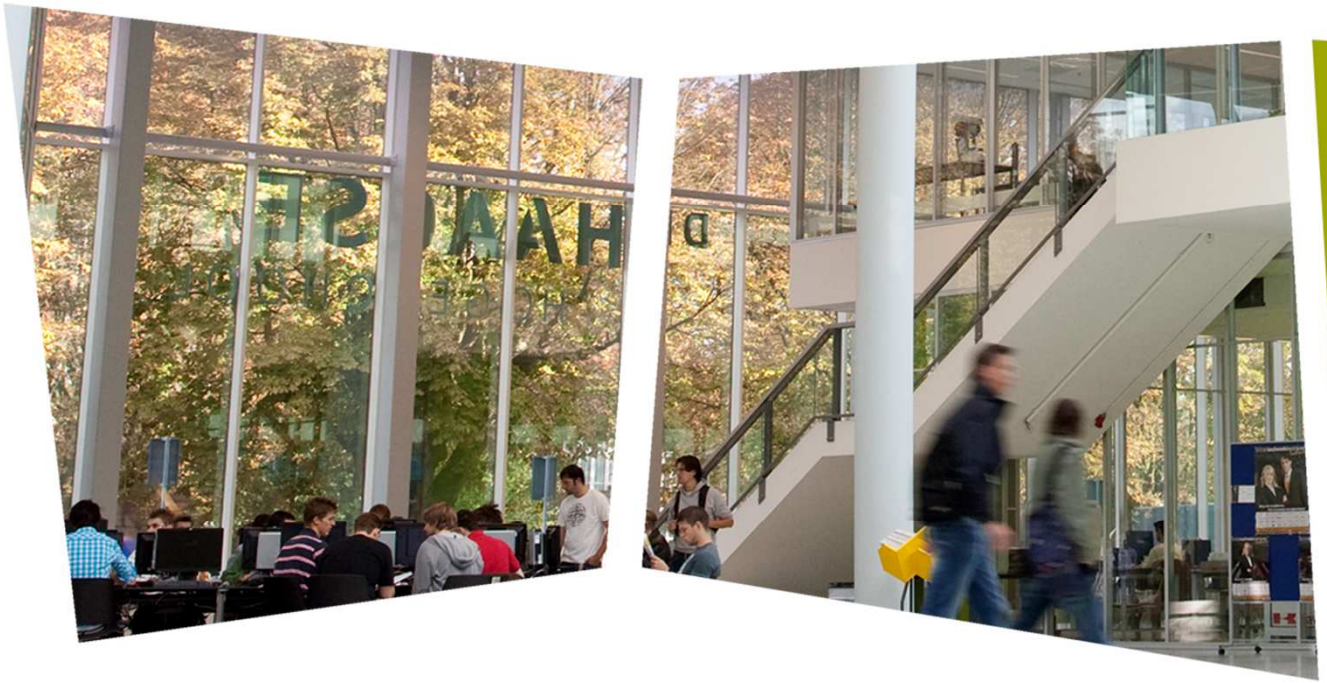


April 5th 2018

(Presenter)
Peter van Duijsen
Pepijn van Willigenburg
Johan Woudstra

Educational setup for Power Electronics and IoT

Power electronics

Caspoc

Educational setup for Power Electronics and IoT

Content

- Introduction
- Aim of the topology
- Topology Workings
- Examples
- Conclusion

Introduction – THUAS DC Projects

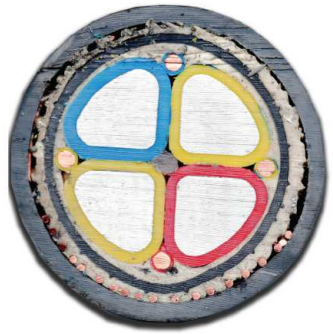
This work is sponsored via the

- **USB-(D)C project** (funded by RVO / Ministery EZK)
  - 350 V DC in-house infrastructuren with USB type C outlets

Related projects

- **DCT - REES**
  - for Educational Development
  - 7 EU partners, 7 SA partners
- Combi Cable research: AC + DC in one cable
- DC Flexhouse
  - Renovation track for existing stock to DC – 350 V DC approach

Funded by the Erasmus+ Programme of the European Union



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Examples of household appliances

