ARDUINO Workshop

Der Plan :

1. Was ist Arduino ?
2. Boardlayout
3. Wiki - Abkürzungen / Beschriftungen
4. IDE Software (**I**ntegrated **D**evelopment **E**nvironment)
5. Blink / Analog Sketch
6. Debug Sketch
7. Iot Boards (NodeMCU / Wemos)
8. Dallas / Maxim 1-Wire
9. Q&A - Fragen und evtl. Antworten
10. Ende

Quickstart Video

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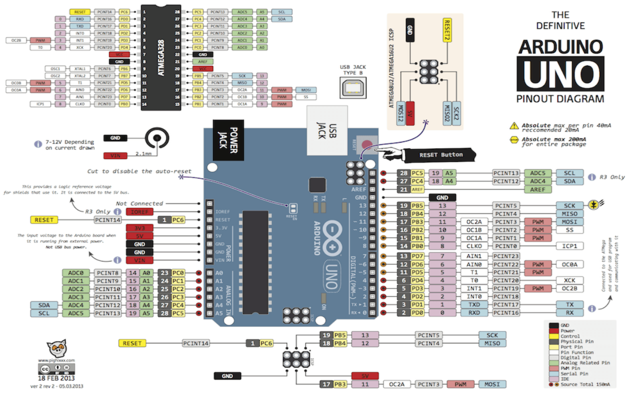
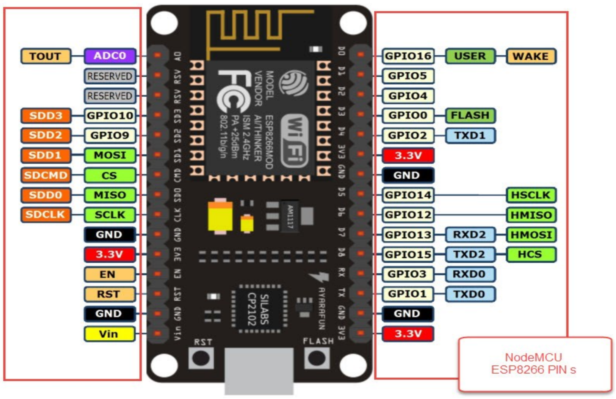
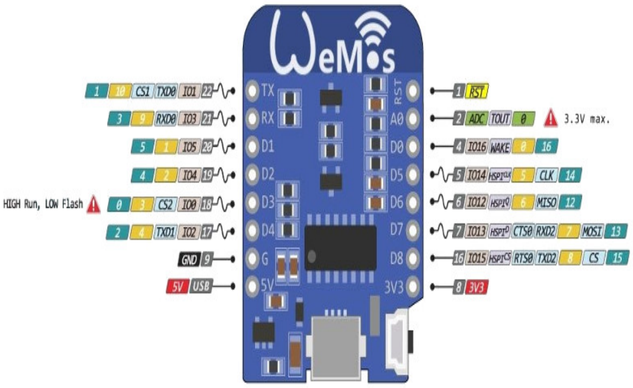
https://www.youtube.com/watch?v=nL34zDTPkcs

Boardlayout - Abkürzungen / Beschriftungen






WeMos
1 10 CS1 TXD0 IO1 22 TX
3 9 RXD0 IO3 21 RX
5 1 IO5 20 D1
4 2 IO4 19 D2
HIGH Run, LOW Flash 0 3 CS2 IO0 18 D3
2 4 TXD1 IO2 17 D4
GND 9 G
5V USB 5V
RST 1 RST
A0 2 ADC TOUT 0 3.3V max.
D0 4 IO16 WAKE 0 16
D5 5 IO14 HSPICLK 5 CLK 14
D6 6 IO12 HSPIQ 6 MISO 12
D7 7 IO13 HSPID CTS0 RXD2 7 MOSI 13
D8 16 IO15 HSPICS RTS0 TXD2 8 CS 15
3V3 8 3V3

