

# Control and monitoring of a solar thermal system

Kevin Bundschuh

HTWG Konstanz, Ubiquitous Computing Lab

Mobile Computing WS2018/19

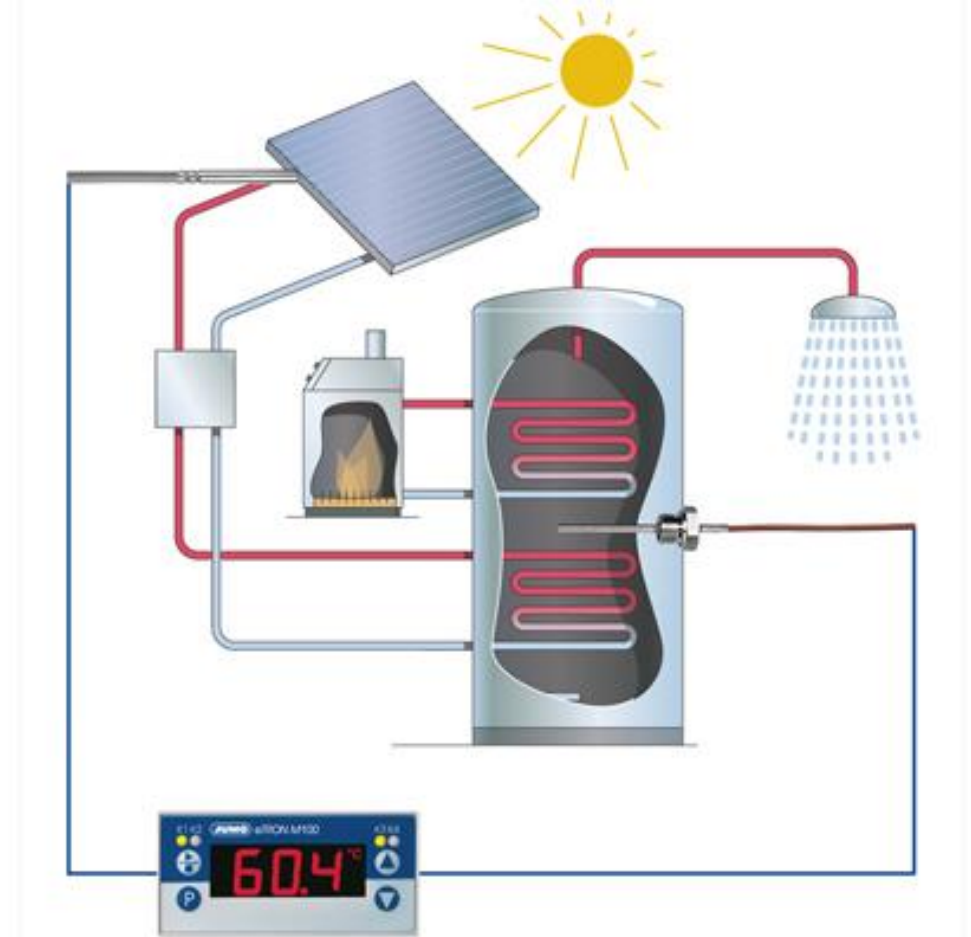
URL: <http://uc-lab.in.htwg-konstanz.de>

# Table of contents

- Introduction
- Project Targets
- Control Unit
  - Hardware
  - Software
- Monitoring System
- Final Solution
- Conclusion future Work

