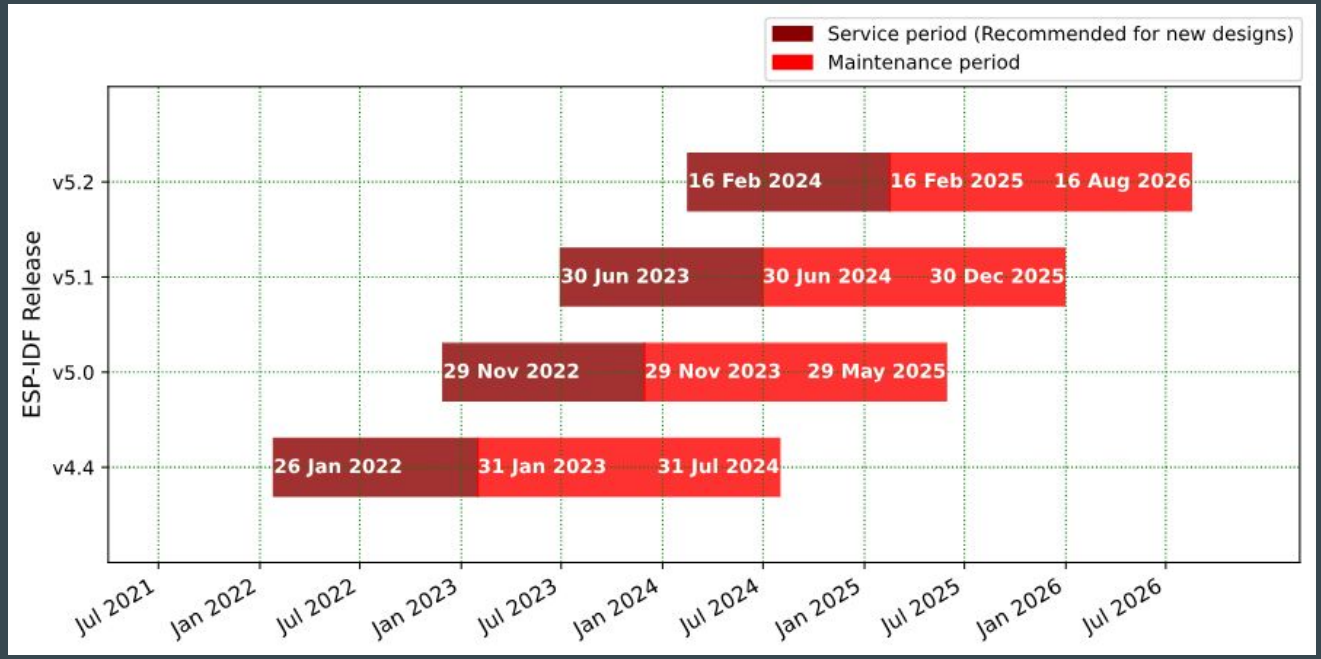

DevKits
ESP32-S3-BOX-3
ESP32-S3-DevKitM-1
ESP32-S3-DevKitC-1
Modules
ESP32-S3-WROOM-1
ESP32-S3-MINI-1
Chips (Soc)
ESP32-S3
ESP32-S3
ESP32-S3-PICO-1
ESP32-S3-PICO-1