4 *Vacuum cleaner; Induction cooking plate; (Street) Lighting*

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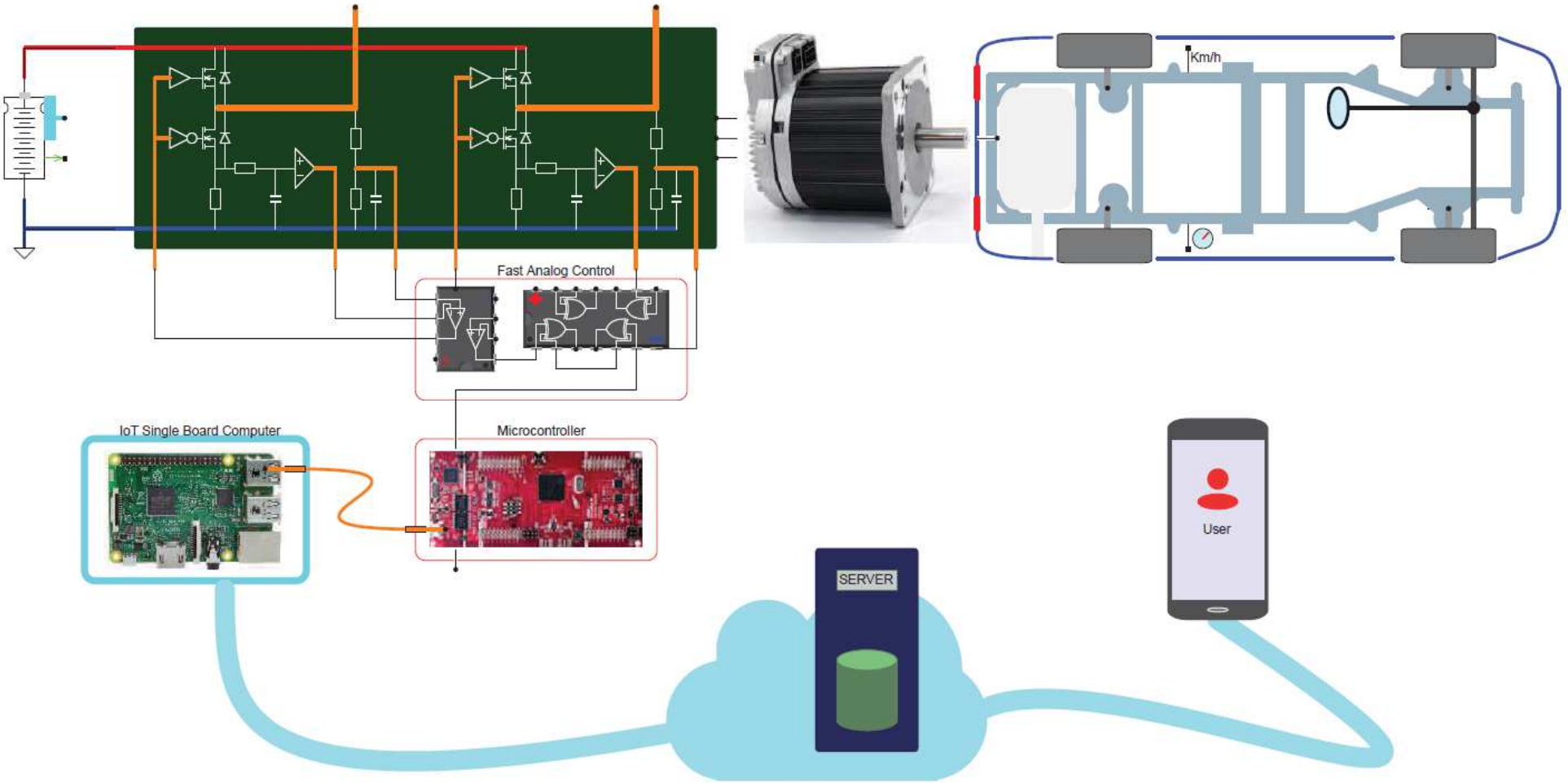
IoT

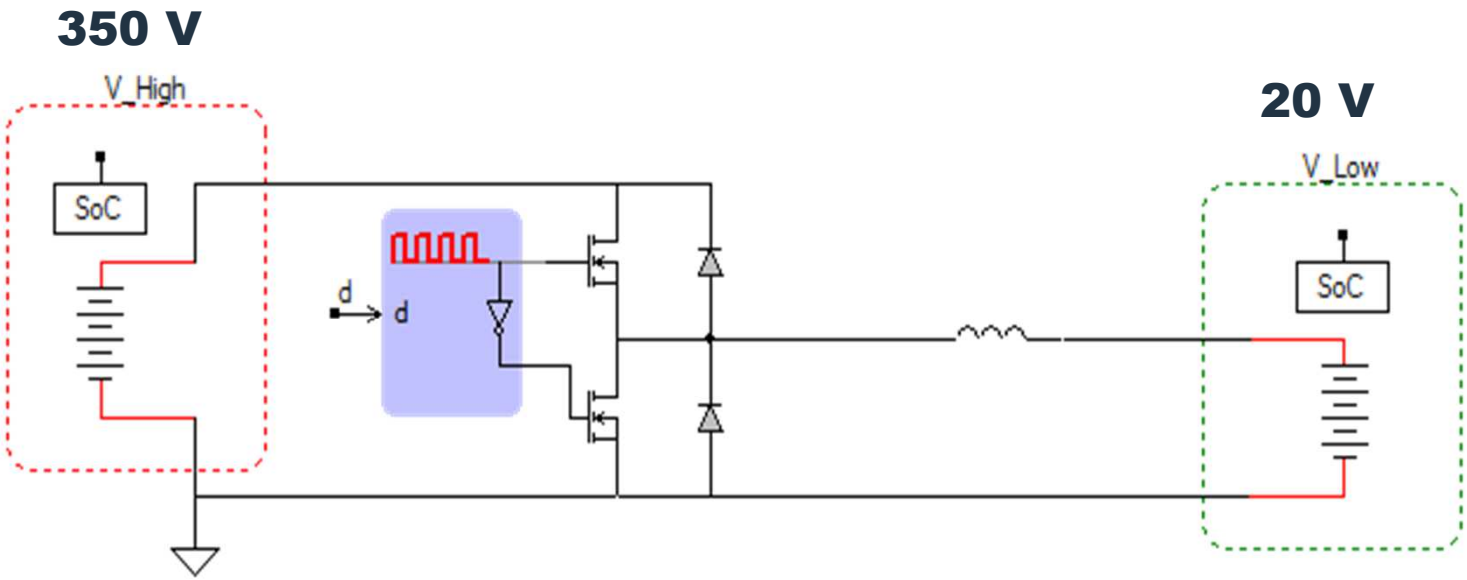

Km/h
Fast Analog Control
IoT Single Board Computer
Microcontroller
SERVER
User

Aim of the topology

Give the students:

- Basic understanding of the conversion process in power electronics
- Basic concepts to the operation of **switched mode power supplies**
- That these concepts can be used as:
  - Single or multiphase motor drives
  - Battery chargers
  - Maximum power point trackers (solar panels)