# Introduction

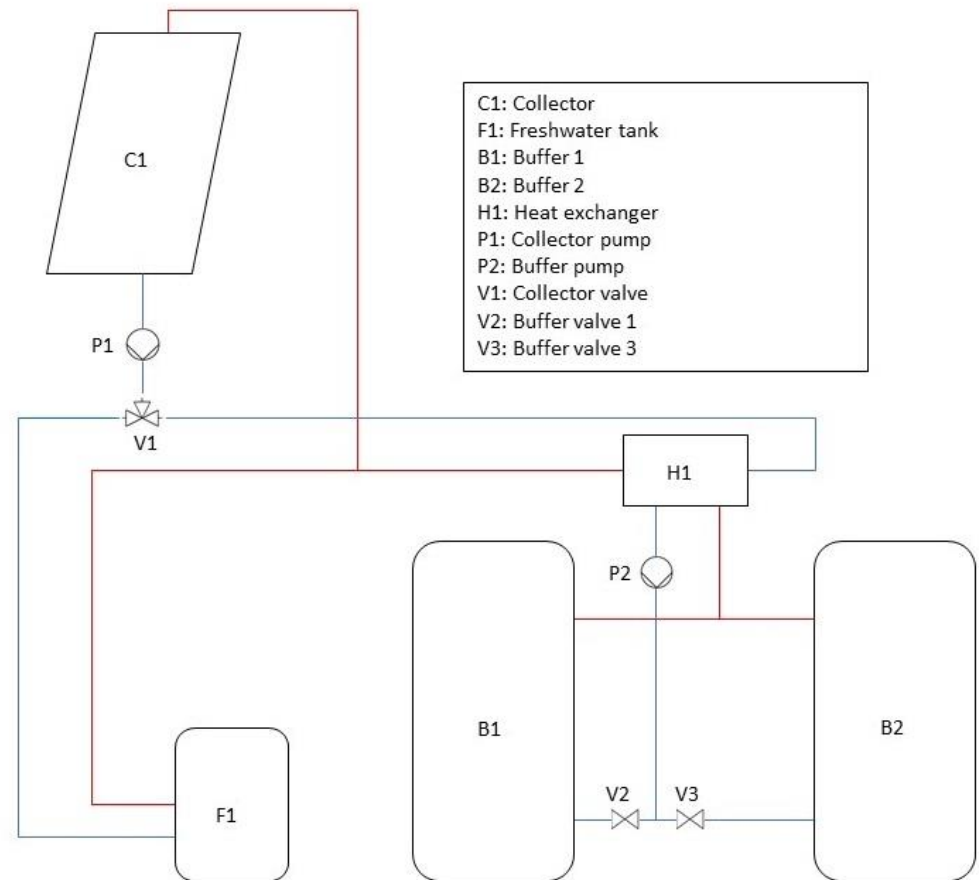
- Carrier fluid is heated up in Collector
- Carrier fluid circulates trough heat exchangers
- Therefore pumps and valves need to be controlled depending on measured temperatures



[http://www.jumo.nl/nl\\_NL/branches/Duurzame-energie/toepassingen/thermische-zonne-energie/solarthermie.html](http://www.jumo.nl/nl_NL/branches/Duurzame-energie/toepassingen/thermische-zonne-energie/solarthermie.html)

