
SimuBridge
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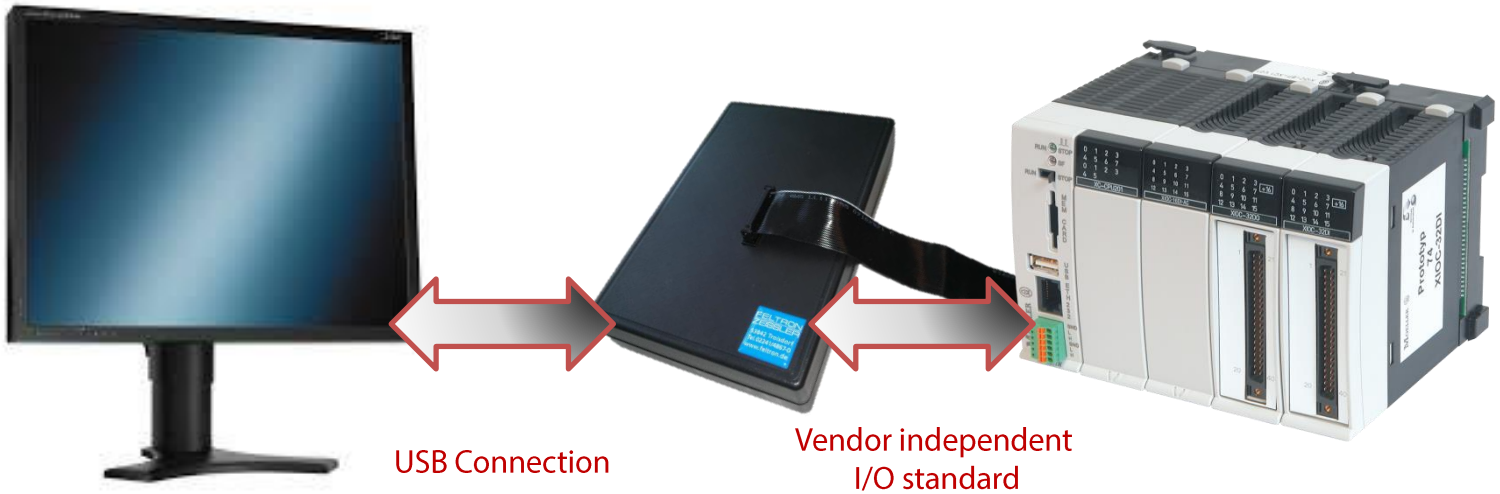
1. What is SimuBridge?

System Simulator Controlled by a Generic PLC as an Innovative Learning Concept

PC with simulation software

I/O Adapter

Programmable Logic Controller (PLC)



USB Connection

Vendor independent
I/O standard
(0-24V Digital, 0-10V Analog)

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Fig.1: SimuBridge System Overview