Many chips, many boards - quick help

https://products.espressif.com/



ESP-IDF Release Support Schedule



ESP-IDF Release and SoC Compatibility

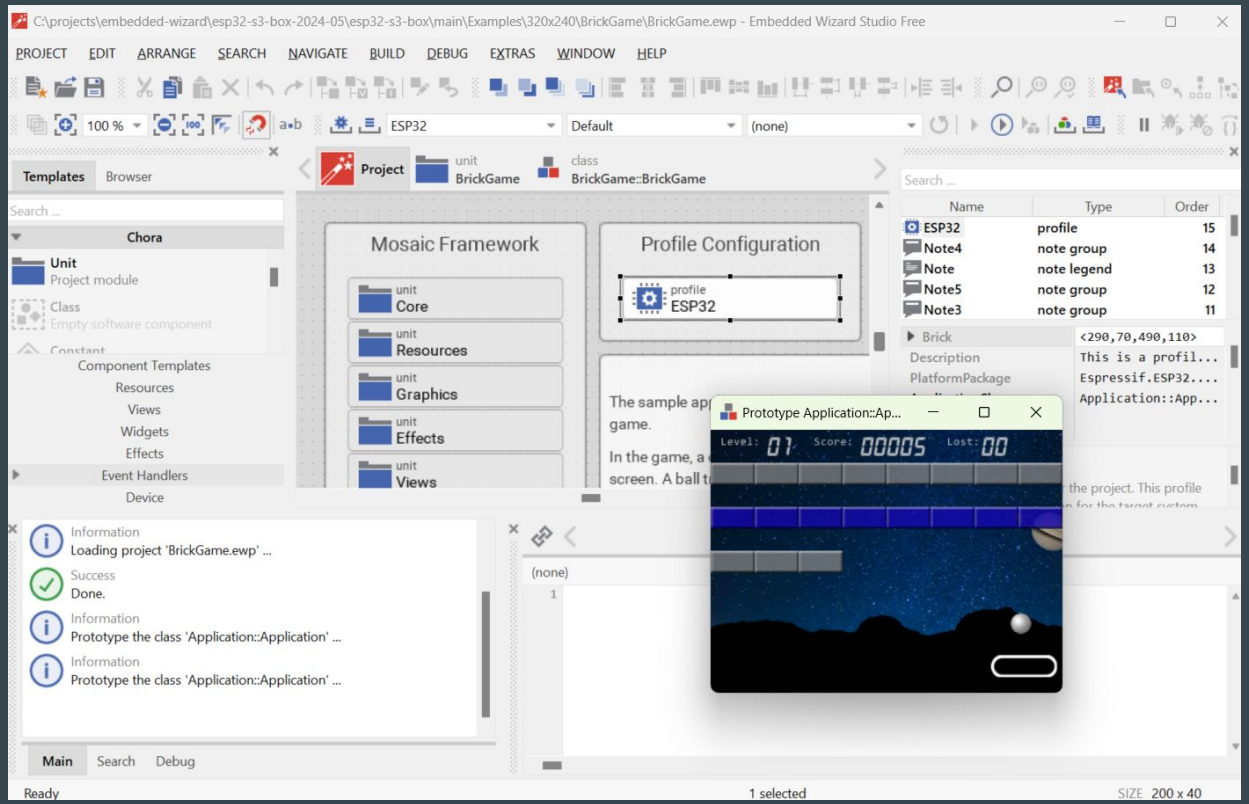
Chip	v4.4	v5.0	v5.1	v5.2	v5.3
ESP32	supported	supported	supported	supported	supported
ESP32-S2	supported	supported	supported	supported	supported
ESP32-C3	supported	supported	supported	supported	supported
ESP32-S3	supported	supported	supported	supported	supported
ESP32-C2		supported	supported	supported	supported
ESP32-C6			supported	supported	supported
ESP32-H2			supported	supported	supported
ESP32-P4					supported
ESP32-C5					preview