Basic Topology



Bridge leg consisting of two Mosfets, to interface between two different voltage levels

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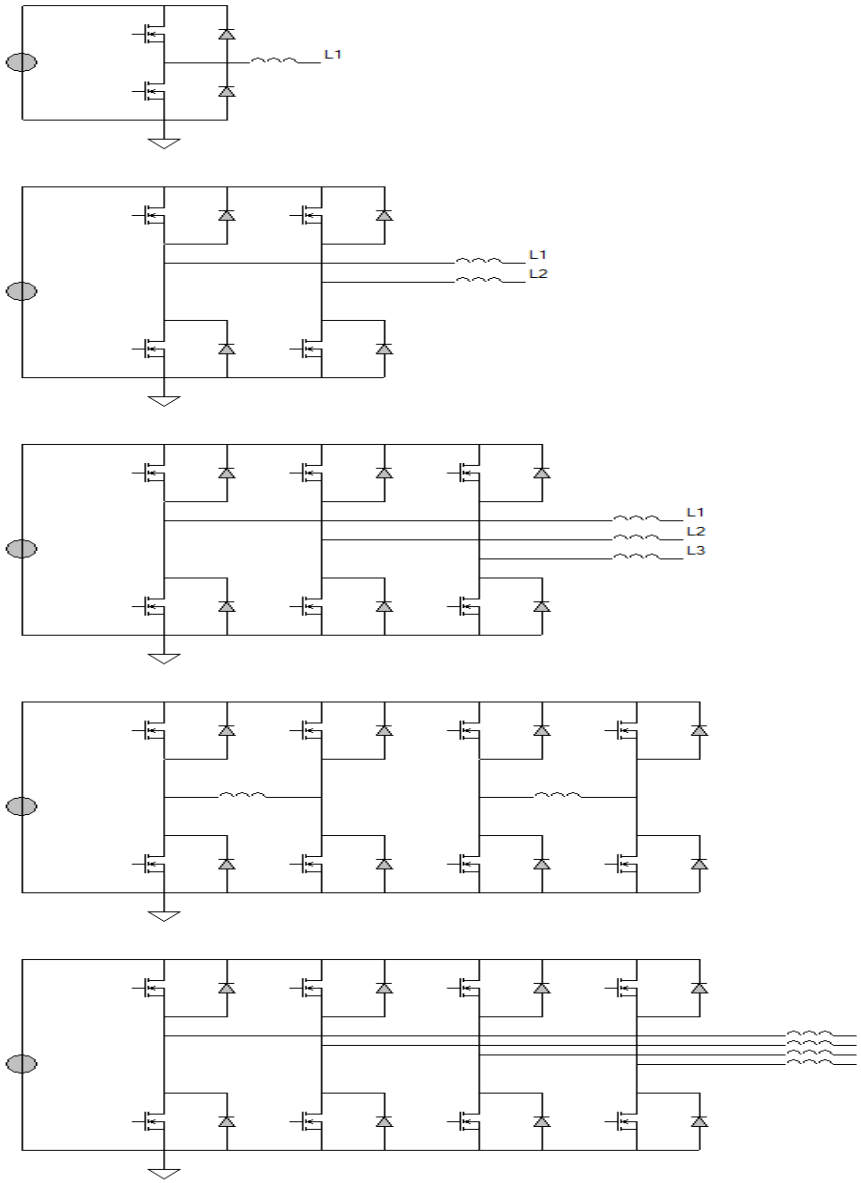
Typical topologies based on two-mosfet bridge leg



