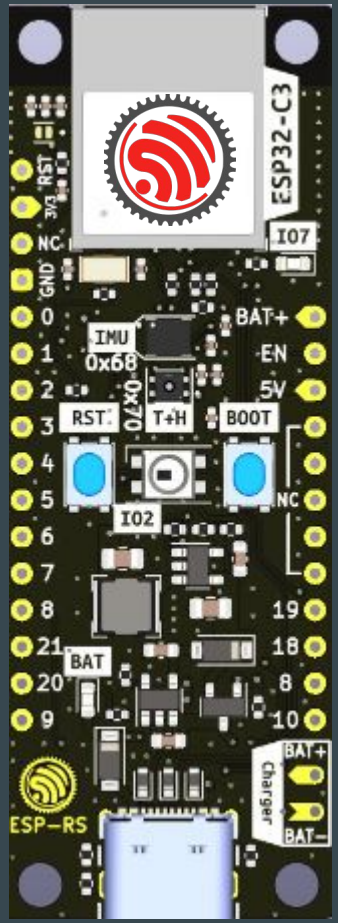
Embedded Development on ESP32

2022-11-29
FEKT VUT - Brno
Juraj Michálek - Espressif Systems



wokwi.com

Quick start

Contribute: https://github.com/wokwi

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

OSes and integration

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

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

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

Further languages and frameworks

Arduino - Maker choice

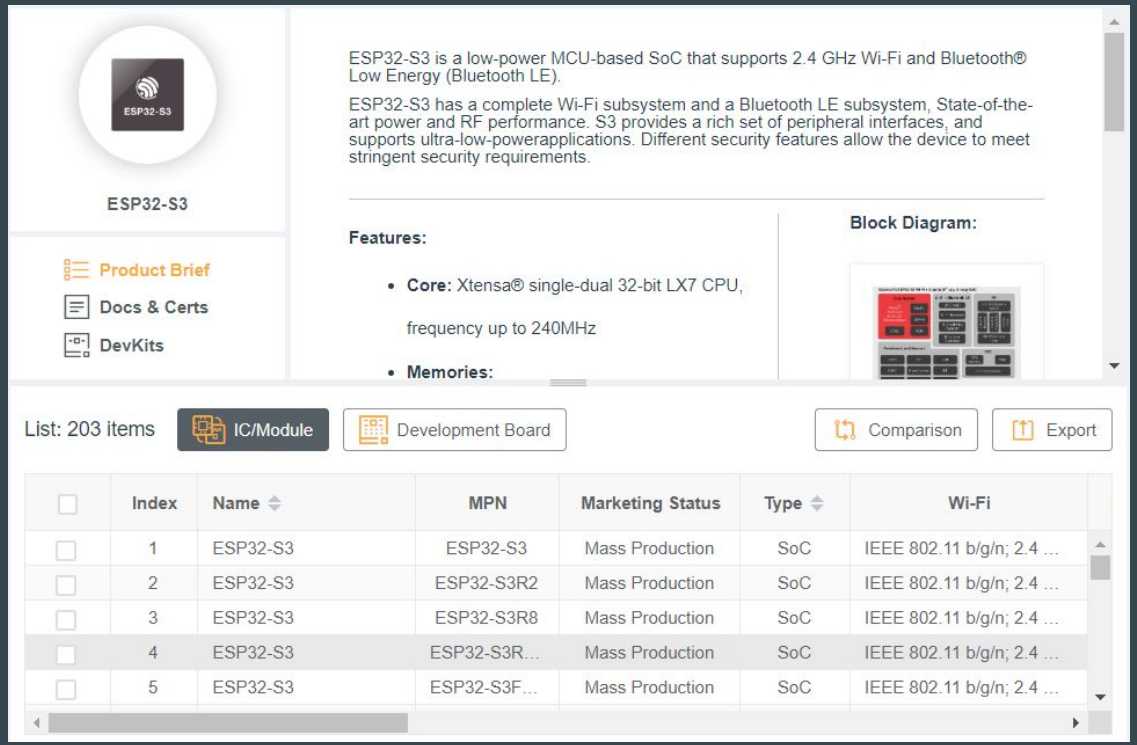
- warning: limitation on production due to licenses!