Tip #9

GUI Designers

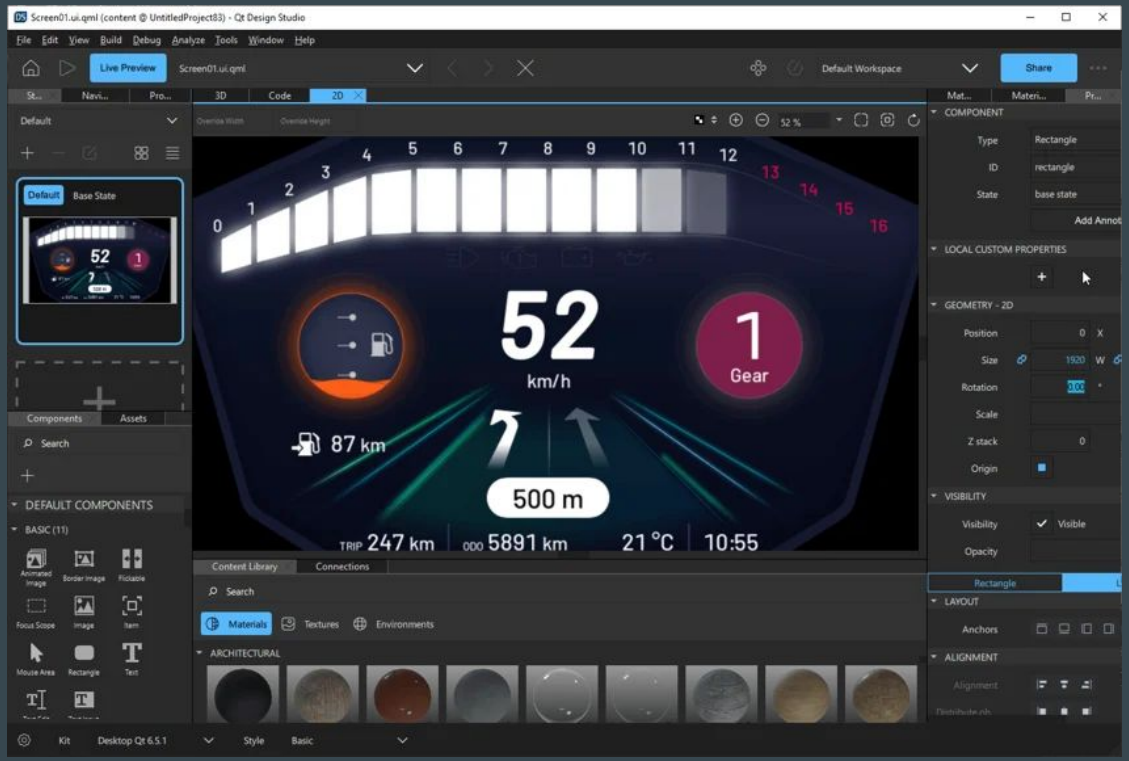
Embedded Wizard

Embedded Wizard
GUI Solutions by TARA Systems

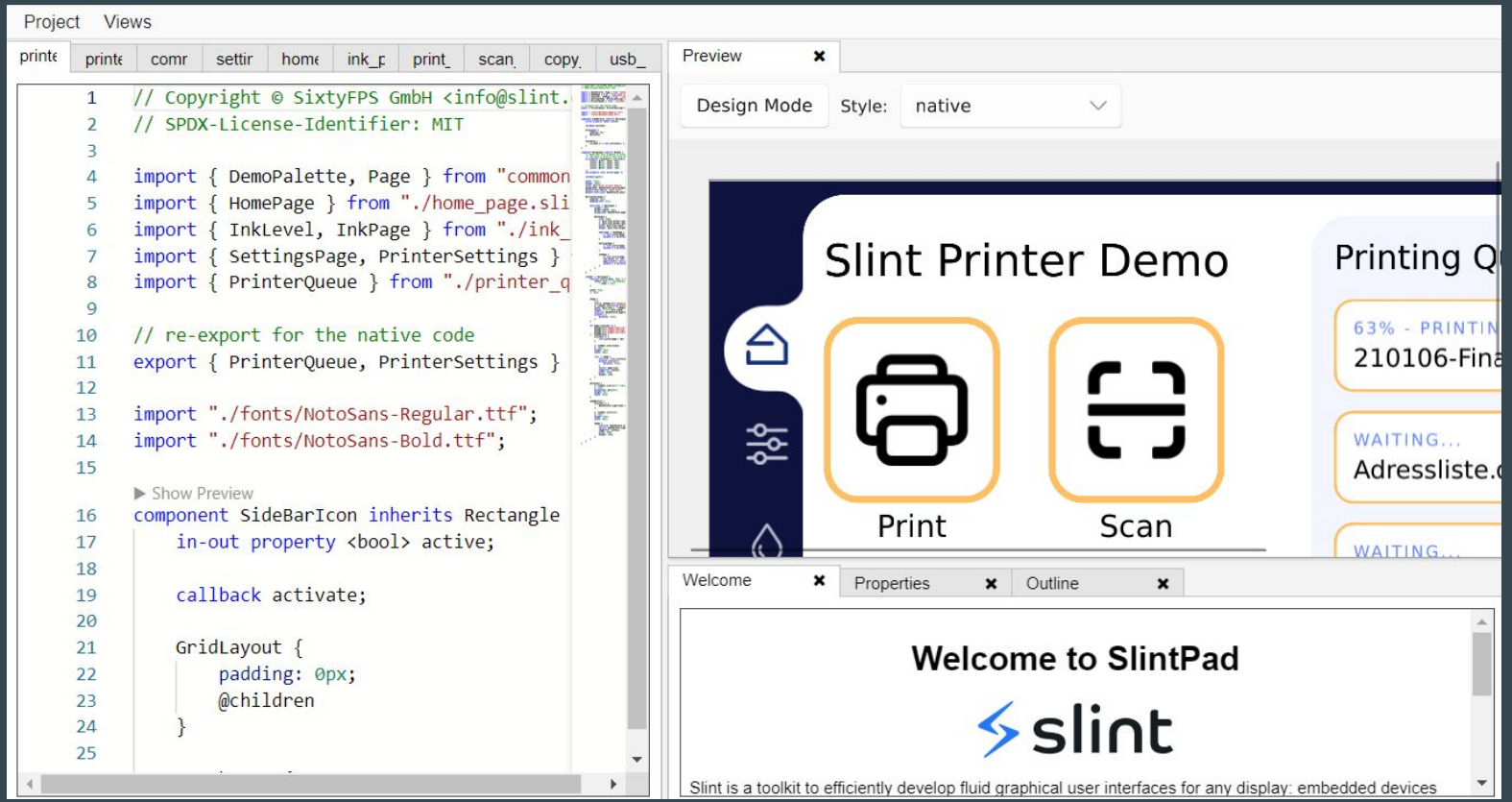


www.embedded-wizard.de

Qt for MCU


Screen01.ui.qml (content @ UntitledProject83) - Qt Design Studio
File Edit View Build Debug Analyze Tools Window Help
Live Preview
Screen01.ui.qml
Default Workspace
Share
3D
Code
2D
Default
Base State
Components
Assets
Search
DEFAULT COMPONENTS
BASIC (11)
52
km/h
1
Gear
87 km
500 m
TRIP 247 km
ODO 5891 km
21 °C
10:55
Content Library
Connections
Search
Materials
Textures
Environments
ARCHITECTURAL
COMPONENT
Type
Rectangle
ID
rectangle
State
base state
LOCAL CUSTOM PROPERTIES
GEOMETRY - 2D
Position
Size
Rotation
Scale
Z stack
Origin
VISIBILITY
Visibility
Visible
Opacity
LAYOUT
Anchors
ALIGNMENT
Kit
Desktop Qt 6.5.1
Style
Basic

Slint UI


Project
Views
// Copyright © SixtyFPS GmbH <info@slint.
// SPDX-License-Identifier: MIT
import { DemoPalette, Page } from "common
import { HomePage } from "./home_page.sli
import { InkLevel, InkPage } from "./ink_
import { SettingsPage, PrinterSettings }
import { PrinterQueue } from "./printer_q
// re-export for the native code
export { PrinterQueue, PrinterSettings }
import "./fonts/NotoSans-Regular.ttf";
import "./fonts/NotoSans-Bold.ttf";
Show Preview
component SideBarIcon inherits Rectangle
in-out property <bool> active;
callback activate;
GridLayout {
padding: 0px;
@children
}
Preview
Design Mode
Style:
native
Slint Printer Demo
