

FOSDEM

OwnTech Update

A demo-talk of V1 Software suit and Hardware advancements



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PhD in power electronics



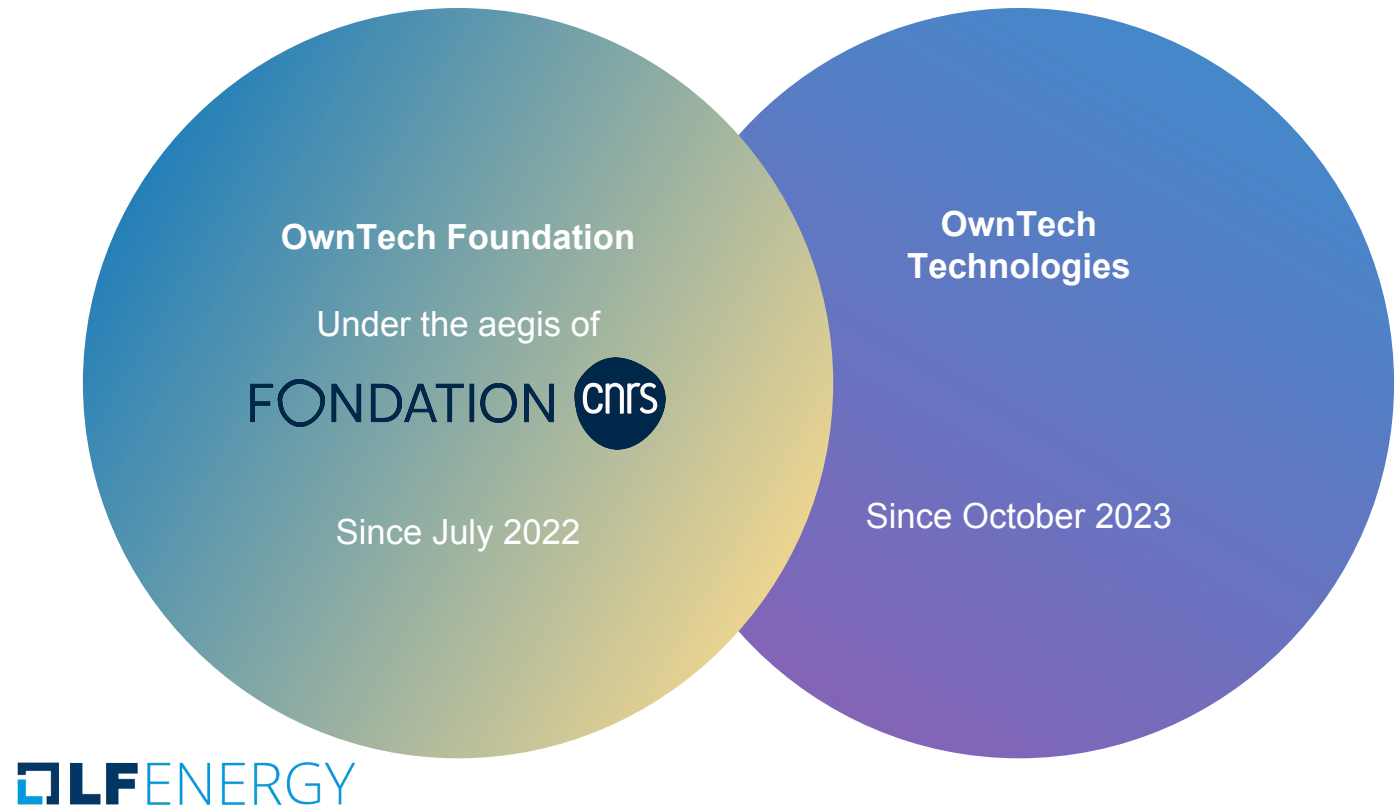
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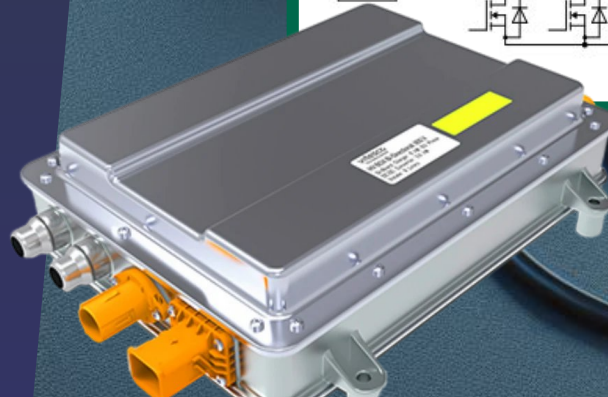
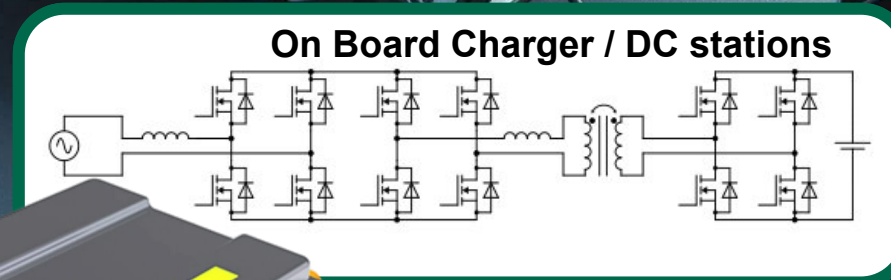
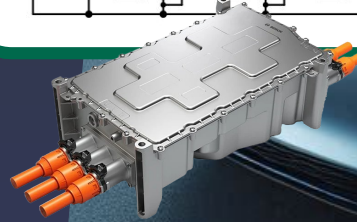
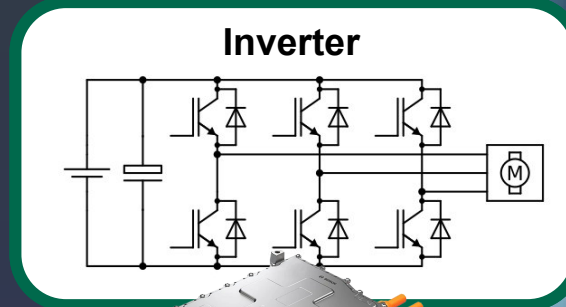
Associate Professor
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PhD in Industrial Informatics