VM based:

- CircuitPython and MicroPython - Python-like language
- Toit - Toit language
- Nanoframework - C# language
- downside: bigger VM
- upside: more robust, comes with OTA and monitoring

Many chips, many boards - quick help

https://products.espressif.com/



Development options

- Local
  - bootstrap whole env with “espup install” - https://github.com/esp-rs/espup#installation (written in Rust)
  - bootstrap with sh/pwsh (older method) - https://github.com/esp-rs/rust-build#download-installer
- Local in container
  - Podman, Docker, Lima
  - with VS Code Remote Container extension
- Cloud in GitPod.io or CodeSpaces
  - EDC22 Day 2 Talk 11 Just Few dot files in Repo or Paradigm Shift to Cloud-based Embedded Development - https://youtu.be/WAwfRyOy7N8
- Wokwi.com

ESP-IDF

Windows

- idf-installer - includes drivers - https://dl.espressif.com/dl/esp-idf/
- https://github.com/espressif/idf-installer

Linux, macOS

- git clone --depth 1 --shallow-submodules https://github.com/espressif/esp-idf.git
- cd esp-idf
- ./install.sh
- . ./export.sh
- cd examples/get-started/blinky
- idf.py build flash monitor

IDE

Supported by Espressif:

- VS Code with Espressif Extension - https://docs.espressif.com/projects/esp-idf/en/stable/esp32/get-started/vscode-setup.html
- Espressif IDE - https://dl.espressif.com/dl/esp-idf/

Supported by 3rd party and community:

- Visual Studio with VisualGDB - https://visualgdb.com/
- CLion - https://www.jetbrains.com/clion/

Rust language support

Talk: Embedded Rust on ESP32 - Juraj Michálek - Rust Linz November 2022

https://youtu.be/0PPPdqoDBQs

Create new project Rust project

Bare metal:

cargo generate https://github.com/esp-rs/esp-template

STD with ESP-IDF:

cargo generate --vcs none --git https://github.com/esp-rs/esp-idf-template cargo

Build, flash, monitor

cargo espflash --release --monitor

-note: always flash with release due to size and other limitations

Examples:

- https://github.com/esp-rs/awesome-esp-rust
- https://github.com/georgik/esp32-buddy-rs
- https://github.com/playfulFence?tab=repositories
- https://github.com/sambenko/esp32s3-box-examples

Embedded Graphics (e.g. ESP32-S3-BOX)

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

ESP32-Sooky-Maze (PoC):

https://github.com/georgik/esp32-spooky-maze-game

Simple bare metal branch: main

WASM | ESP32-S3 Xtensa targets: feature/multiplatform

Big advantage of Rust:

shared business logic over multiple platforms!

Explore STD + ESP-IDF

cargo generate --vcs none --git https://github.com/esp-rs/esp-idf-template cargo

Embuild: https://github.com/esp-rs/embuild

- Rust build system integrating with ESP-IDF
- Big thanks to N3xed, ivmarkov and whole open source community

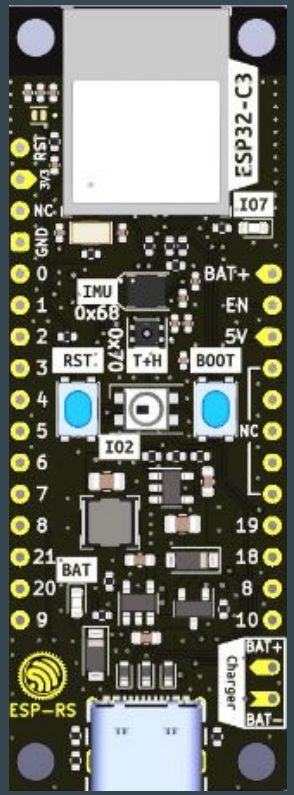
Designing Open Hardware - esp-rust-board

KiCad templates

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

ESP32-C3-DevKit-RUST-1 (available at Mouser, AliExpress)

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



ESP-RS organisation https://github.com/esp-rs

Rust ESP32 Community meeting

Regular meeting every two weeks

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

Training Embedded for ESP32-C3 by Ferrous Systems

Training: https://ferrous-systems.com/training/#package-espressif-beginner-training