Open Arduino UNO Pinout

Open NodeMCU Pinout

Open WEMOS Pinout

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more :

https://www.14core.com/datasheets-pin-outs/

https://www.arduino.cc/en/Main/Products

Wiki - Abkürzungen / Beschriftungen

Led https://de.wikipedia.org/wiki/Leuchtdiode

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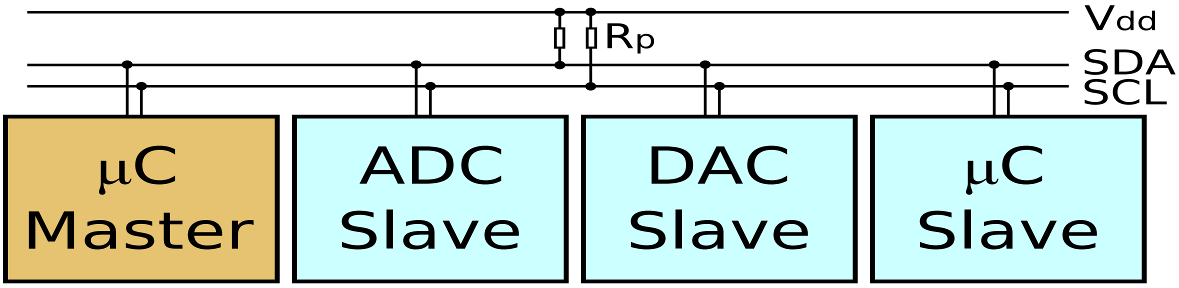
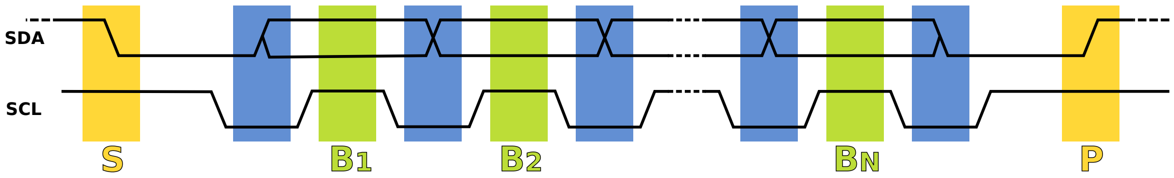
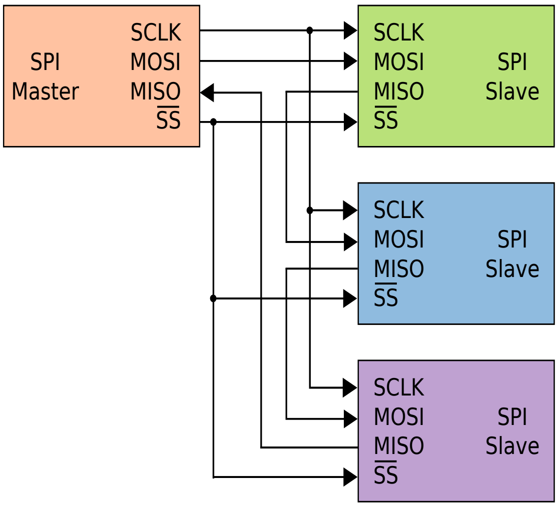
i²C https://de.wikipedia.org/wiki/I%C2%B2C

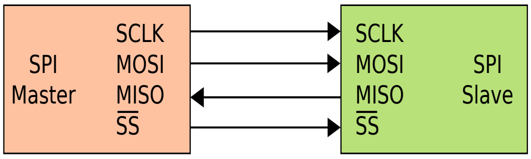




SPI https://de.wikipedia.org/wiki/Serial_Peripheral_Interface

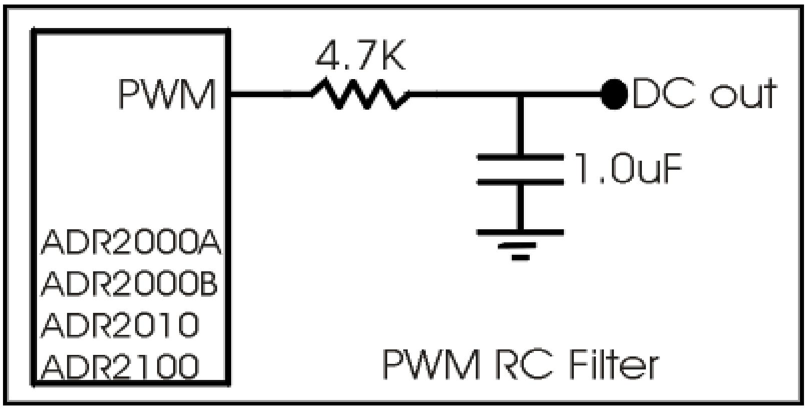
> MOSI / MISO & Co - (**M**aster **O**ut **S**lave **I**n)