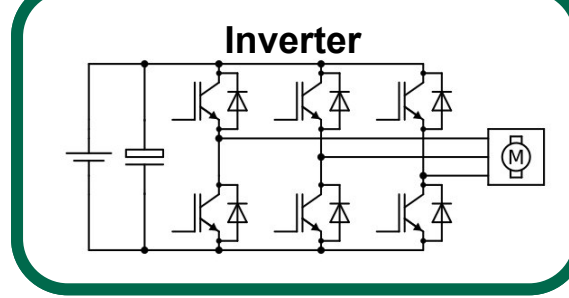
Our goal is to Democratize access to power electronics and contribute to society's electrification through a decentralized peer to peer action.

Electric vehicles

- EV are driving Power Electronics (PE) market growth
- PE market expected to grow by 7 x
- Fierce competition

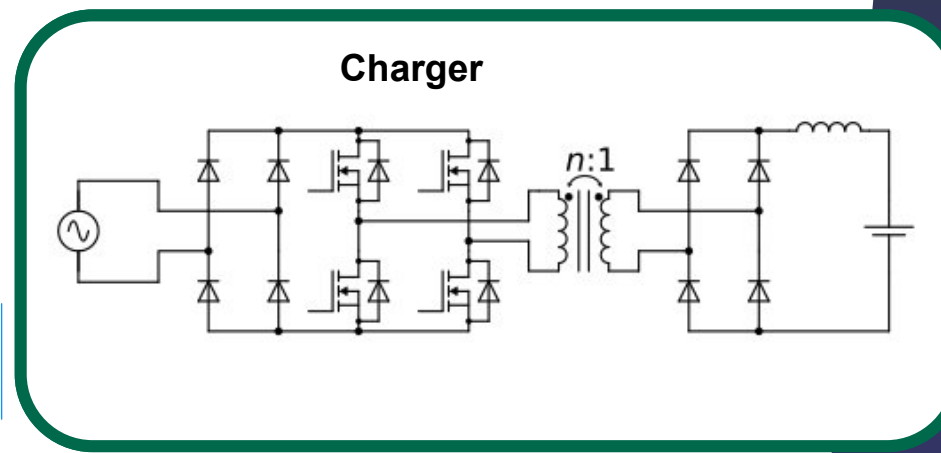


Source Kyu report on PE for e-mobility



Small mobility and e-bikes

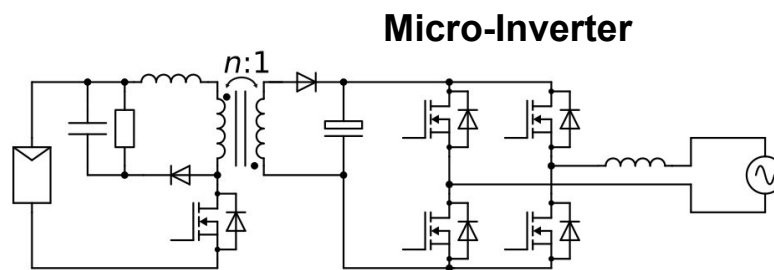
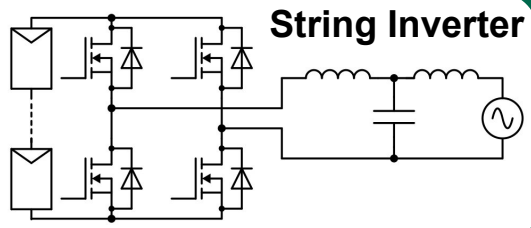
- Increasing demand for intermediate vehicles
- Same Power electronics architectures, but at a lower wattage.