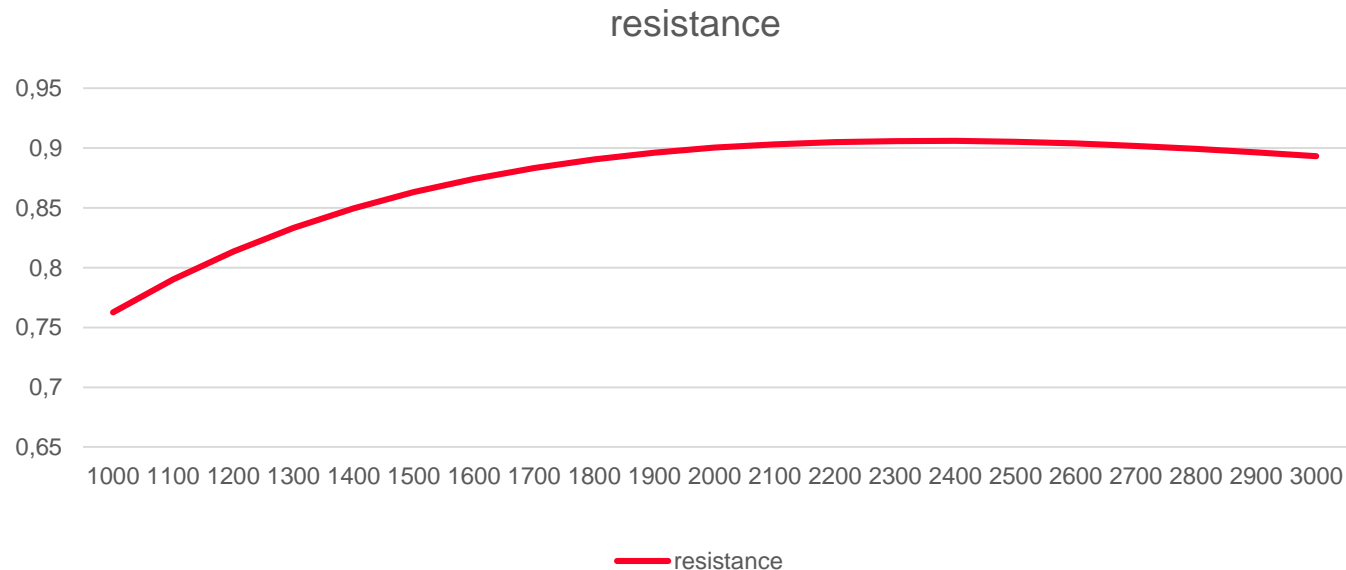
# Project Targets

- Control Unit
  - reliable
  - low cost
  - easy to maintain
- Monitoring
  - Real time data