Bidirectional buck-boost

Full bridge

3-Phase inverter

Step-motor driver

DC grid switches

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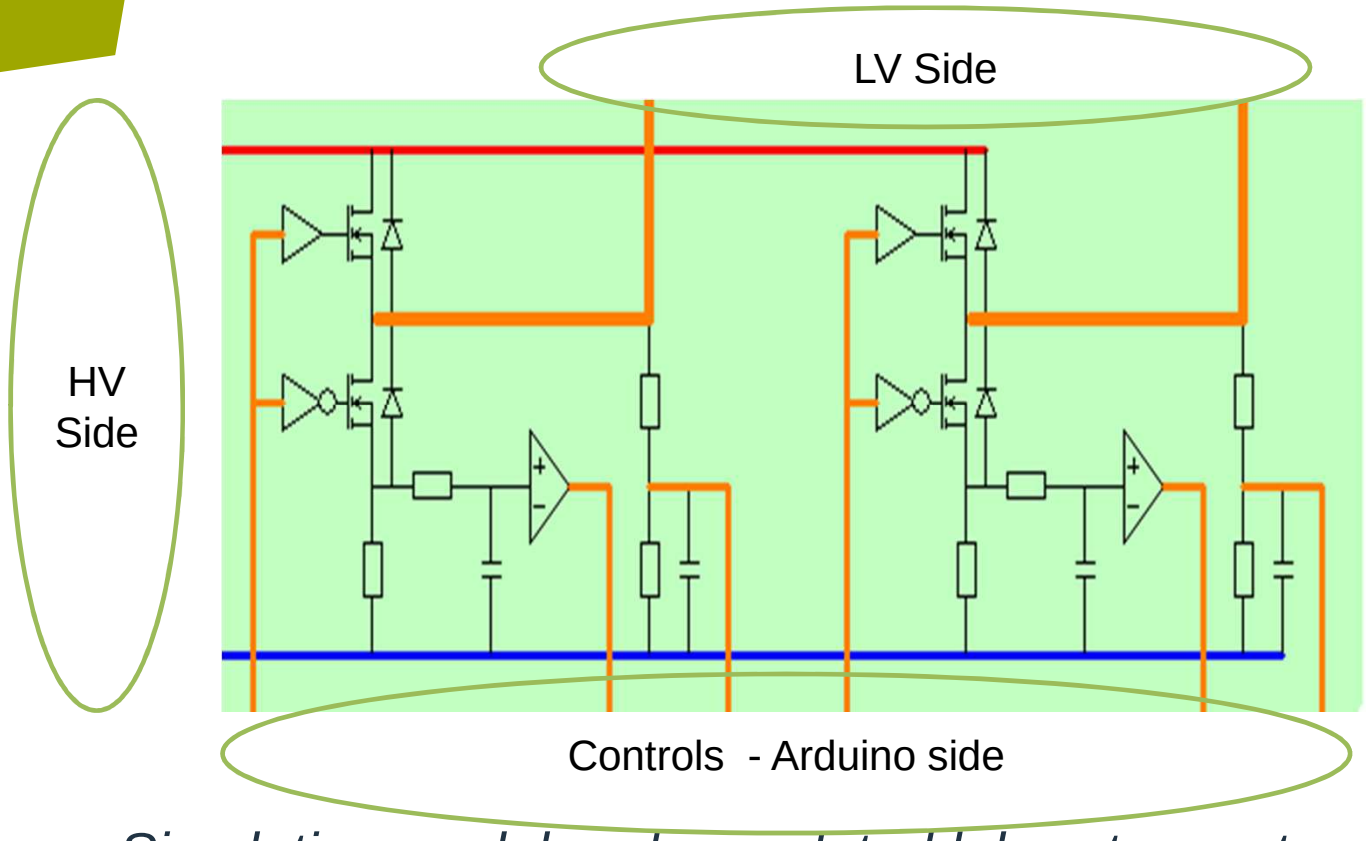
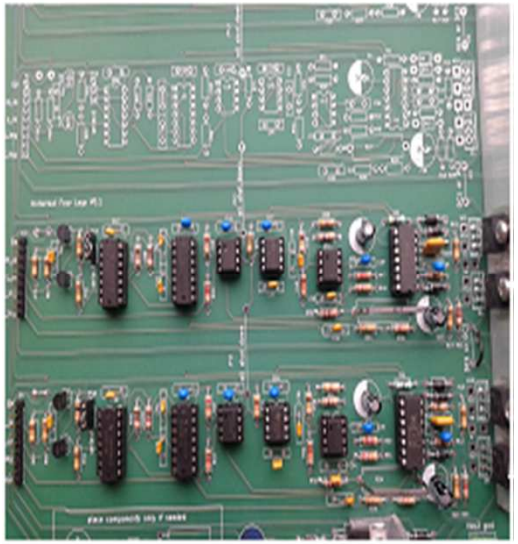
Topology Workings





Simulation model and completed laboratory setup

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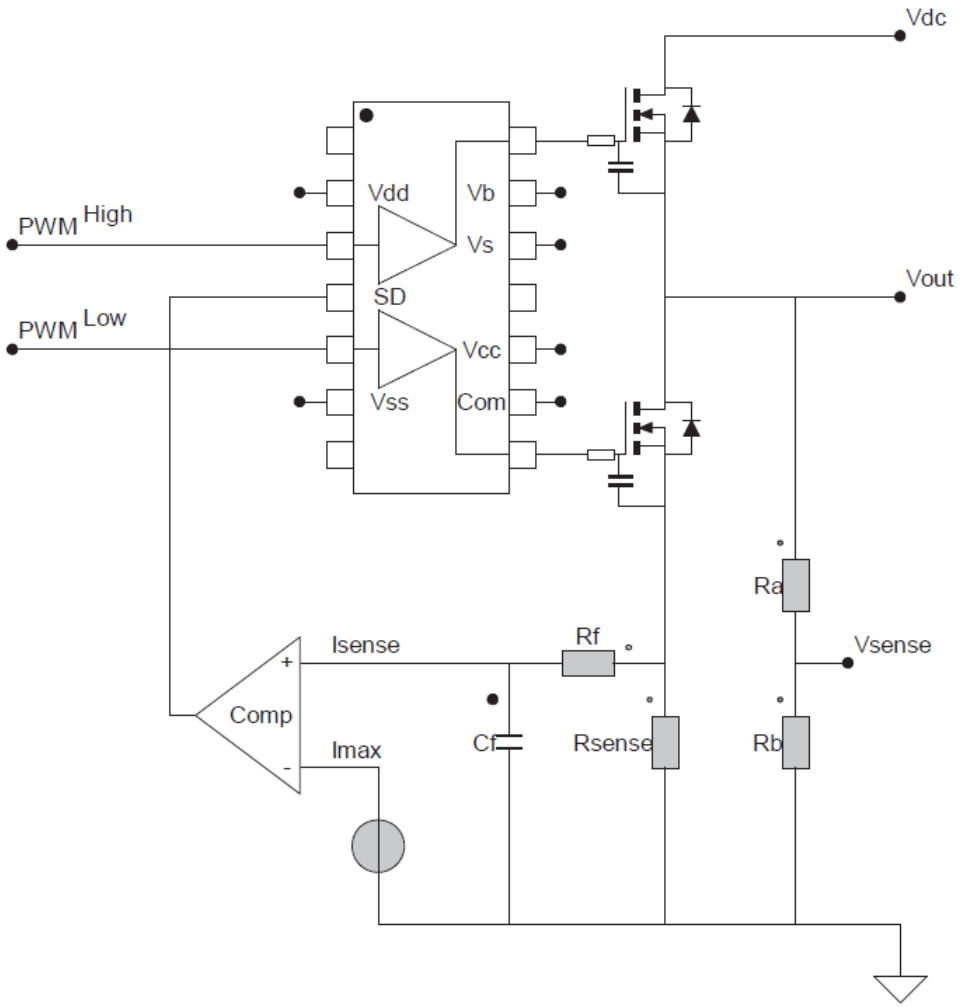
Protection