PV inverters

- In 2023 the U.S. exceeded 30GW of new PV installations.
- PV string inverters and micro-inverters split 50-50
- String inverters go from PV to the grid at high voltage
- Micro-inverters go from your balcony to the grid at low(er) voltage

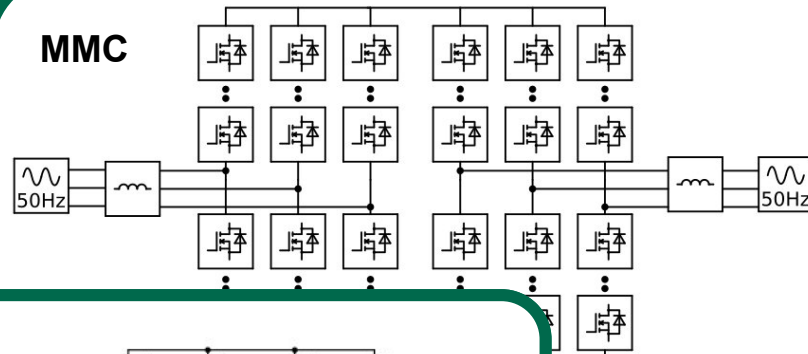
Source Grand View Research PV market Report 2023



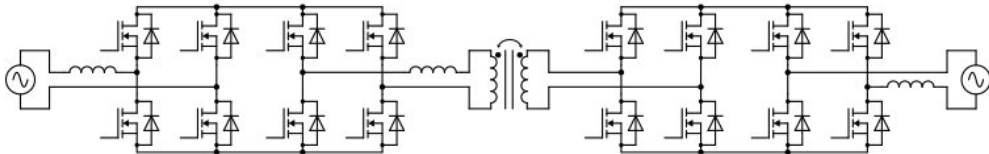
Grid connection

- Grid reinforcement & Renewables integration require more DC links.
- Modular multi-level converters and solid state transformers are to provide flexible solution for the future grid

MMC



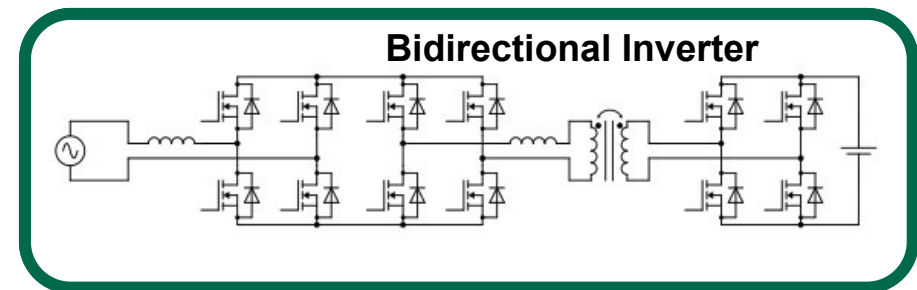
SST



Source Grand View Research PV market Report 2023

Storage - Batteries and H²

- LiFePo4 Rackable Batteries cost now about 30ct€/Wh
- Grid energy cost is soaring due to multiple instabilities
- This fact is to become an enabler both for energy independence & rural electrification use cases
- It pushes the growth of micro inverters B2C market





Complexity barrier

- Electronics are ubiquitous to the energy system
- Their introduction create a complexity barrier
- It is necessary to create, manufacture and repair these systems
- Taking up the challenge of the electric transition require Faster R&D.
- There is a scarcity of trained engineers.

Learning by doing

- We believe that people learn better by solving real life problems
- We also believe that people solve problem together using tools they understand
- That is why we believe it is necessary to have an open-source tool for fast-prototyping in power electronics



A “spiritual successor” for open power

2005



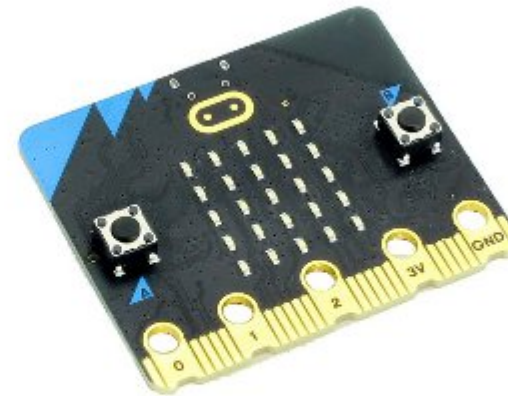
Arduino has made
industrial informatics
accessible to everyone