  - Data Archive
  - Compatible with many different devices

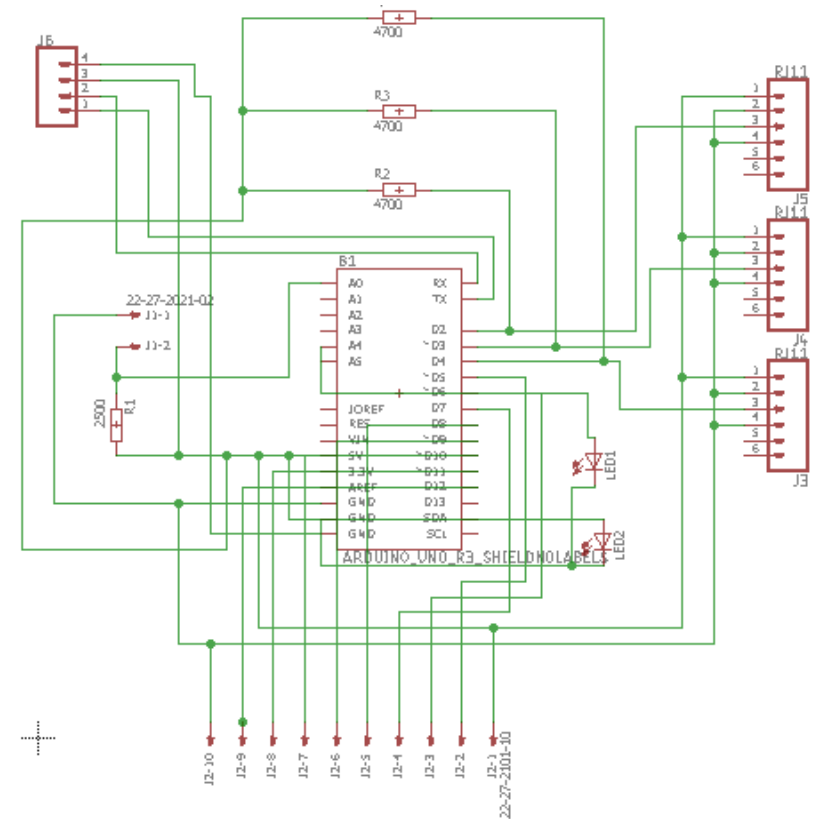
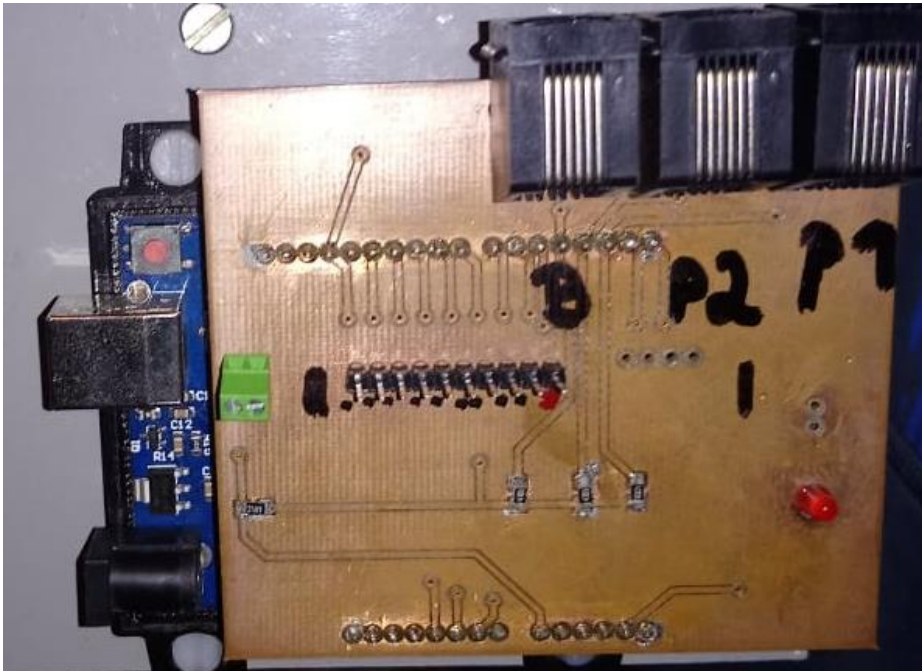