Print
Scan
Printing Q
63% - PRINTIN
210106-Fina
WAITING...
Adressliste.
WAITING...
Welcome
Properties
Outline
Welcome to SlintPad
slint
Slint is a toolkit to efficiently develop fluid graphical user interfaces for any display: embedded devices

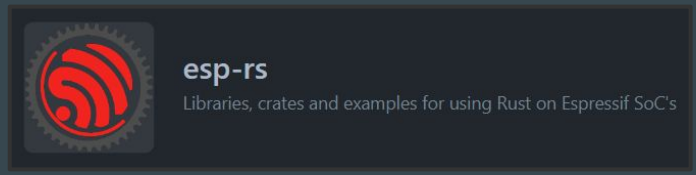
Tip #10

Play with more languages and AI

Programming languages

Active support by Espressif teams

- C/C++
  - most common choice - https://github.com/espressif/esp-idf
- Rust
  - security and memory guaranties of Rust
  - https://github.com/esp-rs
  - multi-target support: Xtensa, RISC-V, plus WASM, desktops or mobile
- Arduino - Maker choice
  - Arduino IDE 2.x
  - note: check the license for production



OSes - C/CPP, Rust

no_std a.k.a. bare metal with Rust - https://github.com/esp-rs/esp-hal (minimalistic)

ESP-IDF (OS based on FreeRTOS) - https://github.com/esp-rs/esp-idf-hal

Zephyr - https://zephyrproject.org/

- EDC22 Day 1 Talk 10: Applications of Asymmetric Multiprocessing with ESP32 Devices - including Rust on one core - https://youtu.be/oble9ObAqxM

NuttX - https://nuttx.apache.org/ (as app, Linux-like OS)

SVD files: https://github.com/espressif/svd

Other languages and frameworks in context of ESP32

- Zig

VM based:

- CircuitPython and MicroPython - Python-like language
- DeviceScript - TypeScript language - Microsoft Research
- Lua
- Mongoose OS
- Nanoframework - C# language
- Toit
- downside: bigger VM
- upside: more robust, comes with OTA and monitoring