2008



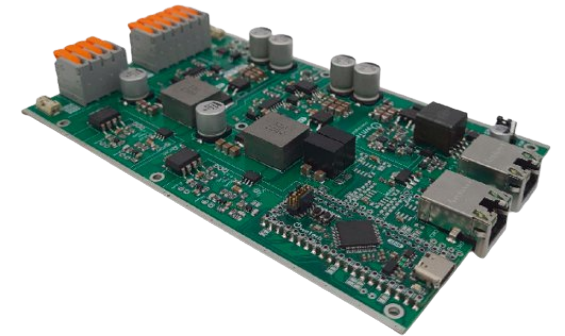
Raspberry pi has made
informatics accessible to
everyone

2015



Micro:bit allowed children
to learn how to code

2022



OwnTech will make power
electronics accessible to
everyone

A comprehensive API for power applications

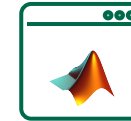
A standard software API



- High Resolution PWM
- Flexible API
- 12bit ADC
- IoT ready



An Intuitive Software Suite



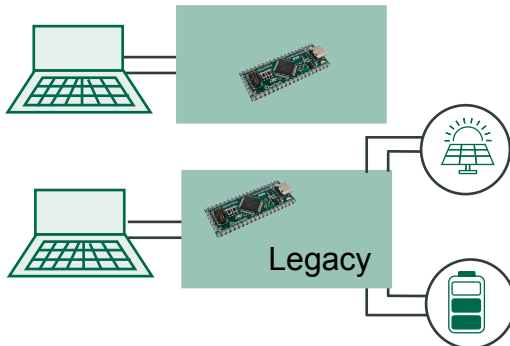
Our GUI allows you to visualize data and control the flow of power.

An IoT platform allows you to communicate with the boards and visualize the data from multiple variables

Native integration with Matlab allows for control engineers to develop new solutions seamlessly.

Use the dedicated IDE to interact with our API and upload your code to your application.

Education use-case



Simple tutorials allow students to charge a battery or drive an electric skateboard.

Industry use-case



After validating the concept with a Twist power board, the same algorithm can be imported into a new product.

The TWIST Board: stackable power

A standard power module



- 300W per module
- Compact 160x100mm form factor
- Optimized for fab'

As a stand alone module..

The same simple ergonomics.



300W

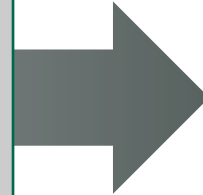
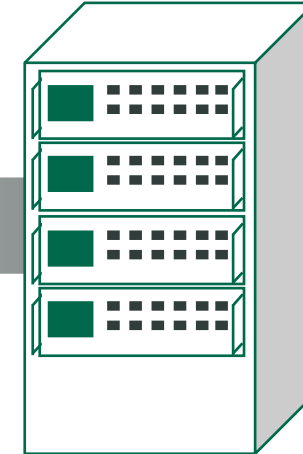


3kW

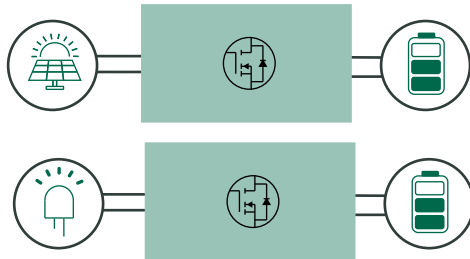
30kW

Adapts to any power rating
Adapts to any power functionality

Or in industrial 19" rack..

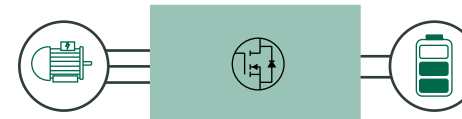


Use case example for Education



Instructors can easily setup their practical classes and manage a group of students who are reprogramming the target while following their class instructions.

Use case example for Industry



Control engineers setting up their test benches in short periods of time. They are also seamlessly changing their models and reprogramming the converter to control their target application.

The list of what's merged on V1



Hard Real Time capable

- Real Time advanced control laws
- Open source control library



Fully featured PWM engine

- 10 PWM signals ready to deploy
- Up to 55MHz PWM frequency
- Up to 184ps temporal resolution



Advanced analog

- Synchronous 12bits measurements
- 60kHz acquisition rate
- Non blocking acquisition system