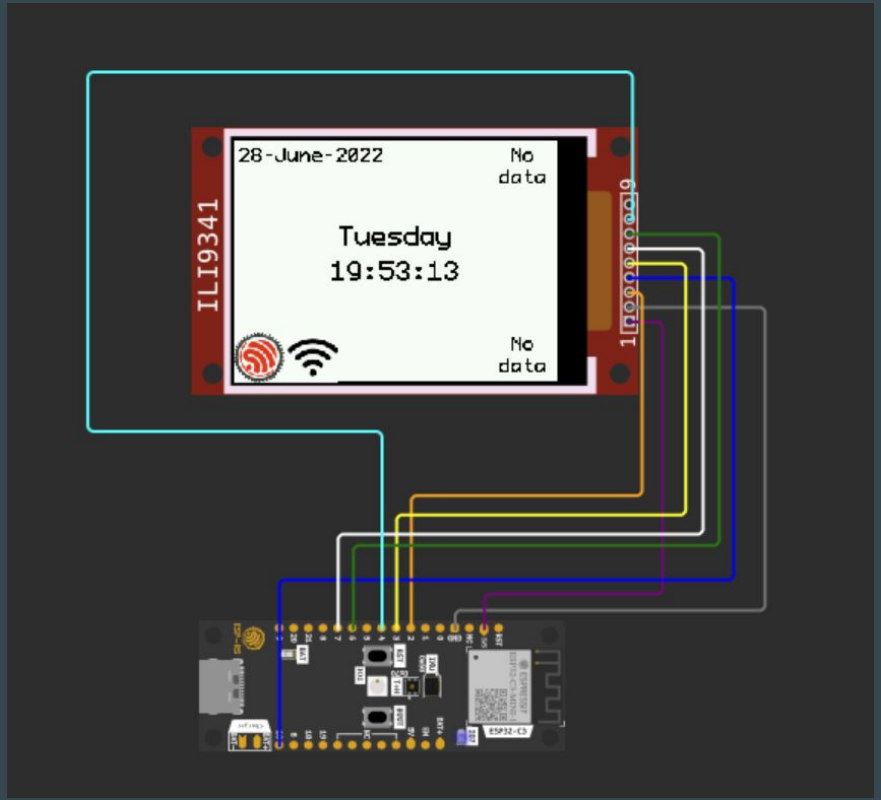
Material: https://espressif-trainings.ferrous-systems.com/

GitHub: https://github.com/ferrous-systems/espressif-trainings/

ferrous systems

GitPod.io + Wokwi.com

Open in Gitpod



https://github.com/playfulFence/esp-clock#dev-containers

Some links

The Rust on ESP Book - https://esp-rs.github.io/book/

Awesome ESP Rust - https://github.com/esp-rs/awesome-esp-rust

- submit your project :-)

Some Inspiration
(not necessary in Rust)

Espressif Developer Conference 2022 - recording

https://www.youtube.com/playlist?list=PLOzvoM7_Knrc6o-n25jYuXRB2T8UKk1NU

CTAG-TBD

CTAG TBD >>to be determined<< an extendible

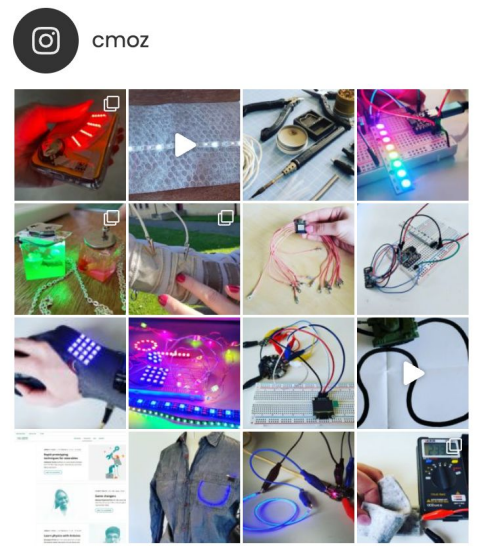
open source Eurorack sound module

https://github.com/ctag-fh-kiel/ctag-tbd

Wearables

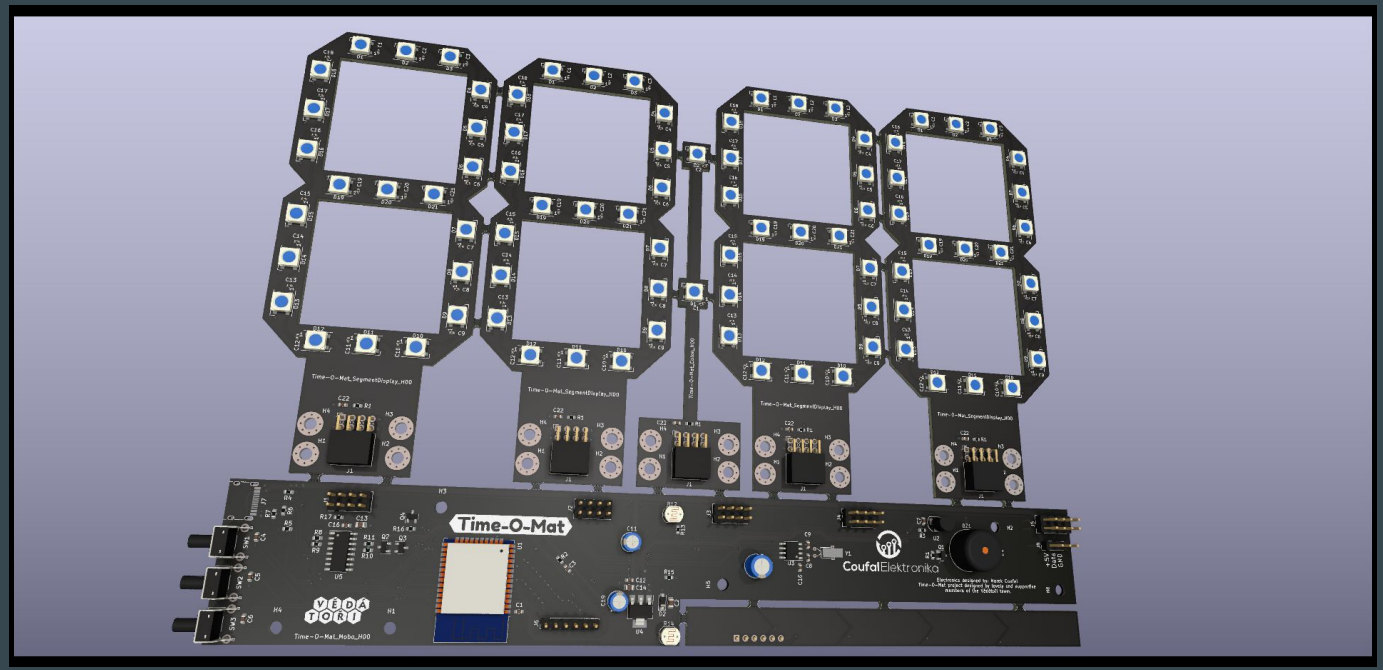
The Ultimate Guide to Informed Wearable Technology