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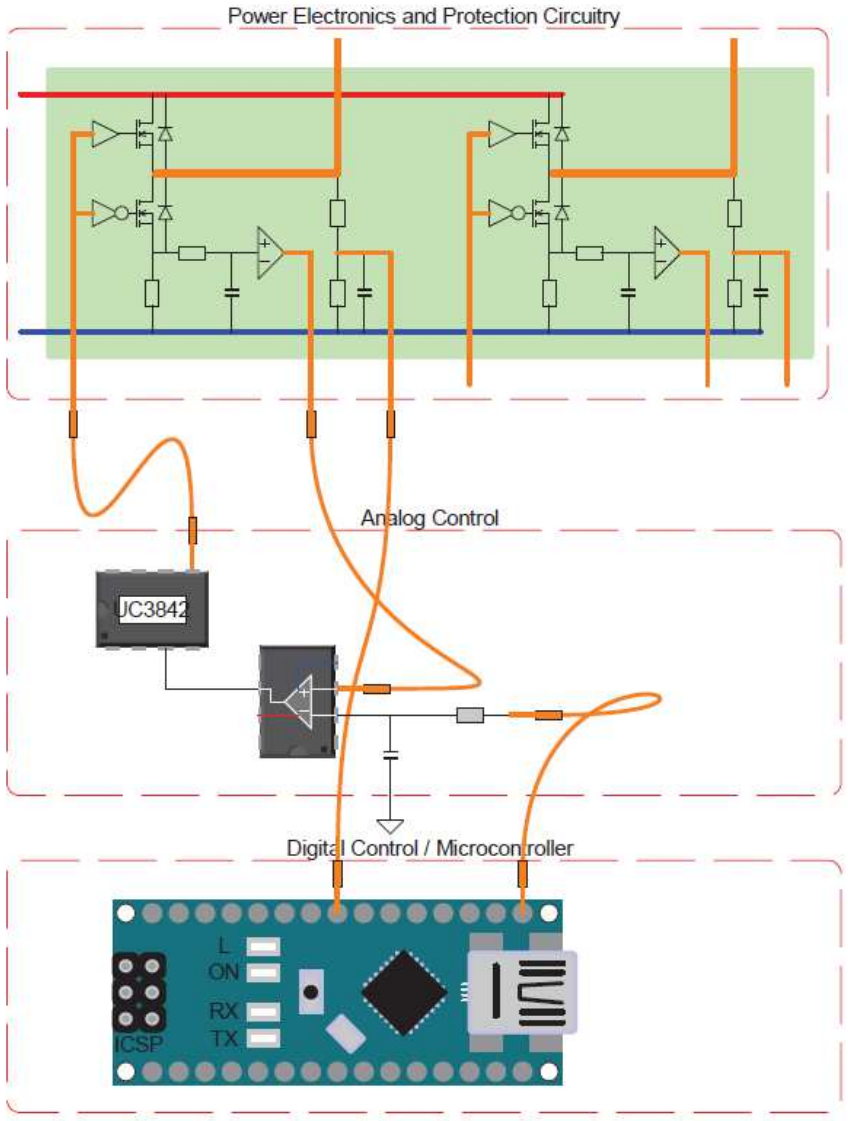
Hybrid control



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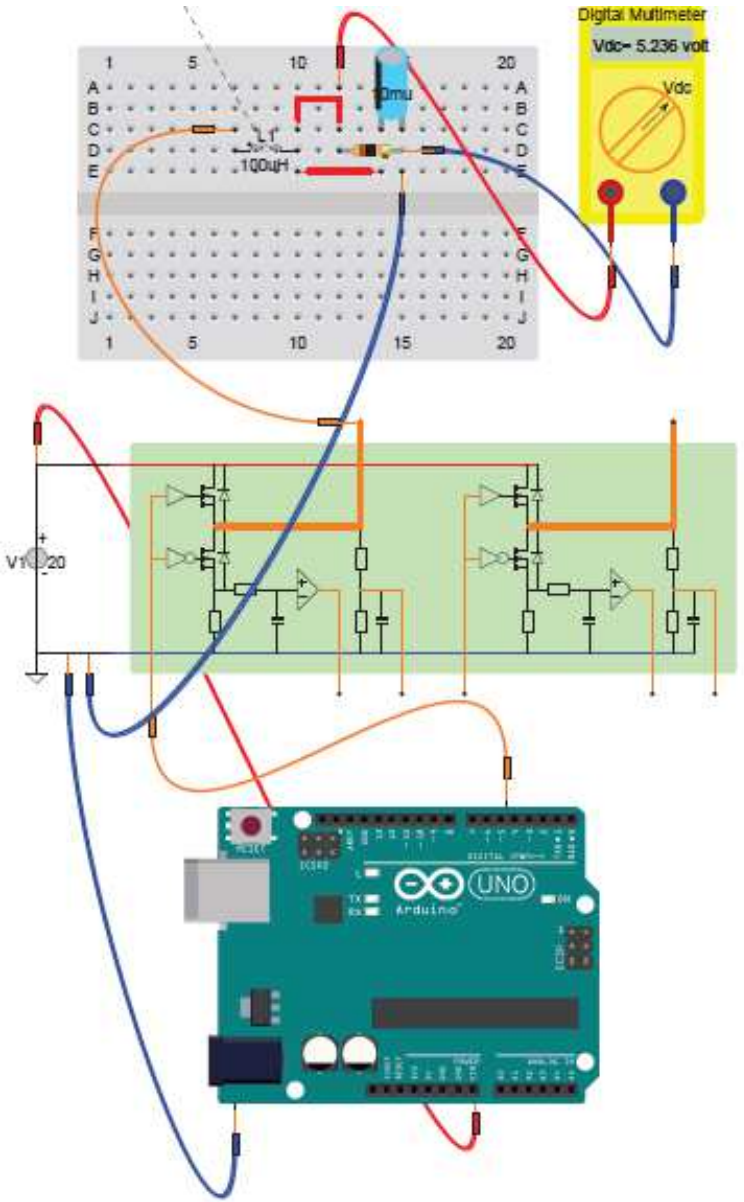