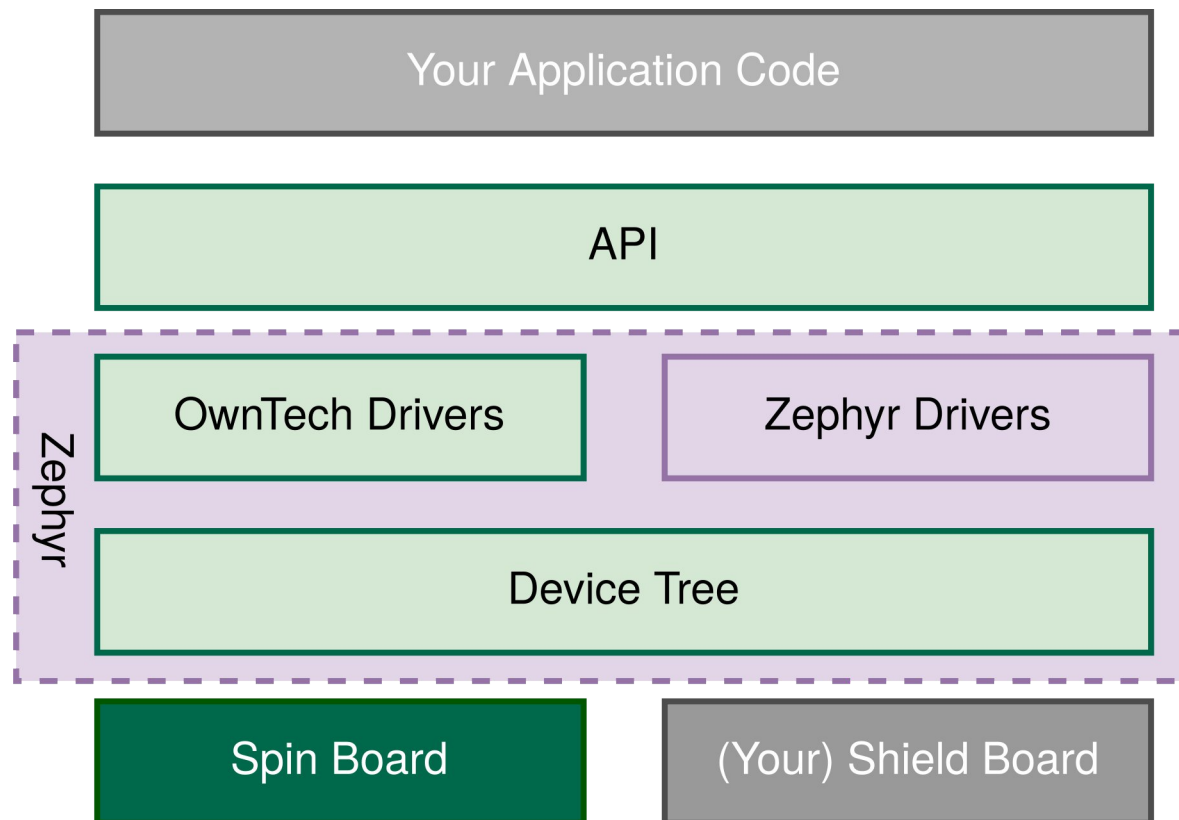
Connectivity

- USB Plug & Play
- Debugger friendly
- Over The Air update over CAN
- Native Secure Bootloader integration

SYNC Decentralized control

- 20Mbps RS485 link
- CAN for self address assignment
- Real Time analog bus
- Synchronous code execution on multiple SPIN at $\pm 1\mu s$.
- Synchronous PWM output on multiple spin at $20ns \pm 10ns$.