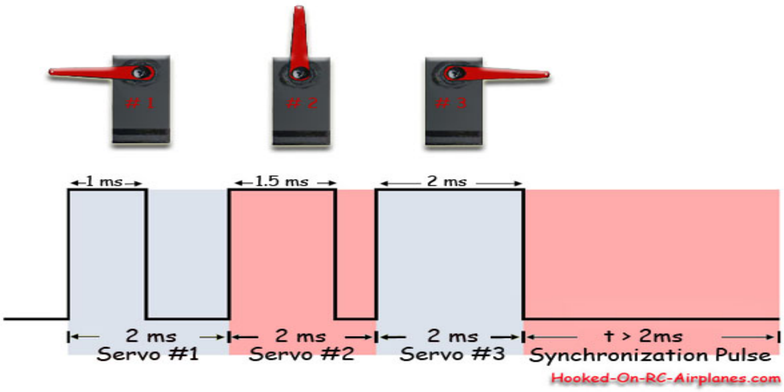


PWM ~ https://de.wikipedia.org/wiki/Pulsweitenmodulation

... als Analog Spannung Signal https://www.instructables.com/id/Analog-Output-Convert-PWM-to-Voltage/



... Servo Library <Servo.h> https://www.mariolukas.de/2011/08/arduino-servo-tutorial/



UART (RS232 / Serial.print()) https://de.wikipedia.org/wiki/Universal_Asynchronous_Receiver_Transmitter

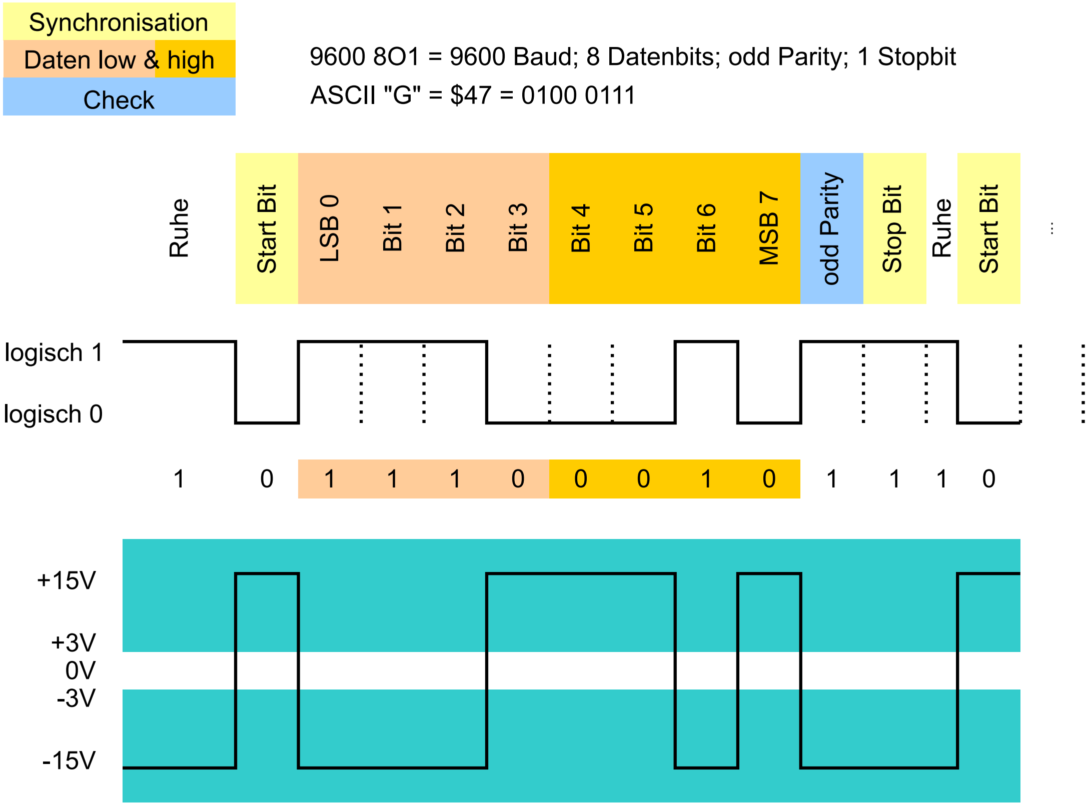
https://www.arduino.cc/reference/en/language/functions/communication/serial/begin/

```
void setup() {
    // opens serial port, sets data rate to 9600 bps
    // SERIAL_8N1 (the default)
    Serial.begin(9600);

    /* speed: in bits per second (baud) - long
       config: sets data, parity, and stop bits.
    */
    Serial.begin(19200, SERIAL_8N1)
}
```