Accelerated learning with AI

Help with learning new prog. language

Very good results: Chat GPT 4, GitHub CoPilot

Less accurate results: Chat GPT 3.5, Gemini

Tip #11

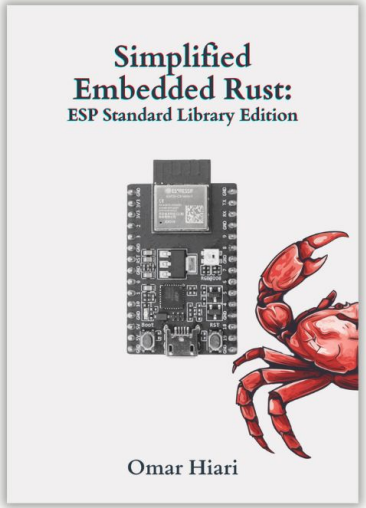
Read books

NEW BOOK RELEASES

LEARN EMBEDDED RUST WITH ESP

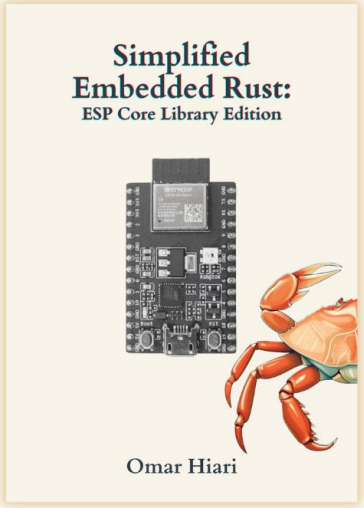
RELEASE DATE: MAY 17TH

STANDARD LIBRARY EDITION



HTTPS://ME-QR.COM/L/SER-STD

CORE LIBRARY EDITION



HTTPS://ME-QR.COM/L/SER-NO-STD

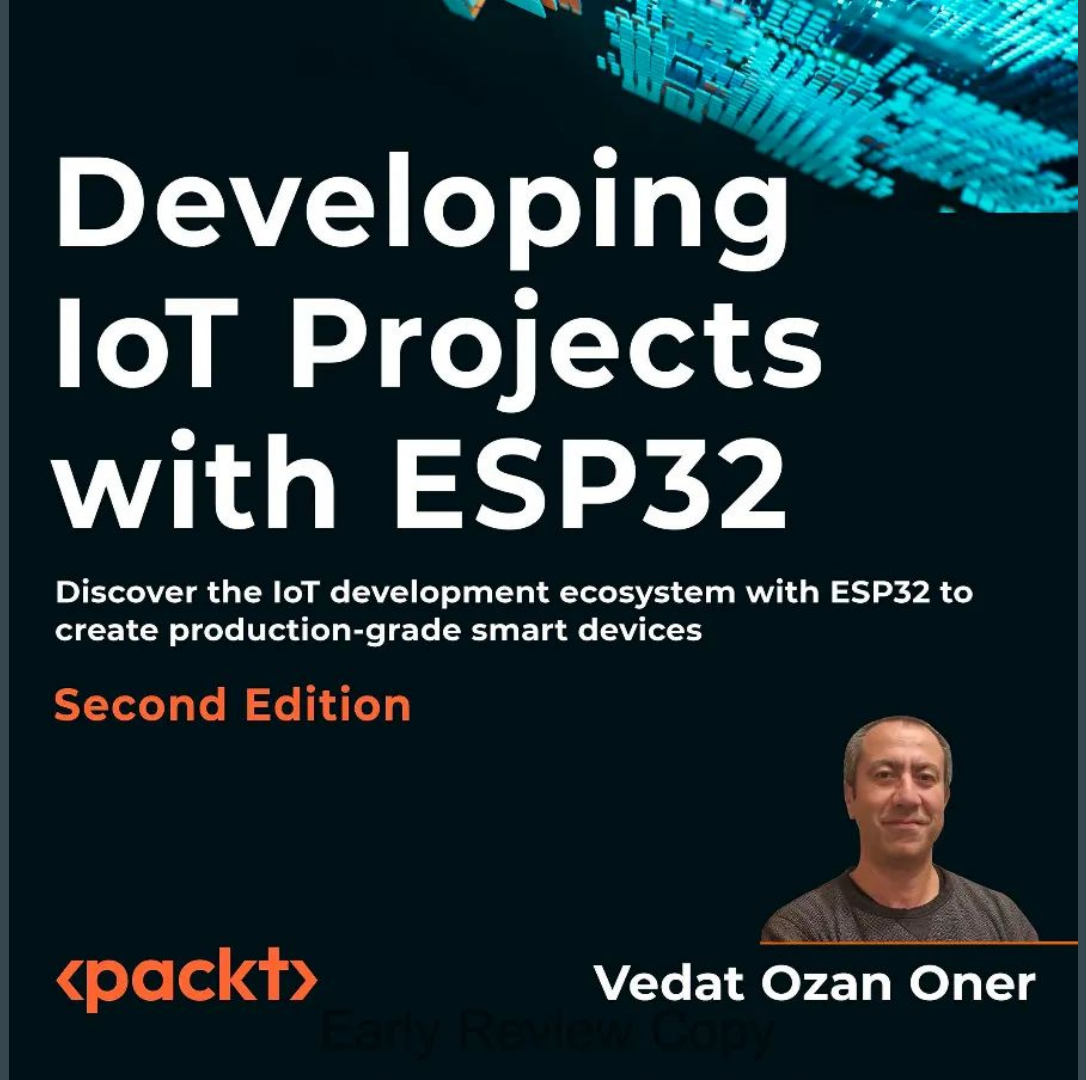
Elektor Mag

Special Guest Edition

https://www.elektor.com/products/elektor-special-espressif-guest-edition-2023-pdf-en