Under the hood



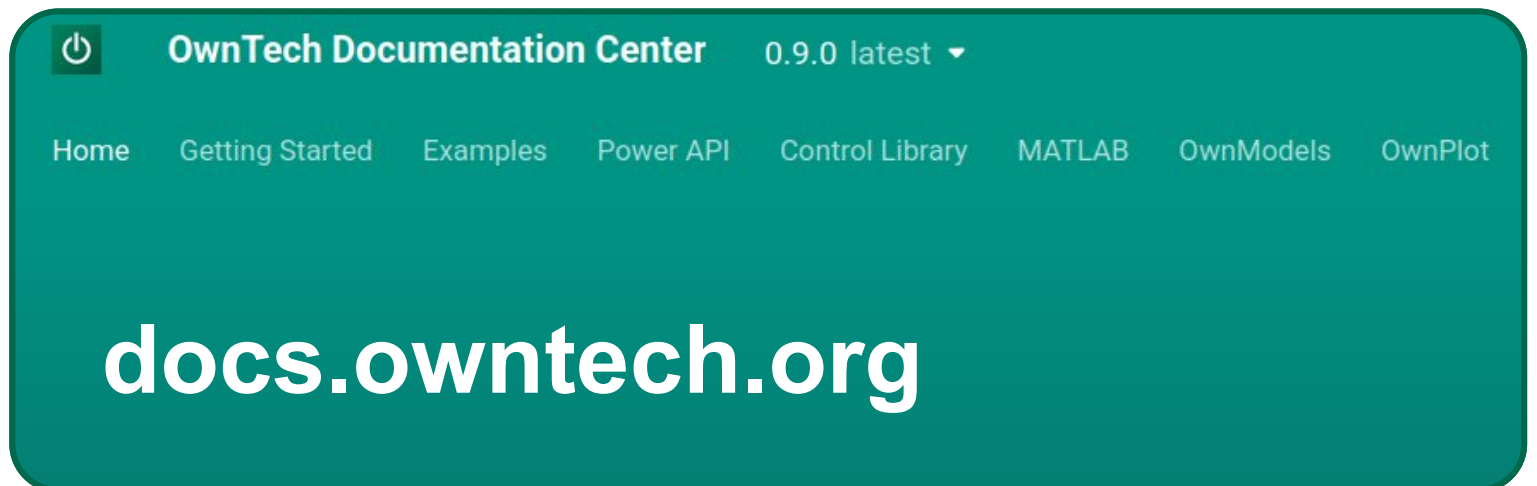
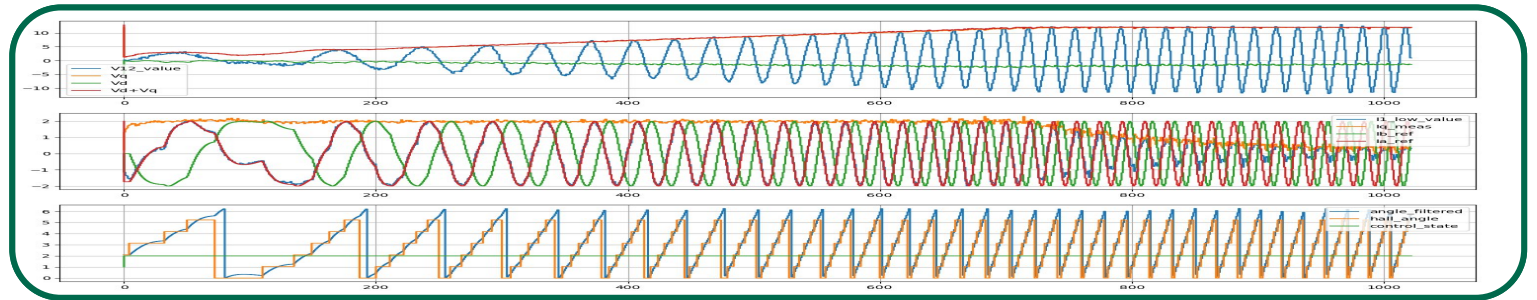
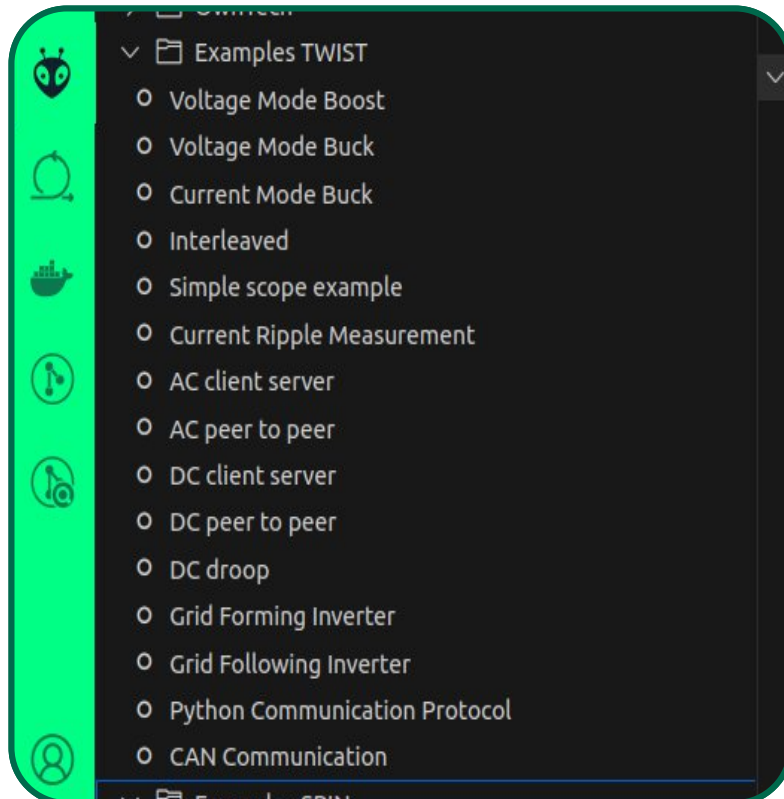
Now upstream in v1.0.0-rc2

Well, first you download the toolchain, and install the dependencies and run this script, and compile the source, and eventually it will blink. - **This time no more pain !**

Meant to be used by electrical and control engineers that does not know much about IT.

USER Centered Interface

- Extensive Examples Library
- Online documentation center
- Tool tips to guide your usage
- Auto-completion to help you develop
- Easy to retrieve sensor data



