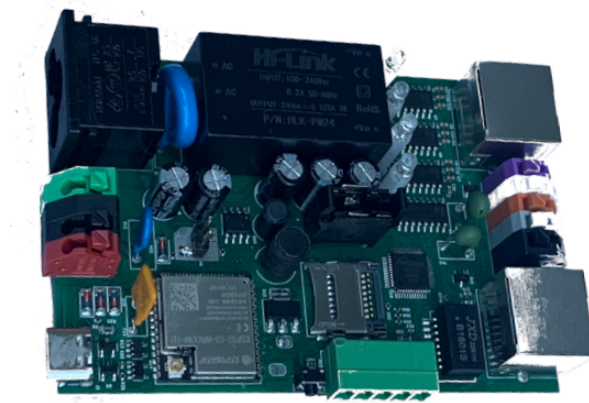


IoT Platform for a PV hybrid inverter

In the project SUNSHINE, funded by the Swiss Federal Office of Energy (SFOE), FHNW is developing a new topology for photovoltaic inverters based on a hybrid configuration of power semiconductors. The solar inverter will feature industrial standards of operation and state-of-the-art cloud communication.



IoT platform

Objective

The objective of this project was to develop an IoT platform to connect a hybrid PV inverter to a designated cloud, enabling seamless data transmission.

Implementation

The ESP32-S3-WROOM-1U module, developed by Espressif Systems, is a widely used microcontroller in various applications, particularly in the field of Internet of Things (IoT). Its key features include a dual-core processor, low power consumption, built-in Wi-Fi and Bluetooth connectivity, ample memory capacity, and support for various interfaces, making it an optimal choice for enabling IoT functionalities. The de-

vice implements an RS485 interface, which is commonly used in industrial automation, control and communication, along with the Modbus serial data protocol. It supports two input configurations: easy usage with a standard CAT5e cable or by using wires onto adjacent connectors. The device employs the Ethernet controller W5500 from Wiznet, enabling Ethernet communication over a LAN. This dedicated controller ensures robust performance. The device offers multiple power input options: 230 V mains voltage input via an IEC 60320 C5 connector, 5 – 48 V DC voltage input through integrated cable connectors, a USB Type-C interface for firmware development and communication. Buck,

boost, and inverting converters as well as a linear regulator (LDO) are used to regulate voltage levels for the various applications on the PCB.

Conclusion

A communication interface designed for hybrid PV inverters has been implemented, allowing for seamless data transfer to a cloud platform. This IoT platform has the potential to enhance the efficiency and monitoring capabilities of PV hybrid inverters, contributing to the advancement of renewable energy technologies. Further testing and refinements will bring us closer to realizing the full potential of this IoT platform and its positive impact on sustainable energy solutions.

Specifications

Processor	ESP32-S3
Dimensions	9 cm x 6.5 cm
Interfaces	2 x R485 1 x Ethernet
Power	230 V AC via IEC C5 connector 5 – 48 V DC via wire connectors: Earth(Green) Ground(Black) 5-48V(Red) 5 V DC via USB Type C port
Additional Features	Integration of a micro SD-card Connector for a future 4G extension module 4 x RGB LED for data transmission status Button n for potential future functionality Integration of a CR1220 battery holder

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