Übliche Bitraten

Bitrate	Bitdauer
50 bit/s	20,0 ms
. . . .	. . . .
1.200	bit/s 833 μs
9.600	bit/s 104 μs
19.200	bit/s 52,1 μs
57.600	bit/s 17,4 μs
. . . .	. . . .
500.000	bit/s 2,00 μs



9600 8O1 = 9600 Baud; 8 Datenbits; odd Parity; 1 Stopbit

ASCII "G" = $47 = 0100 0111

Terminal (LKTerm) https://www.loksoft.ch/sites/downloads/dlTerminal.aspx

ADC https://de.wikipedia.org/wiki/Analog-Digital-Umsetzer

SRAM https://de.wikipedia.org/wiki/Static_random-access_memory

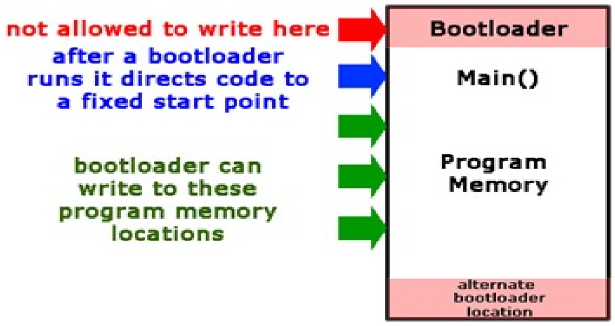
LoRa https://de.wikipedia.org/wiki/Long_Range_Wide_Area_Network

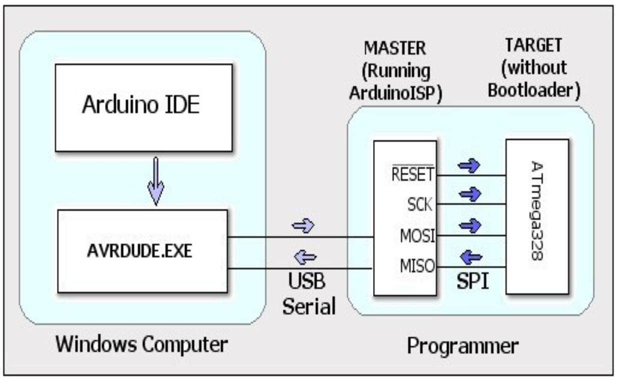
LDR (Fotowiderstand) https://draeger-it.blog/sainsmart-lektion-4-led-mit-fotowiderstand/

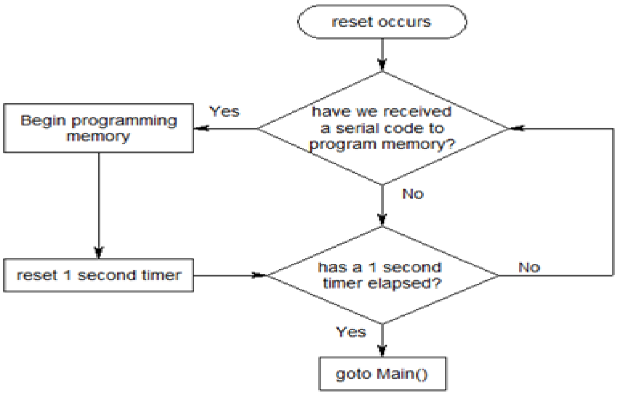
Sketch (Arduino Programm) https://www.arduino.cc/en/tutorial/sketch