# Control Unit → Hardware

- Arduino uno
- 8-Way Relais Module
- 6 x DS18B20 temperature sensors (1Wire)
- 1 x PT 1500 temperature sensor

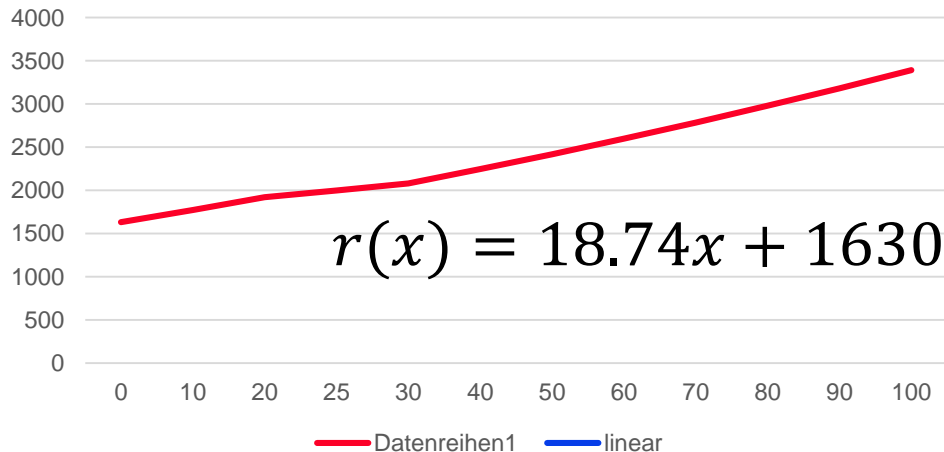


# Control Unit → Hardware



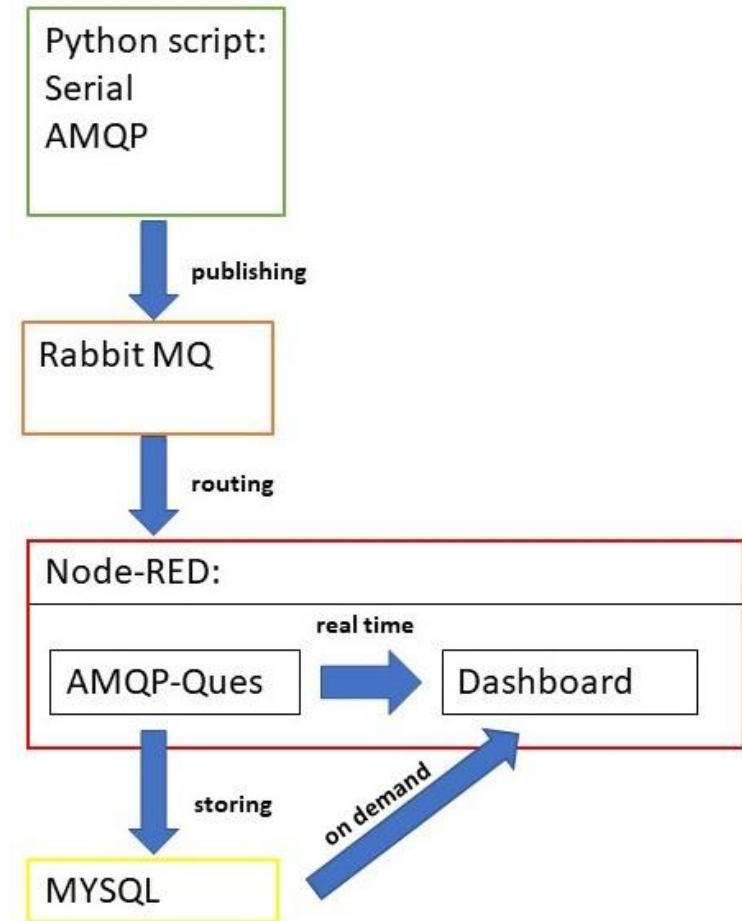
# Control Unit → Software

- Arduino \*.ino sketch
  - Reading temperatures from 1Wire devices
  - Calculating temperature from PTC
  - Controlling relais module via GPIOs
  - Watchdog timer to increase reliability
  - Providing data over serial port



# Monitoring System → Architecture

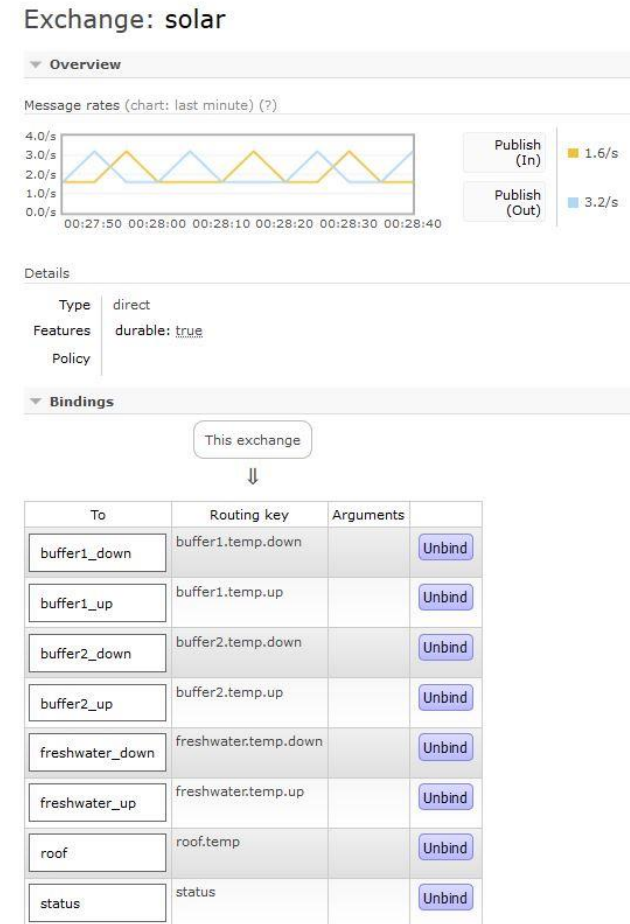
- Software running on the Raspberry PI
- Managing real time data and data archive