uP control

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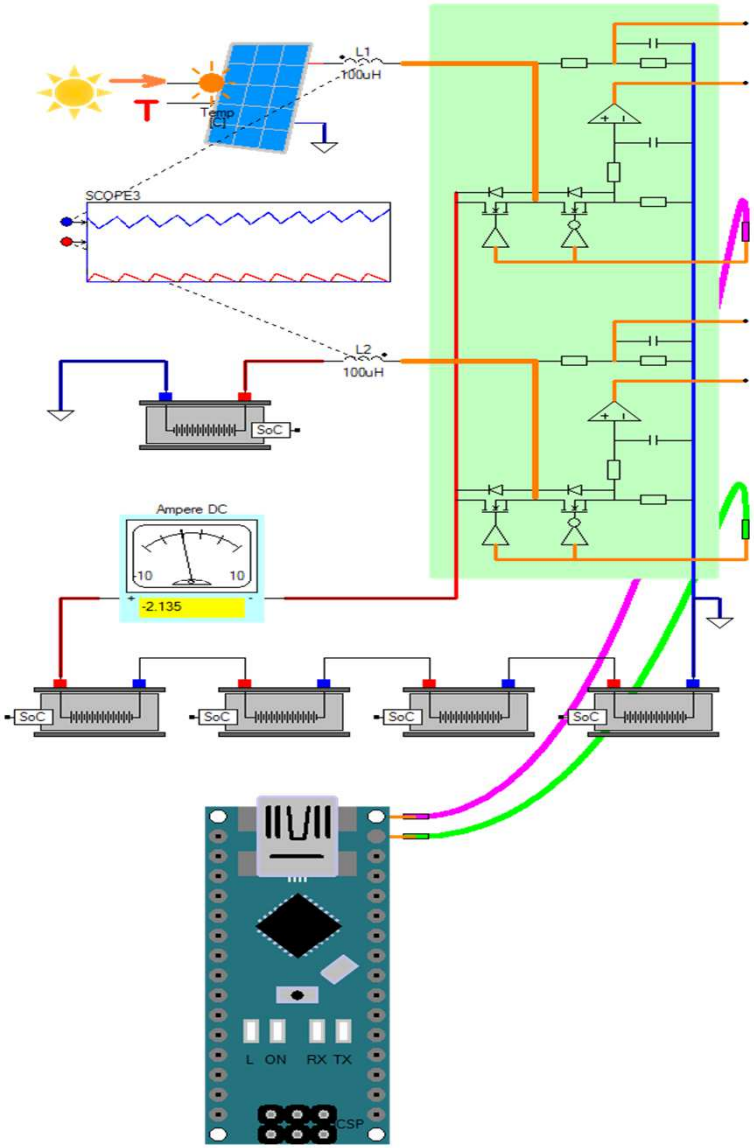
48V DC link (Represents the DC grid)



Solar charging a battery in a small scale DC grid.

while control is performed by a low-cost Arduino Nano Microcontroller

48 Volt DC is a safe operating voltage for our students

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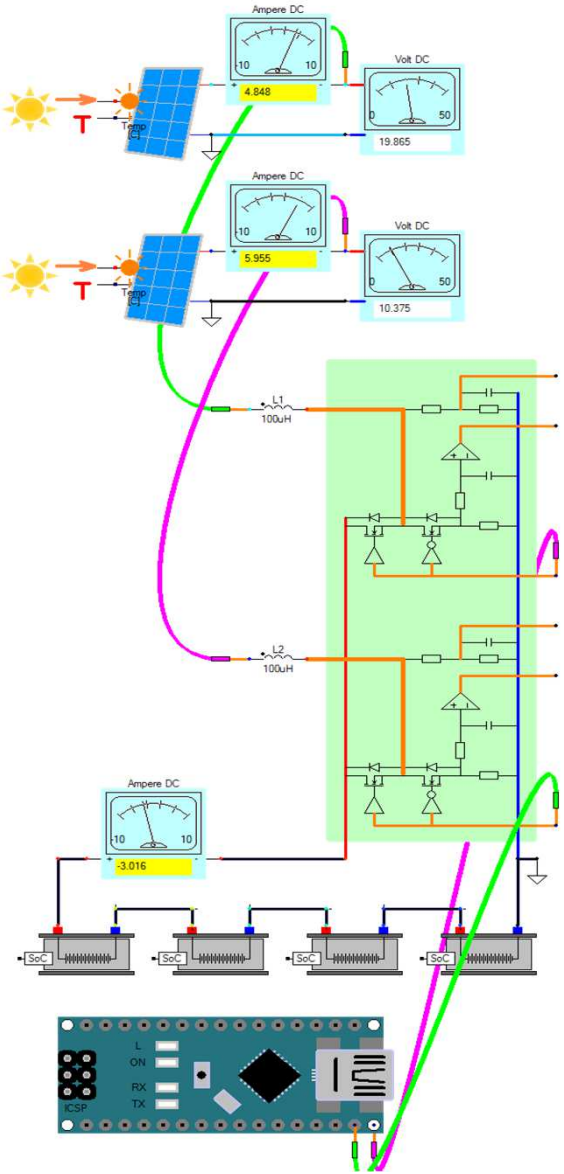