2. Simulation Software

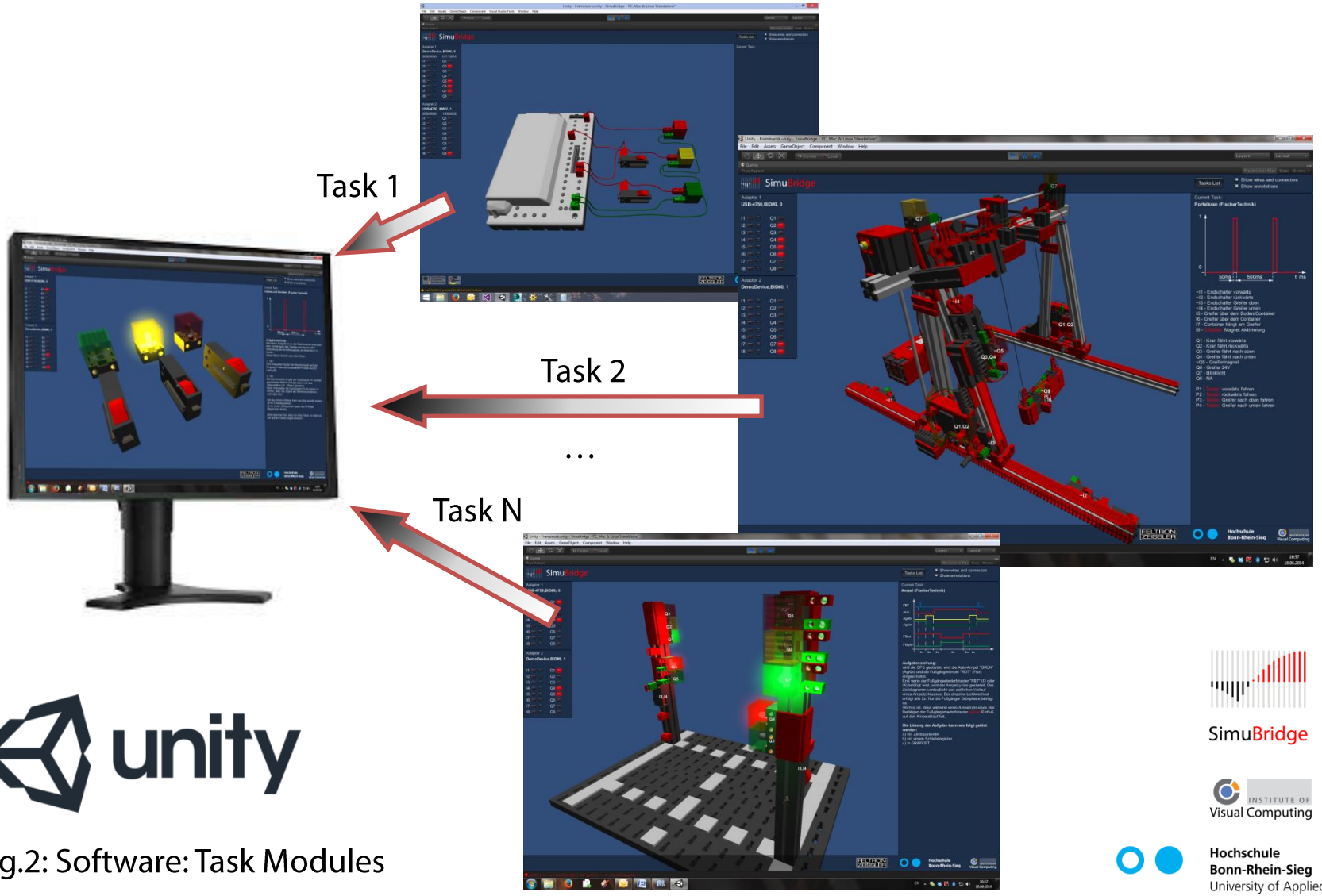

Fig.2: Software: Task Modules

3. Keypoints of the Teachware:

> Realistic Electrical and Mechanical Behaviour

> Multiple Faults Simulation

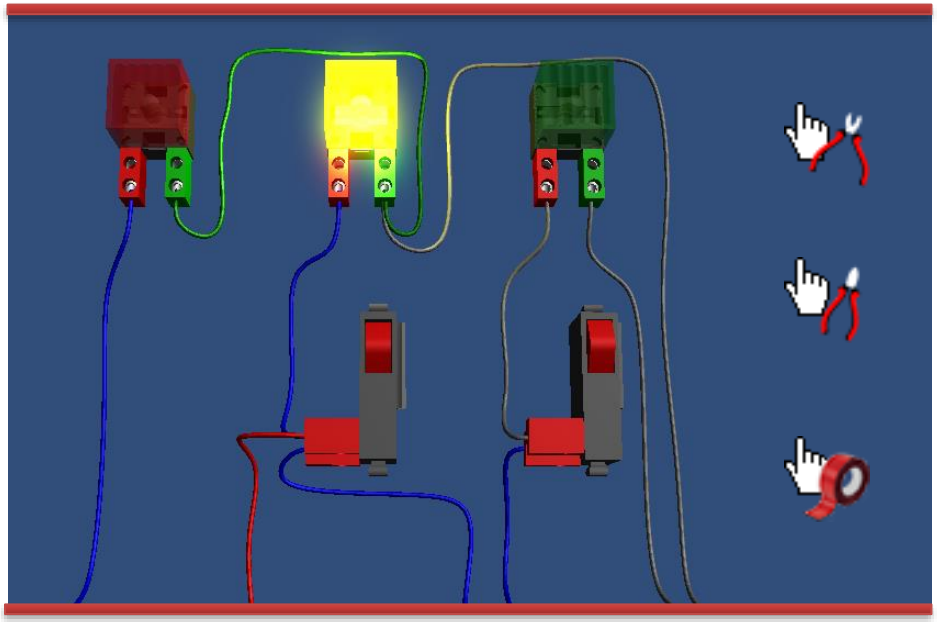

Fig.3: Electrical simulation. Correct behaviour even with multiple concurrent faults (contact loss, cable break), (24V blue, 0V grey, + polarity red, - polarity green)