# Monitoring System → AMQP Broker

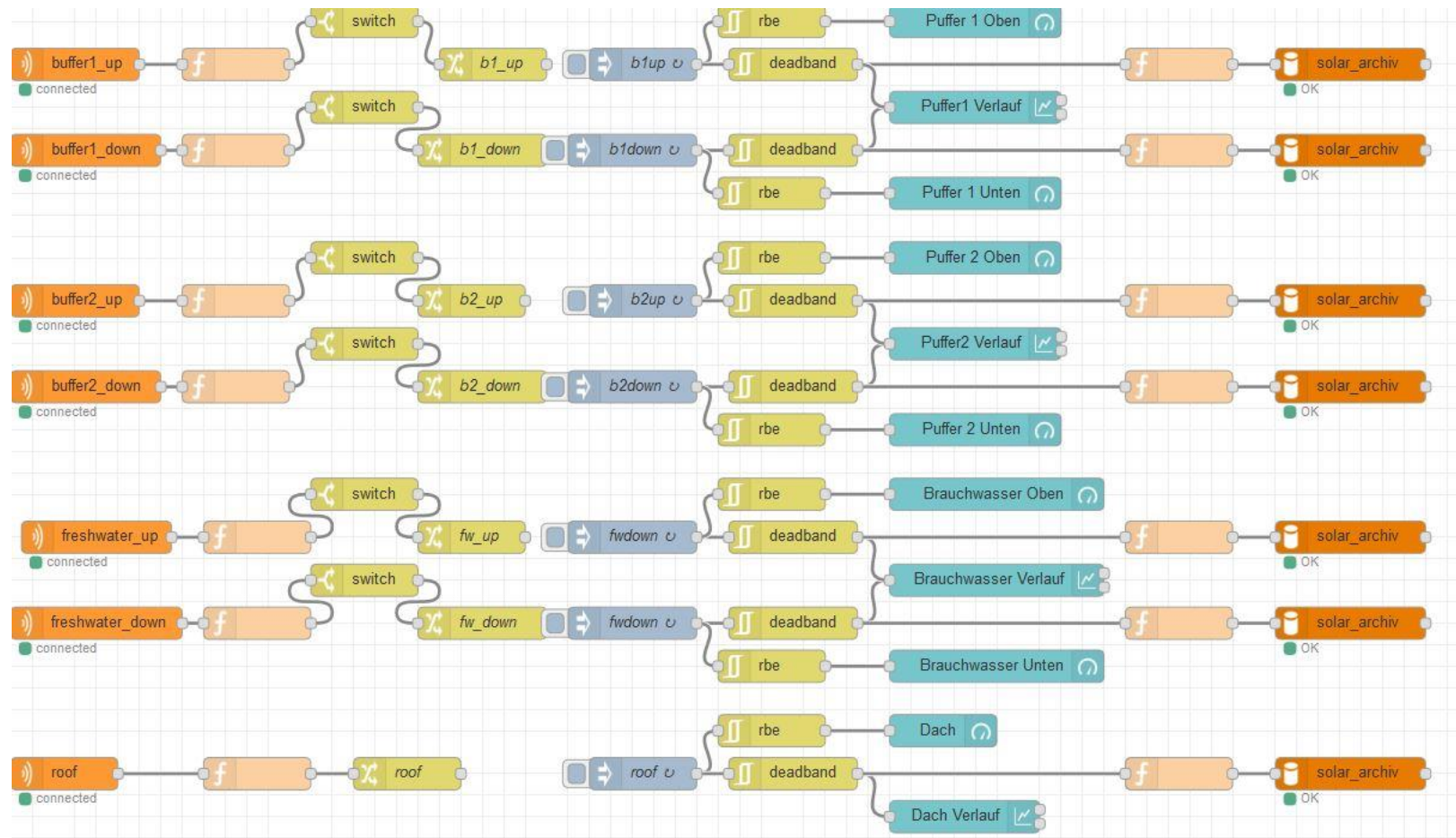
- Exchange has multiple bindings to certain queues
- One queue for each temperature value and current status of the system