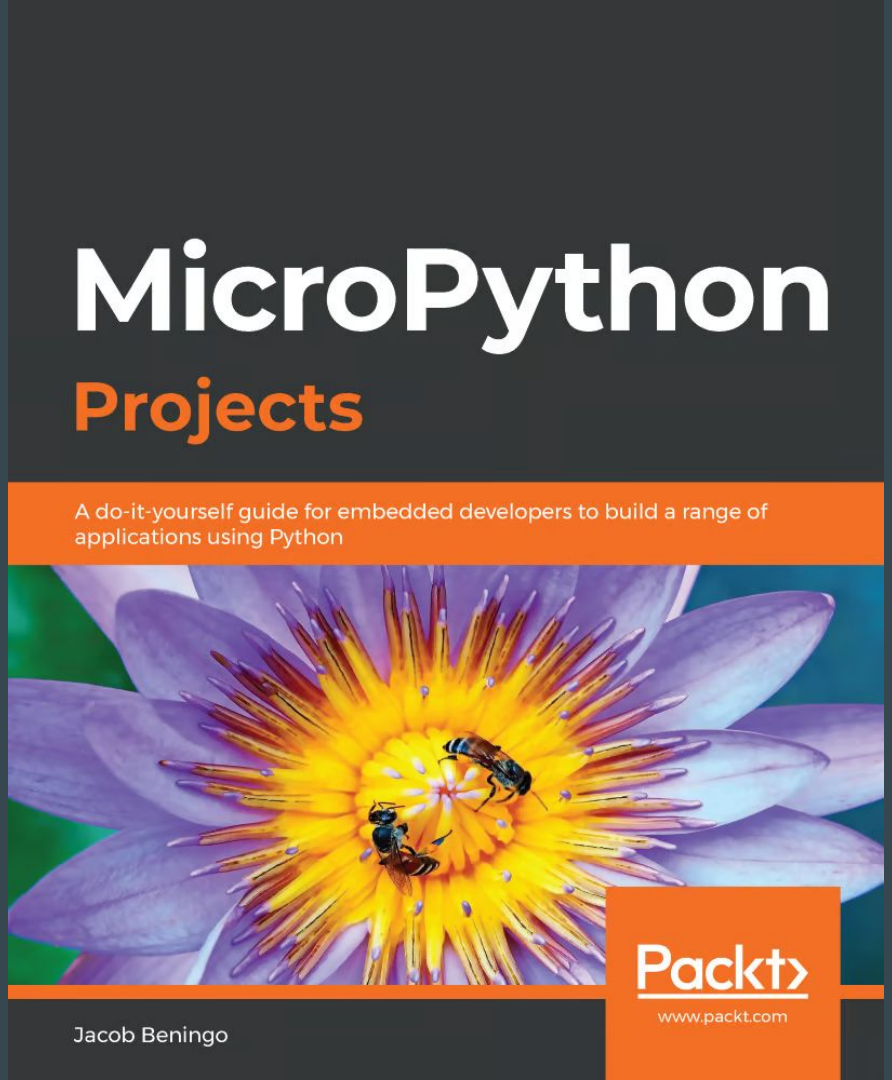
Developing IoT Projects with ESP32

https://blog.espressif.com/book-review-developing-iot-projects-with-esp32-2nd-edition-facdef7545bb



MicroPython Projects

https://www.packtpub.com/product/micropython-projects/9781789958034



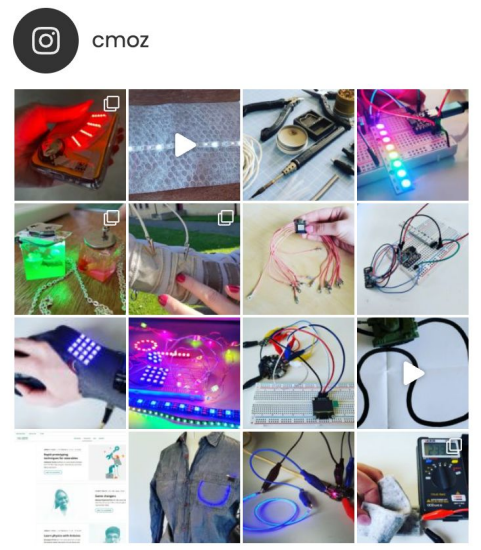
ESP32-C3 Wireless Adventures a Comprehensive Guide to IoT