NGSPICE

Used for electrical simulations
(in real-time) (in general offline simulator)

PhysX by NVIDIA

Used for physical simulations

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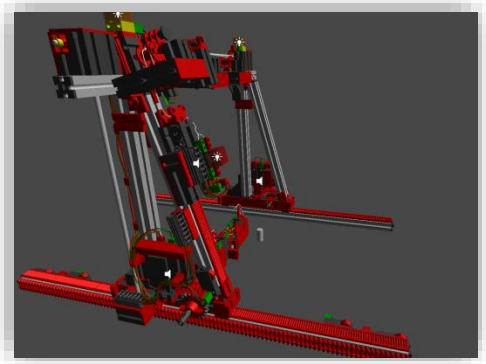
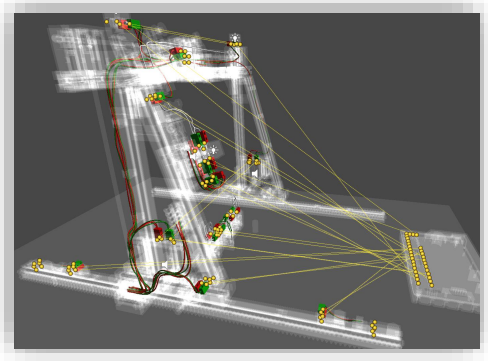
4a. Modelling of the Underlying Semantics

- Each component is a pre-build object containing a 3D-model and a set of electro-mechanical „rules“ encoding its „behaviour“.
- Logical connections between components are set in a specially developed „Connection Mode“ system inside the Unity3d editor.
- At run-time, a special text-based description of the underlying schematics is generated based on the current connections and components, allowing any changes being reflected in real-time (wires can be virtually cut and repaired).
- The text-based description is then simulated using NG-Spice simalator and resulting currents and voltages are then distributed among all the componetns and connections.
- As last step each components „reacts“ accordinly to the results and provides visual feedback of the simulation (changing brightness of a lamp, speed of a motor rotation, etc.)





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4b. Modelling of the Underlying Semantics