# Monitoring System → Node RED

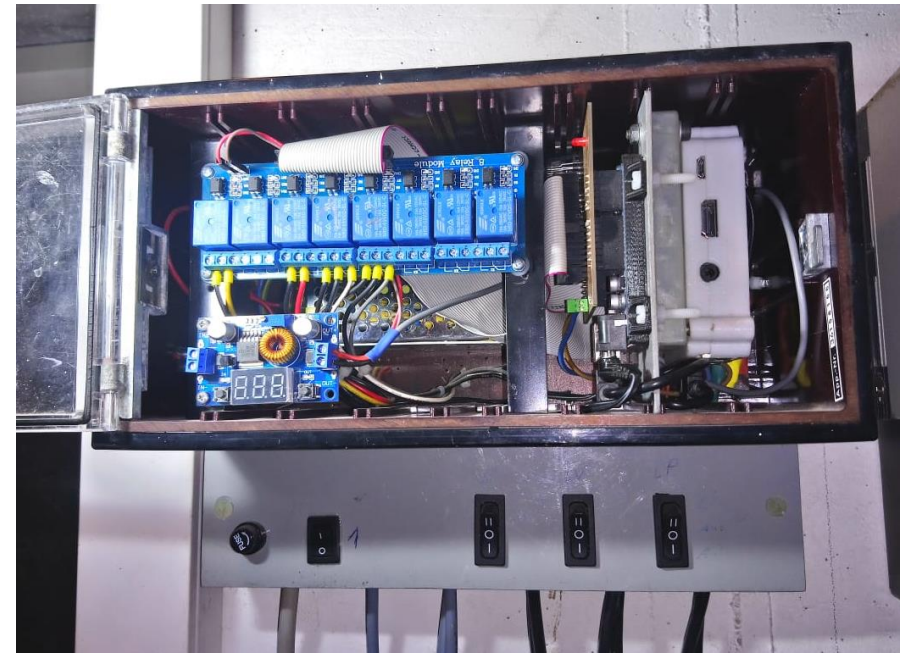
- Is a programming tool for wiring together hardware devices, APIs and online services
- The runtime is built on Node.js
- Nodes for a live data dashboard

# Monitoring System → Node RED



# Final Solution

Raspberry Pi	39,49	<a href="#">Raspberry Pi 3</a>
Relais module (8-fach)	10,69€	<a href="#">Relais Modul</a>
Temperature sensor(s)DS18B20 (10x)	2,016€/Stück 20,16€	<a href="#">Temperatur Sensoren</a>
Arduino Uno R3	20,12€	<a href="#">Arduino</a>
Power supply 220VAC - 12VDC 5A 60W	9,99€	<a href="#">Netzeil</a>
Step down Converter 5A 75W DC DC	5,99€	<a href="#">Step down Converter</a>
SUMME:	98,38€	



# Conclusion Future Work

- System is now tested for several days without any failure
- Every target reached
  - Real time data
  - Data archive
  - <100€
- Email/sms alert in case of failure
- Controlling system via dashboard
- Adjust regulation parameters for efficiency

# Thanks for your attention. Questions?

**Kevin Bundschuh**

HTWG Konstanz  
Department of Computer Science  
Ubiquitous Computing Lab<sup>[L]</sup><sub>[SEP]</sub>  
Alfred-Wachtel-Str. 8  
D-78462 Konstanz (Germany)<sup>[L]</sup><sub>[SEP]</sub>  
Phone: +49 7531-206 0

URL: <http://uc-lab.in.htwg-konstanz.de>  
Twitter: /UCLabHTWG  
Facebook: /UCLabHTWG