Shield (Erweiterungen) https://www.arduino.cc/en/Main/arduinoShields

Bootloader https://www.arduino.cc/en/Hacking/Bootloader?from=Tutorial.Bootloader


not allowed to write here
after a bootloader runs it directs code to a fixed start point
bootloader can write to these program memory locations
Bootloader
Main()
Program Memory
alternate bootloader location




reset occurs
have we received a serial code to program memory?
Yes
Begin programming memory
No
reset 1 second timer
has a 1 second timer elapsed?
No
Yes
goto Main()

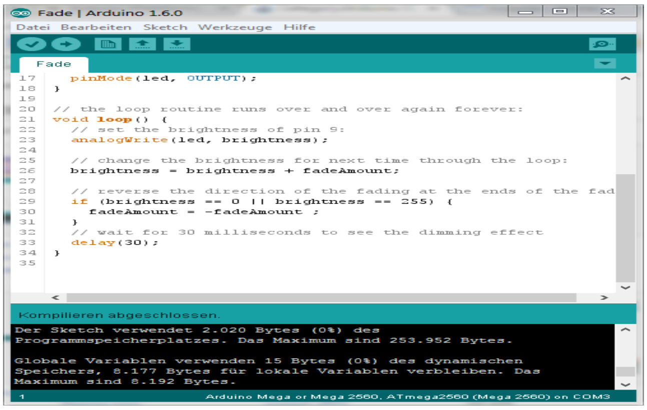
Open Pic 1

Open Pic 2

Open Pic 3

IDE Software (**I** ntegrated **D** evelopment **E** nvironment)

https://de.wikipedia.org/wiki/Integrierte_Entwicklungsumgebung



```
  pinMode(led, OUTPUT);
}

// the loop routine runs over and over again forever:
void loop() {
  // set the brightness of pin 9:
  analogWrite(led, brightness);

  // change the brightness for next time through the loop:
  brightness = brightness + fadeAmount;

  // reverse the direction of the fading at the ends of the fad
  if (brightness == 0 || brightness == 255) {
    fadeAmount = -fadeAmount ;
  }
  // wait for 30 milliseconds to see the dimming effect
  delay(30);
}
```

```
Kompilieren abgeschlossen.
Der Sketch verwendet 2.020 Bytes (0%) des
Programmspeicherplatzes. Das Maximum sind 253.952 Bytes.

Globale Variablen verwenden 15 Bytes (0%) des dynamischen
Speichers, 8.177 Bytes für lokale Variablen verbleiben. Das
Maximum sind 8.192 Bytes.
1                 Arduino Mega or Mega 2560, ATmega2560 (Mega 2560) on COM3
```

open picture

Blink.ino sketch :

```
/*
  Blink

  Turns an LED on for one second, then off for one second, repeatedly.

  Most Arduinos have an on-board LED you can control. On the UNO, MEGA and ZERO
  it is attached to digital pin 13, on MKR1000 on pin 6. LED_BUILTIN is set to
  the correct LED pin independent of which board is used.
  If you want to know what pin the on-board LED is connected to on your Arduino
  model, check the Technical Specs of your board at:
  https://www.arduino.cc/en/Main/Products

  modified 8 May 2014   by Scott Fitzgerald
  modified 2 Sep 2016   by Arturo Guadalupi
  modified 8 Sep 2016   by Colby Newman

  This example code is in the public domain.

  http://www.arduino.cc/en/Tutorial/Blink
*/

// the setup function runs once when you press reset or power the board
void setup() {
  // initialize digital pin LED_BUILTIN as an output.
  pinMode(LED_BUILTIN, OUTPUT);
}

// the loop function runs over and over again forever
void loop() {
  digitalWrite(LED_BUILTIN, HIGH);   // turn the LED on (HIGH is the voltage
level)
  delay(1000);                       // wait for a second
  digitalWrite(LED_BUILTIN, LOW);    // turn the LED off by making the voltage LOW
  delay(1000);                       // wait for a second
}
```