48V DC link

Two solar panels of different size

can have their individual

Maximum Power Point tracker

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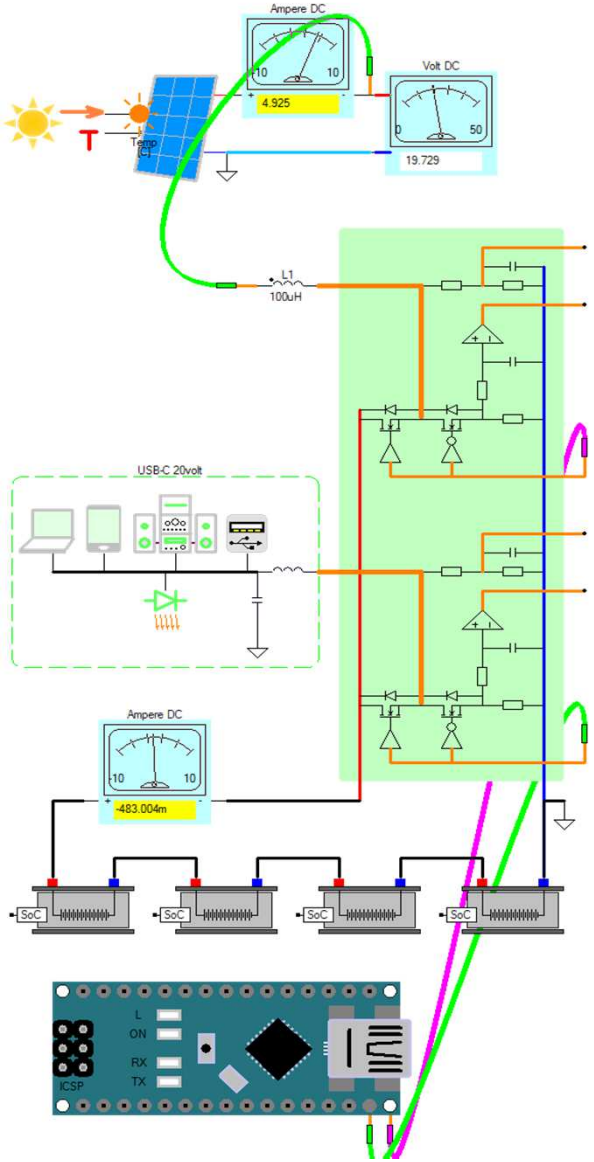
5 – 12 – 18 – 20V



48V DC link

Bidirectional power interface to USB-C [20 volt] is established from the DC link voltage [48 volt] using a single leg configured as a bidirectional Buck-Boost converter

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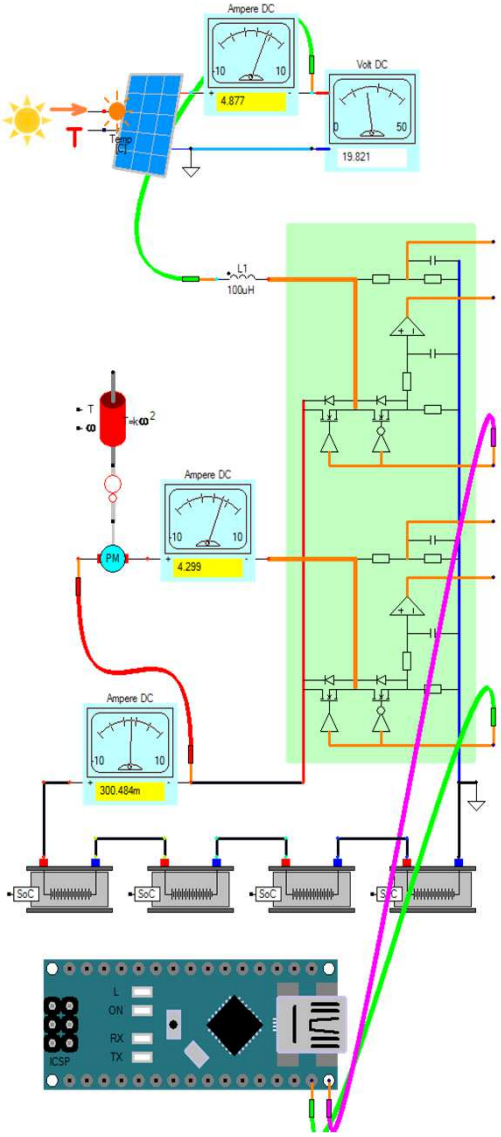