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

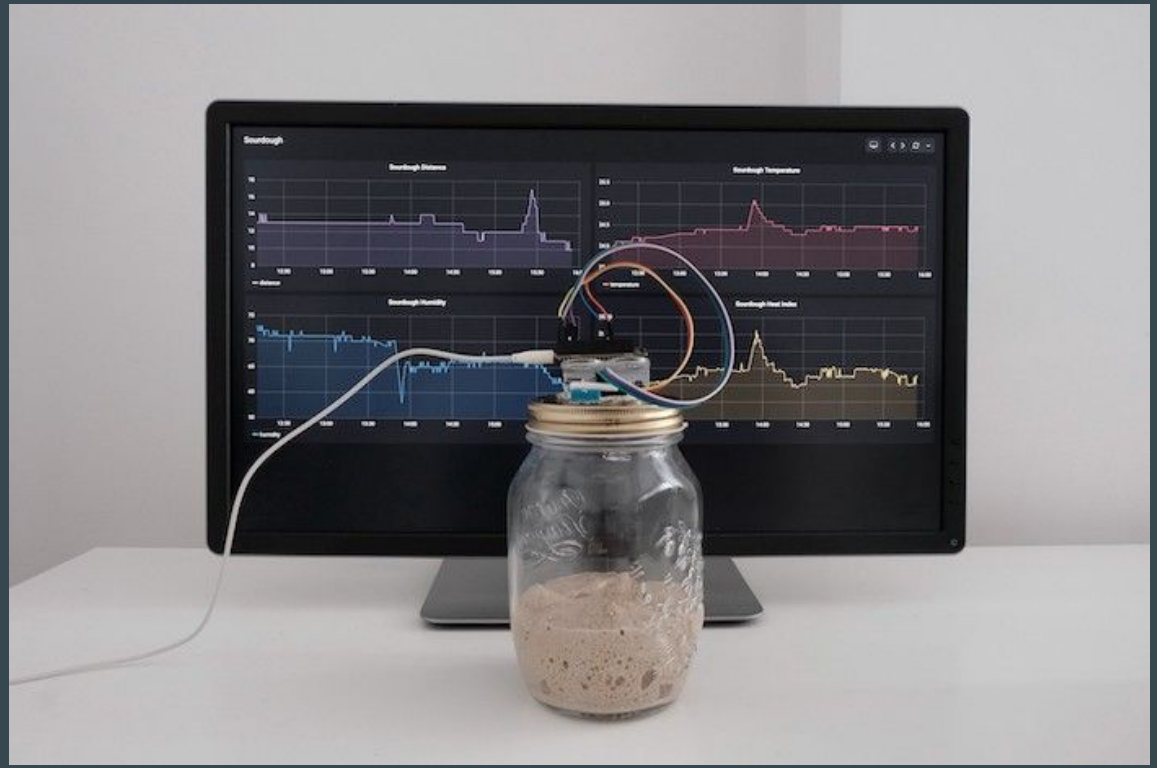


Time-O-Mat - built at summer camp

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 :)

Visit us in Brno

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Czechia, Europe

See you in Linz in 2023. We're planning ESP32 Rust Workshop ;-)