Tutorials / HowTo

http://www.marc-schaffer.ch/data/Arduino101.pdf https://www.arduino-tutorial.de/ https://www.tutorialspoint.com/arduino/arduino_tutorial.pdf

How to Use a Breadboard

https://www.youtube.com/watch?v=6WReFkfrUIk

Debug

https://forum.arduino.cc/index.php?topic=46900.0

```
#define DEBUG 1

#ifdef DEBUG
 #define DEBUG_PRINT(x)  Serial.println (x)
#else
 #define DEBUG_PRINT(x)
#endif

void loop()
{
...
  // will only printed / compiled in code if DEBUG = 1
  DEBUG_PRINT ("I'm here");
...
}

#define DEBUG
#include "DebugUtils.h"
```

Youtube - Andreas Spiess

https://www.youtube.com/channel/UCu7_D0o48KbfhpEohoP7YSQ

Dallas 1-Wire

https://www.youtube.com/watch?v=CjH-OztKe00

DS2438 - Switch

https://github.com/jbechter/arduino-onewire-DS2438

LevelShifter

https://circuits4you.com/2016/12/14/io-level-conversion-esp8266/
https://hackaday.com/2017/01/20/cheating-at-5v-ws2812-control-to-use-a-3-3v-data-line/

Interrupts

https://www.packtpub.com/mapt/book/web_development/9781785888564/3/ch03lvl1sec27/reading-and-counting-pulses-with-arduino https://www.electronicwings.com/nodemcu/nodemcu-gpio-interrupts-with-arduino-ide

volatile (global Var)

https://www.arduino.cc/reference/en/language/variables/variable-scope--qualifiers/volatile/

```
// toggles LED when interrupt pin changes state

int pin = 13;
volatile byte state = LOW;

void setup()
{
  pinMode(pin, OUTPUT);
  attachInterrupt(digitalPinToInterrupt(2), blink, CHANGE);
}

void loop()
{
  digitalWrite(pin, state);
}

void blink()
{
  state = !state;
}
```

ESP8266 / ESP32 - IoT Device

https://www.instructables.com/id/NodeMCU-ESP8266-Details-and-Pinout/
https://www.esp8266.com/wiki/doku.php?id=esp8266-module-family
https://github.com/FablabTorino/AUG-Torino/wiki/Wemos-Lolin-board-(ESP32-with-128x64-SSD1306-I2C-OLED-display) https://www.instructables.com/id/ESP32-With-Integrated-OLED-WEMOSLolin-Getting-Star/

ADC

https://www.instructables.com/id/ESP8266-ADC-Analog-Sensors/

ESP8266 Analog Inputs Expander

https://www.tindie.com/products/AllAboutEE/esp8266-analog-inputs-expander-version-2-2/#specs

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SPIFFS & JSON

https://www.youtube.com/watch?v=jIOTzaeh7fs

Connect ESP8266 with the world (and IFTT) through MQTT and Adafruit.io (Tutorial)

https://www.youtube.com/watch?v=9G-nMGcELG8

ATTiny85

https://medium.com/jungletronics/attiny85-easy-flashing-through-arduino-b5f896c48189