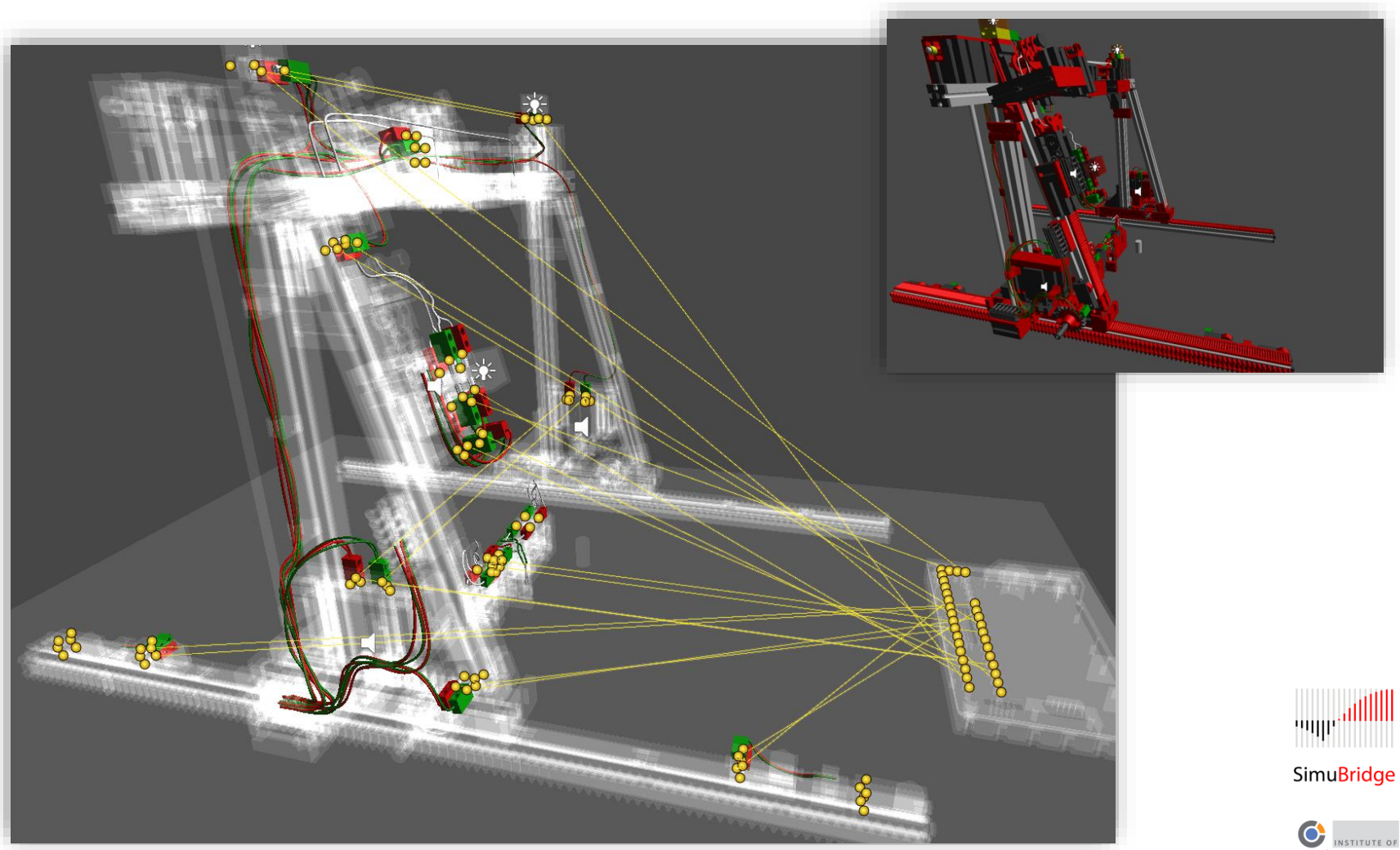

Fig.4: Underlying semantics: each component is connected to the other components in the model forming an electrical schematic.

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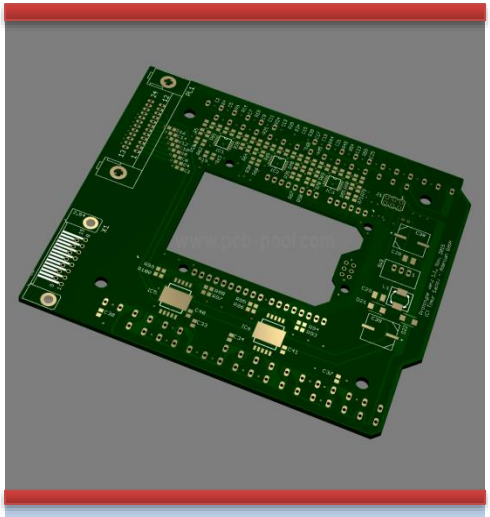
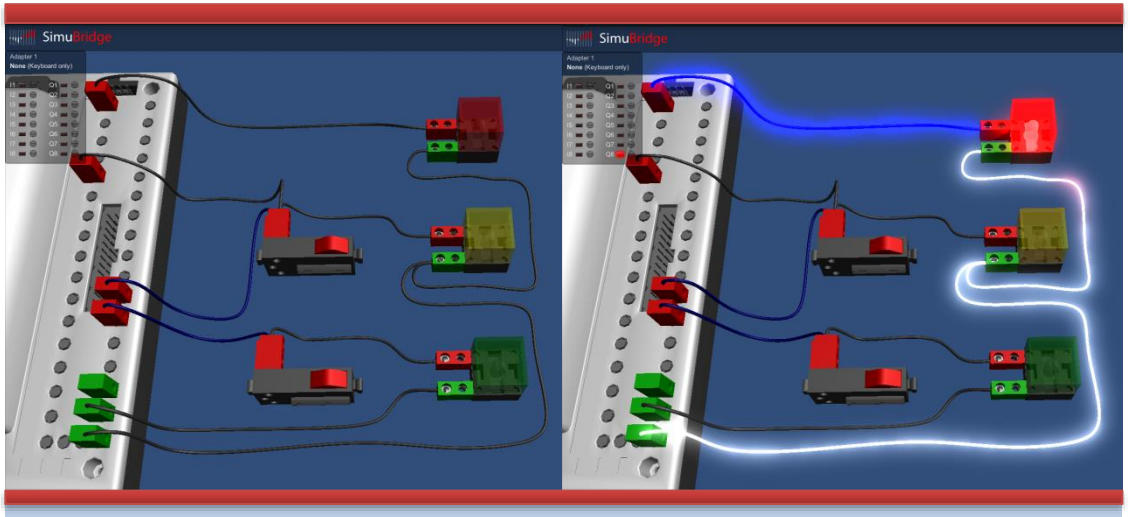
5. Related / Post-project Work