https://espressif.github.io/esp32-c3-book-en/

Wearables

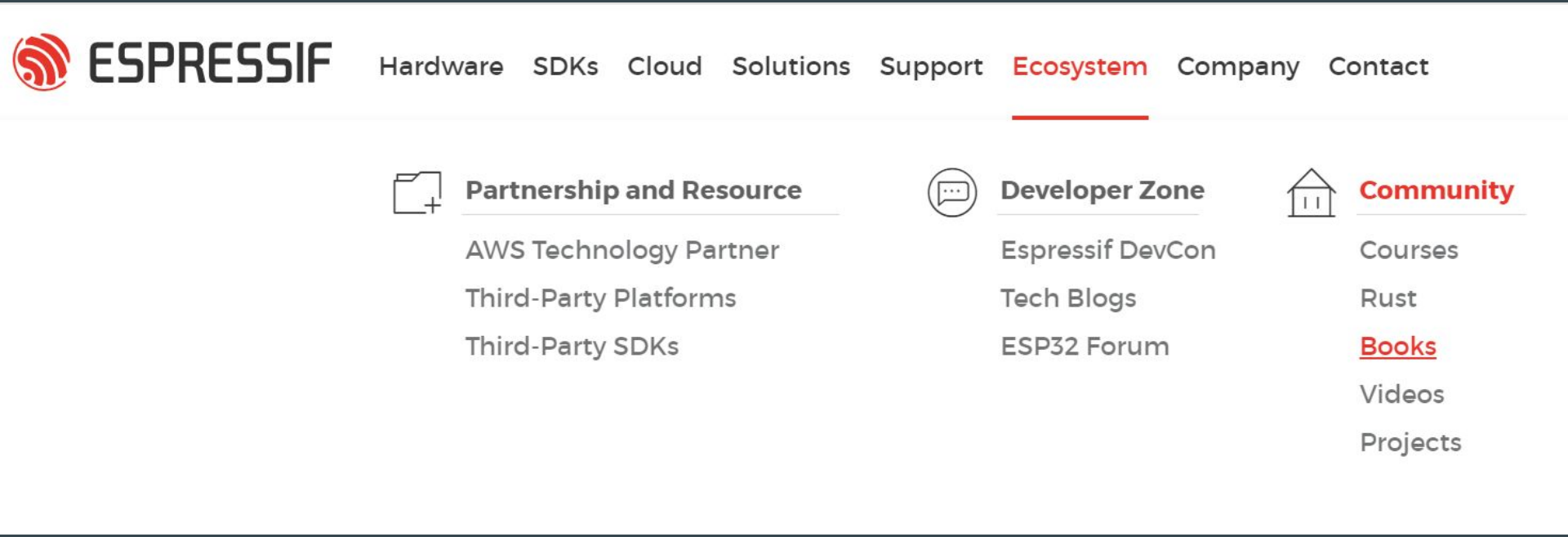
The Ultimate Guide to Informed Wearable Technology

- book: https://packt.link/01VBv



More books about ESP32

https://www.espressif.com/en/ecosystem/community-engagement/books



Tip #12

Follow us

Embedded World 2025

Meet us in Nuremberg, Germany - 11th - 13th March 2025

https://devcon.espressif.com/

Visit us in Brno

Espressif Systems (Czech) s.r.o.