Create your own Power shield and leverage OwnTech API

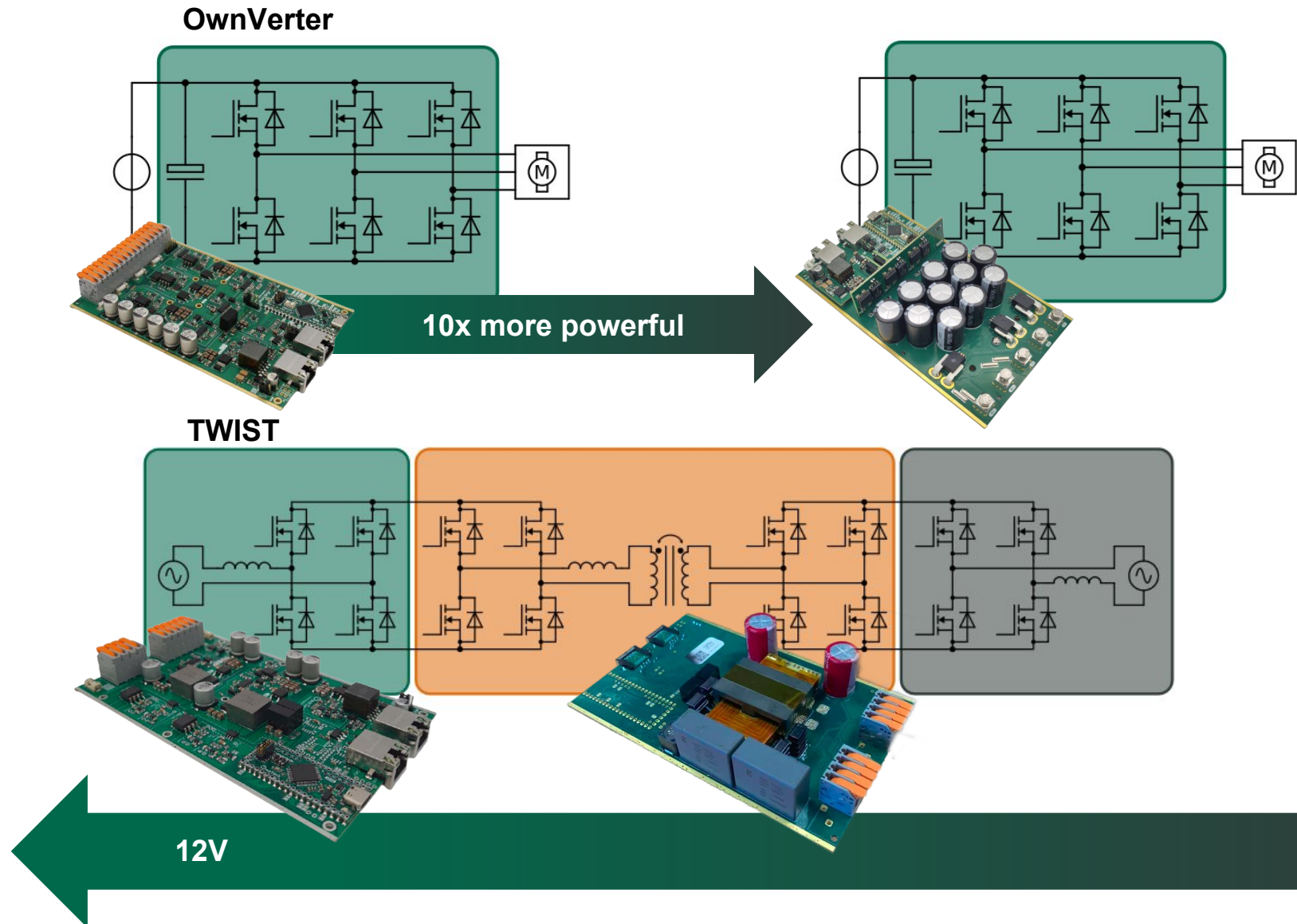
```
shield-sensors {  
    /* Voltage channels */  
    v1low: v1-low {  
        compatible = "shield-sensors";  
        sensor-name = "V1_LOW";  
        default-gain = <0x3d3851ec>;  
        default-offset = <0xc2b867f0>;  
        sensor-conv-type = "LINEAR";  
        v1-low-adc1 {  
            io-channels = <&adc1 6>;  
            spin-pin = <24>;  
        };  
        v1-low-adc2 {  
            io-channels = <&adc2 6>;  
            spin-pin = <24>;  
        };  
        status = "okay";  
    };  
};  
  
powershield: power-shield{  
    compatible = "power-leg";  
    default-frequency = <200000>;  
    leg1: leg1{  
        leg-name = "LEG1";  
        pwms = <&pwma 1 0>, <&pwma 2 0>;  
        pwm-pin-num = <12 14>;  
        driver-pin-num = <19>;  
        current-pin-num = <25>;  
        default-adc = "ADC_1";  
        default-adc-decim = <1>;  
        default-edge-trigger = "EdgeTrigger_up";  
        default-dead-time = <100 100>;  
        default-modulation = "UpDwn";  
    };  
};
```

About now !

v1.0.0-stable about to sprout



Hardware roadmap



Goal

- A subset of wide range, versatile power modules
- Standard, Open Source, stackable, Power Electronics building blocks