I2C - TinyWire https://github.com/lucullusTheOnly/TinyWire

I2C - Demo http://forum.arduino.cc/index.php?topic=524760.0

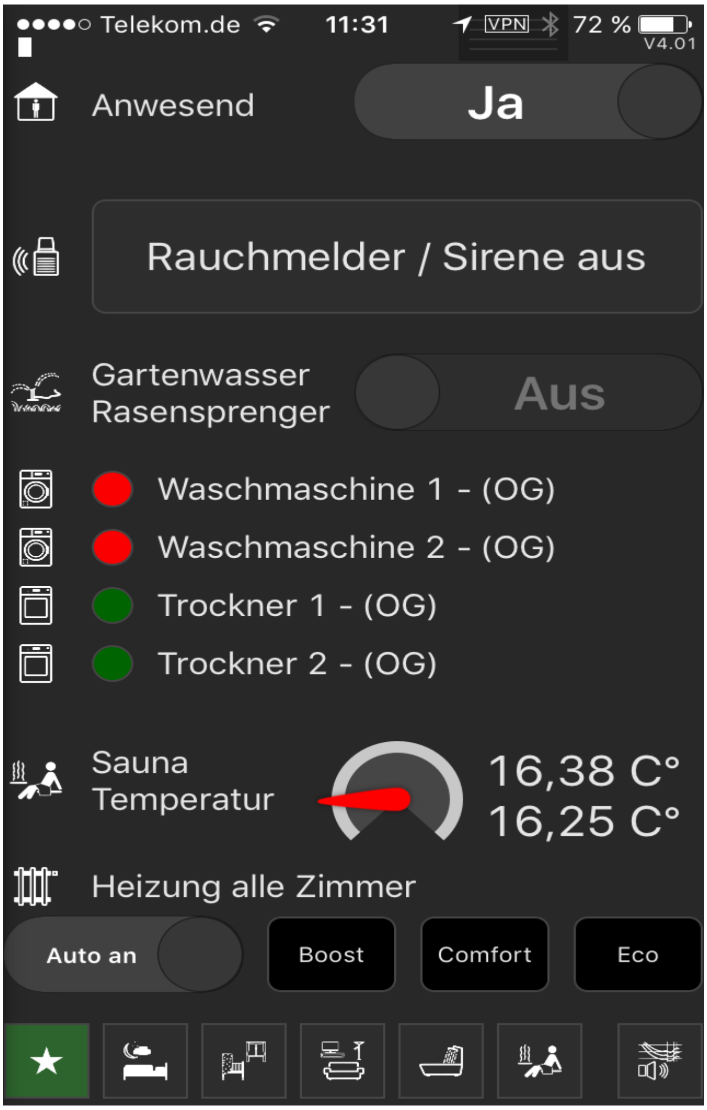
Mobile APP

ThingSpeak Demo

https://thingspeak.com/channels/82013

NetIO

https://netioapp.com/de/projects/ https://netioapp.com/de/projects/868



Anwesend Ja

Rauchmelder / Sirene aus

Gartenwasser Rasensprenger Aus

🟥 Waschmaschine 1 - (OG)

🟥 Waschmaschine 2 - (OG)

🟩 Trockner 1 - (OG)

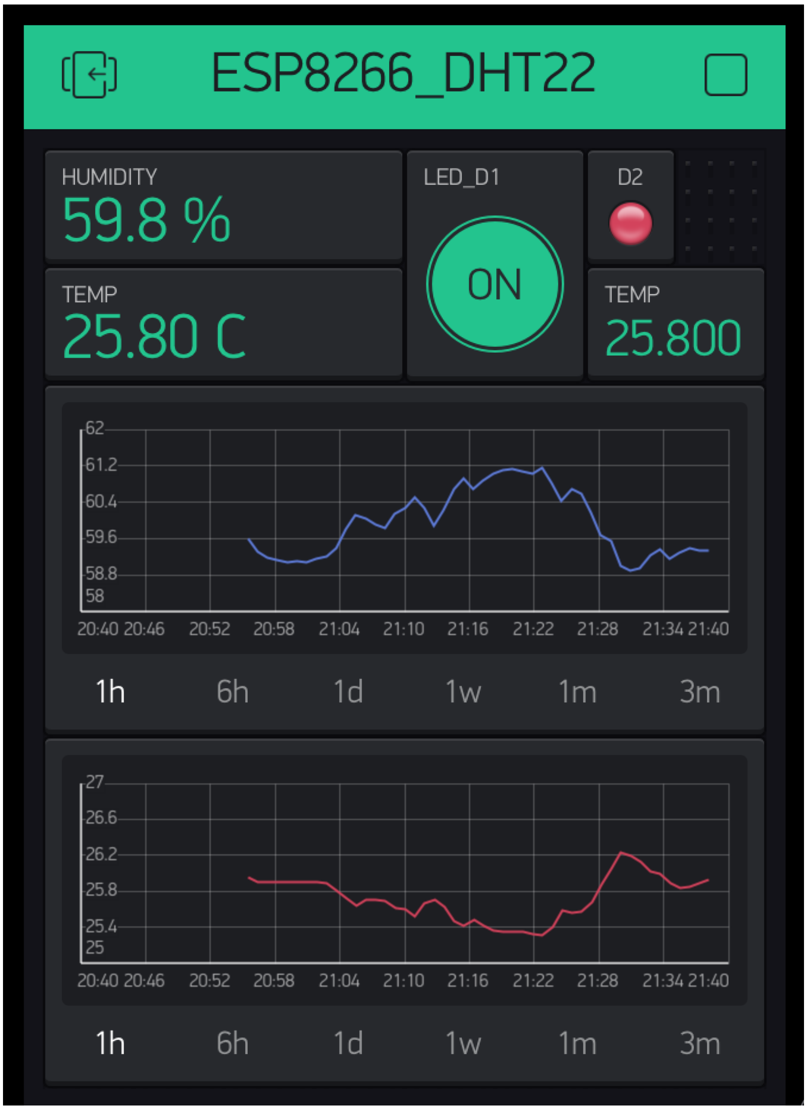
🟩 Trockner 2 - (OG)