After the project end a new analog version of the I/O adapter has been developed



Voltage and current visualisation:
Colour intensity represents the voltage, brightness - shows to the current.

Fig.5: Post-project work

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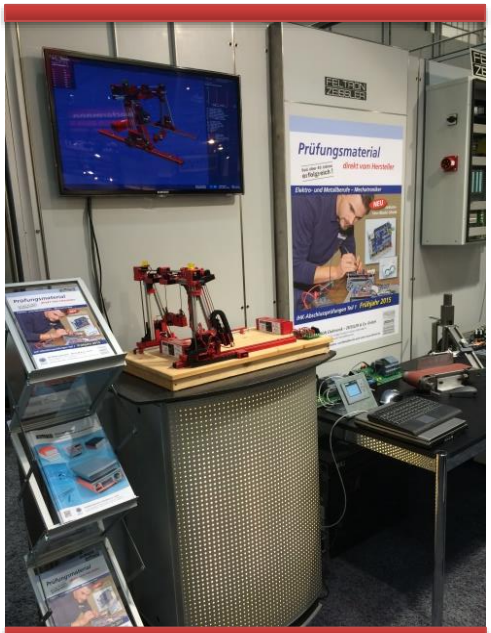
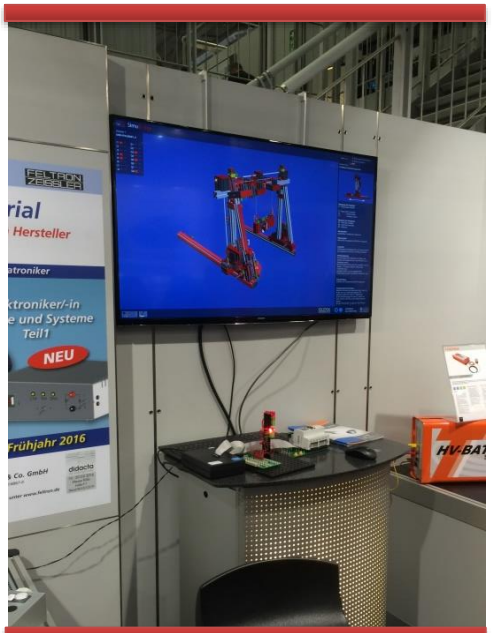
6. Didacta

Didacta 2014 Stuttgart



Didacta 2015 Hannover



Didacta 2016 Cologne

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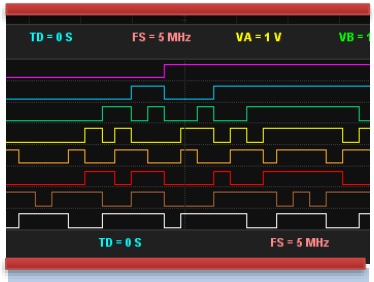
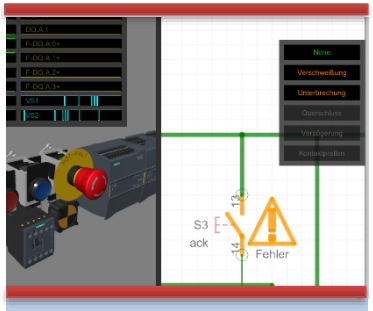
7. Follow-up Project

SafetSim: Extended version of the simulation with a series of training exercises developed for safety relevant aspects of PLC wiring and programming.

New version of I/O Adapter with short-circuit, open wire, high current simulations (switching matrix design)



Virtual Oscilloscope



Faults injection system

SafetySim

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