Hardware roadmap

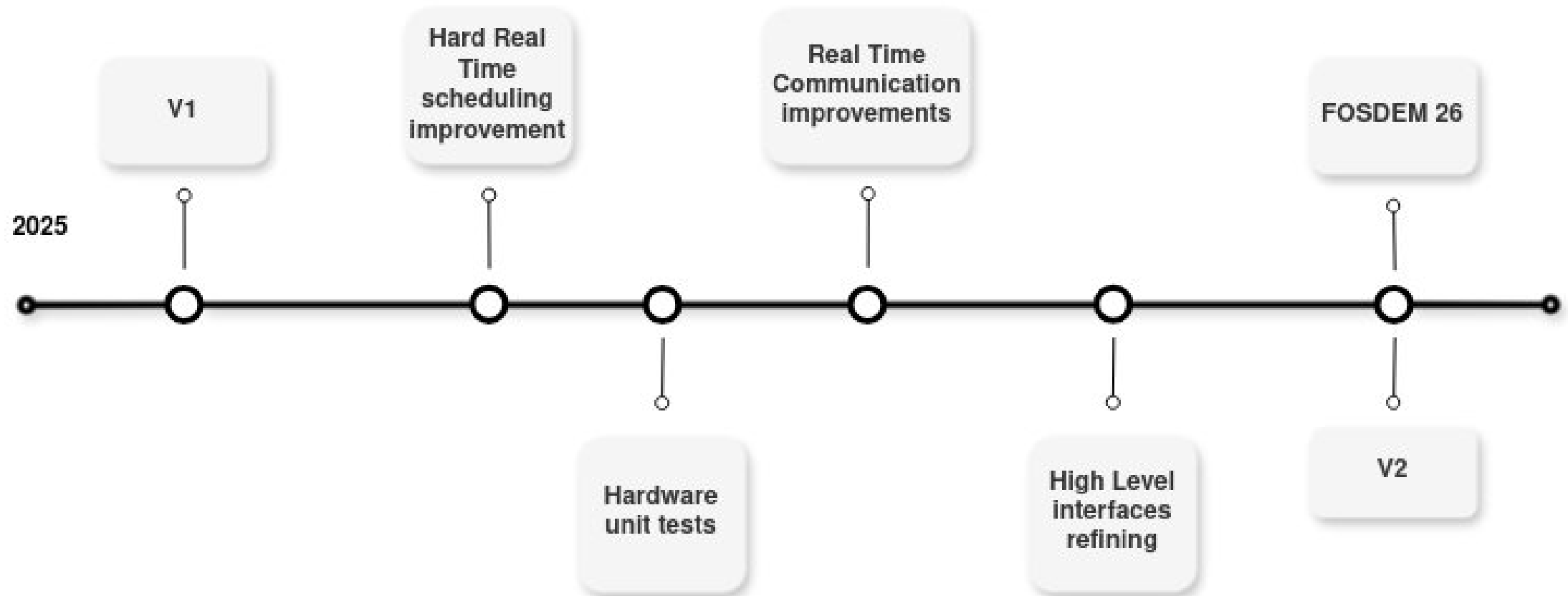


Goal

- Open source prototyping tools
- Parallel arrangements
- Series arrangements



Software Roadmap



How to contribute :

- Try OwnTech APIs on your use case
- Hardware feedbacks and contributions
- Real Time enthusiasts folks
- TSO / DSO interested in talking MMC or SST together ?



Join and chat on Discord

OwnTech Demo Video

Mission: Open power electronics to All

Manage an effective and welcoming community space.

- Create an open digital space
- Include contributions made by the community
- Create a physical space

Disseminate technology and educational content

- Communicate and explain how the digital space works
- Create and distribute content, tutorials and instructional videos
- Participate in physical events

Animate the community

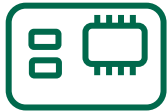
- Organize IP creation by providing a clear collaborative development roadmap
- Connecting community members
- Organize challenges and events

Fund projects and open technology development

- Finance key projects that have a significant positive impact
- Fast-track development of key functionalities requested by the community

OwnTech is open-source

Open Tool



TWIST& SPIN

CERN-OHL-S-V2

All changes have to be shared with the community

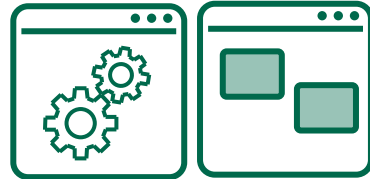


Documentation

Creative Commons SA-BY

Share Alike – The documentation must keep its current licence

Can be sold, modified but must remain open source



OwnDev + OwnPlot

GPL V2

Can be interfaced with open-source and proprietary libraries



Dataware

Apache 2

Can be interfaced with open-source and proprietary libraries

Solution



Solutions

Licence of your choice

Open-source or proprietary

★ Open-o-meter - 8/8

- ✓ The design files are available
- ✓ Assembly instructions are available
- ✓ Component list is available
- ✓ Contribution guide is available
- ✓ CAD files available in editable format
- ✓ Assembly instructions available in editable format
- ✓ Component list available in editable format
- ✓ All information is available for commercial use

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