48V DC link

First quadrant speed control of a PMDC motor

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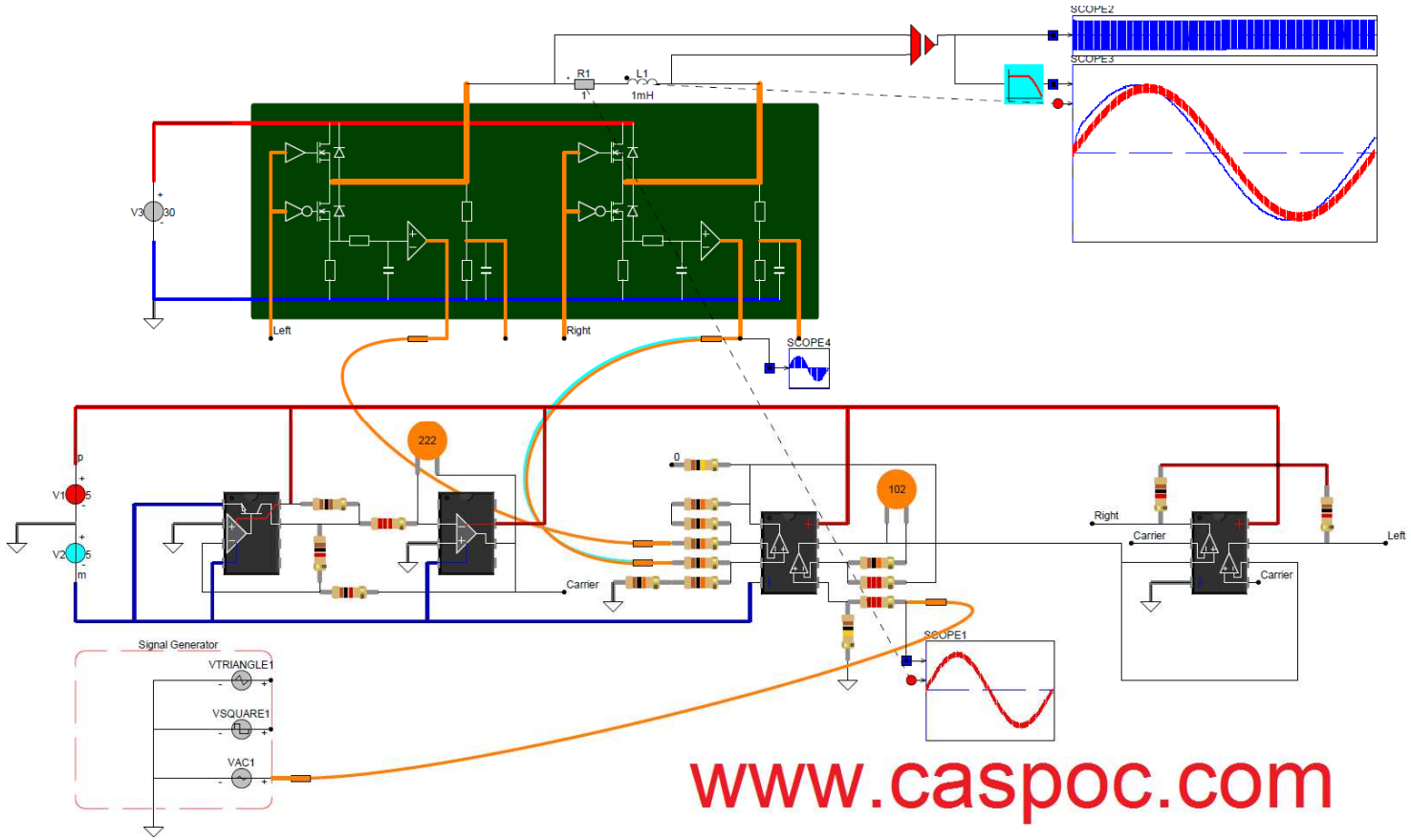
Laboratory assignment



Simulation 1 phase Inverter

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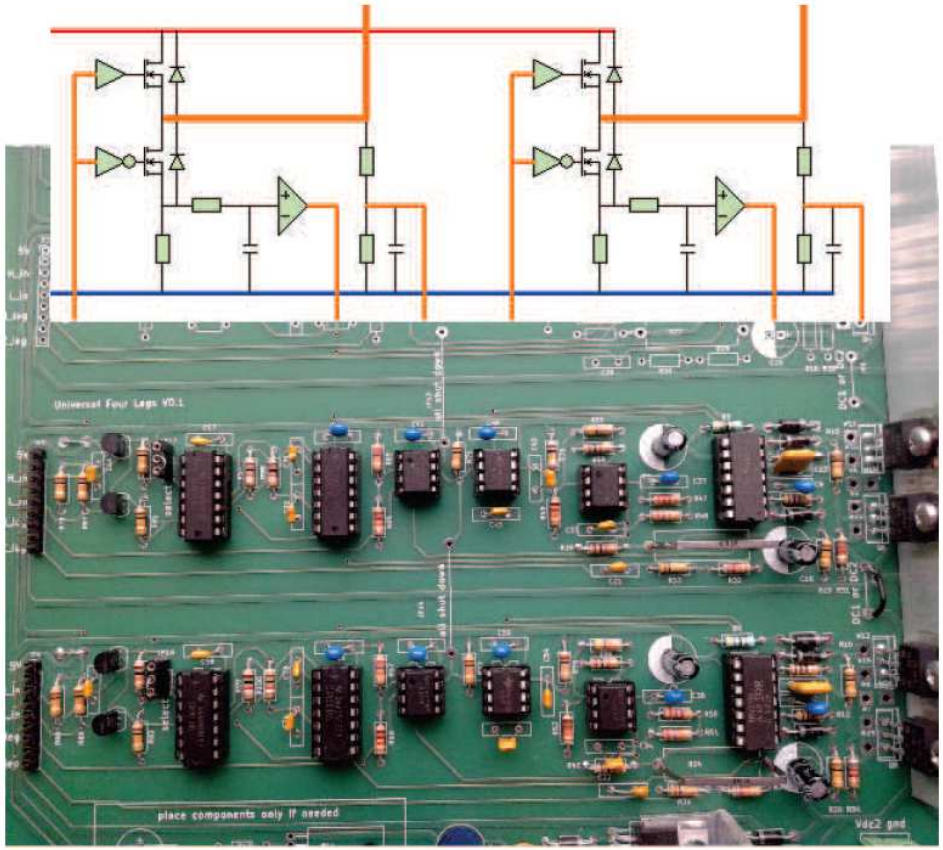
Educational setup for Power Electronics and IoT

Conclusion

- Simple setup for teaching basics of power electronics is presented
- Can be done in conjunction with:
  - Solar panels
  - Battery charging
  - PMDC motor control
- First students have to perform simulations
- Second the experimental setup can be used



Questions?

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