Přízova 3, 602 00 Brno

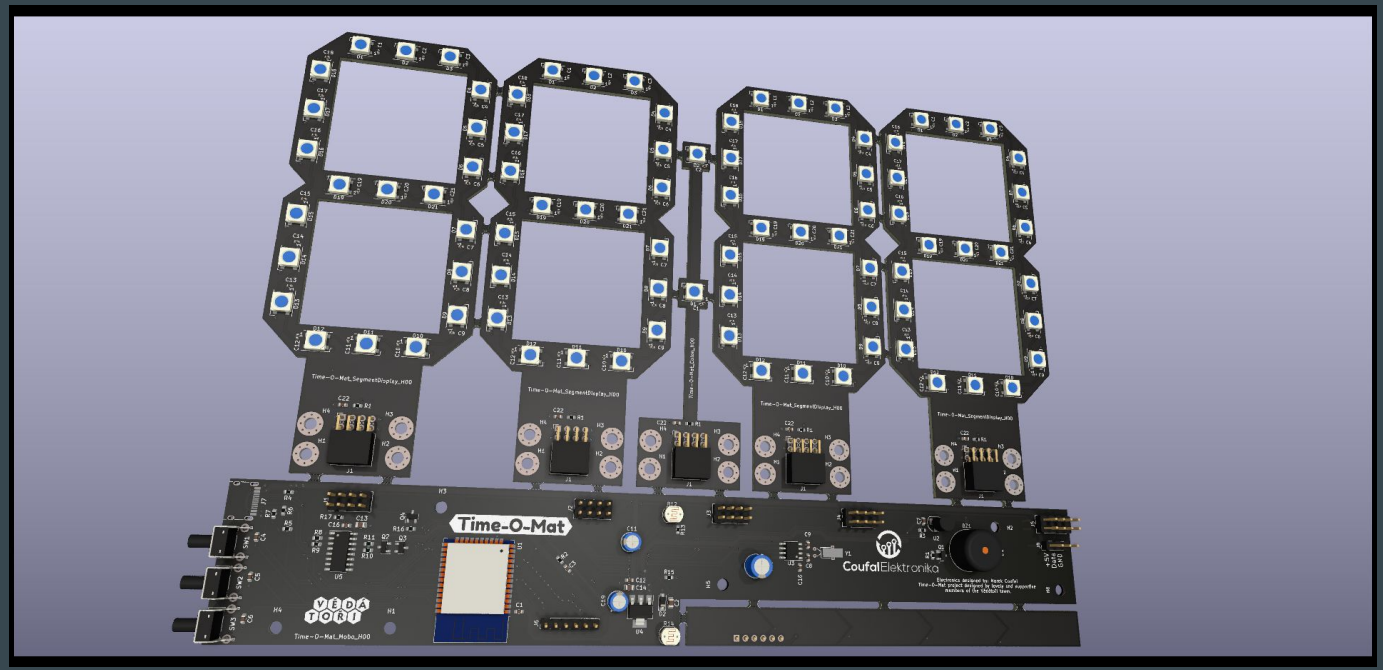
Czechia, Europe

Tip #13

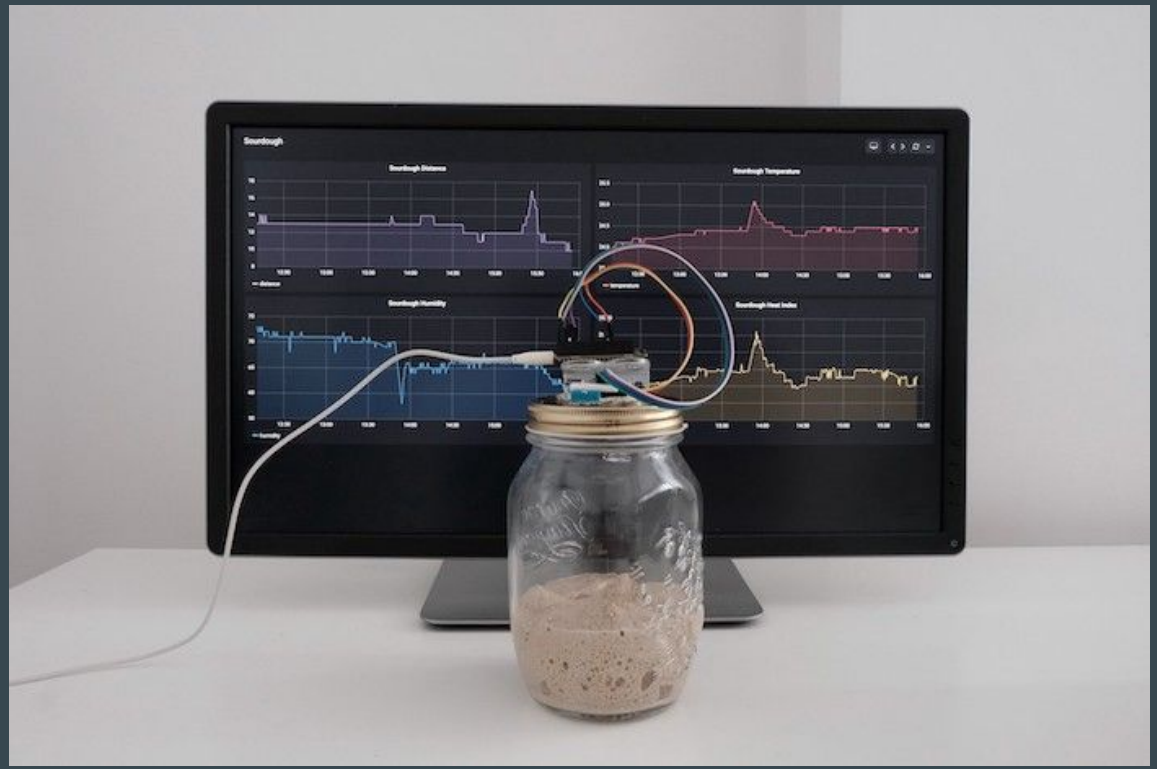
Create and explore

Time-O-Mat - built at summer camp

https://github.com/vedatori/Time-O-Mat



Grafana



https://grafana.com/blog/2020/06/17/how-to-monitor-a-sourdough-starter-with-grafana/

https://github.com/grafana/diy-iot - Arduino now. We're not Rust yet :)

Tip #14

Have fun