Sauna Temperatur 16,38 C° 16,25 C°

Heizung alle Zimmer

Blynk

https://www.blynk.cc/ https://www.eevblog.com/forum/microcontrollers/blynk-users-(ios-or-android-app-to-control-arduino-rasbpi-esp8266-over-eth)/



ESP8266_DHT22

HUMIDITY 59.8 %

TEMP 25.80 C

LED_D1 ON

D2

TEMP 25.800

Thinger

https://thinger.io/

ESPproMon Energy Meter

https://peacefairapp.com/

SMASE original

https://twinters.de/smase2/ https://www.amazon.de/Bausatz-Pufferspeicher-Temperatur-Anzeige-Kontrolle/dp/B01DI0OMKC

eigene Variante

https://github.com/andyprv/SMASE

IFTTT

https://ifttt.com/

Adafruit

https://io.adafruit.com/andyprv/dashboards/demo https://learn.adafruit.com/mqtt-adafruit-io-and-you/arduino-plus-library-setup http://138.197.189.77:1880/#flow/4e2ad3be.02c88c

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Boards

https://www.adafruit.com/product/3405

micro:bit

https://learn.adafruit.com/use-micro-bit-with-arduino/overview

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dfrobot Boards

https://www.dfrobot.com/product-1075.html

Serial.print() / Serial.printF() ???

https://playground.arduino.cc/main/printf

If you use F() you can move constant strings to the program memory instead of the ram. This will take up space that will decrease the amount of other code you can write. But it will free up dynamic ram.

```
// text1 will be stored in Ram
  Serial.print("text1: ");

// text2 will be stored in fash (program memory)
  Serial.print(F("text2: "));


  Serial.print(variable, HEX);
/*
will print the value of the variable in HEX, for instance and you can also include
\t, \n and \r in strings to give a tab, newline and carriage return respectively.
*/

float ver = 1.1;
  Serial.print("version : ");
  Serial.println(ver,2);
```

Compiler internal Vars

https://forum.arduino.cc/index.php?topic=189325.0

```
// sketch file name
// compile date ( "Sep 22 2013 01:19:49" )

Serial.begin(9600);

  Serial.print("Filename: ");
  Serial.println(__FILE__);

  Serial.print("Compilation timestamp: ");
  Serial.println(__DATE__ " " __TIME__);

  Serial.print("Compiler version: ");
  Serial.println(__VERSION__);

  Serial.print("Debug Line: ");
  Serial.println(__LINE__);
```

BME280 - Luftdruck-/Luftfeuchtesensor

https://arduino-projekte.webnode.at/meine-libraries/luftdruck-luftfeuchtesensor-bme280/

Fast kompatibel zum Luftdrucksensor BMP280 der Firma Bosch (siehe hier), gibt der BME280 neben dem gemessenen Luftdruck und der Umgebungstemperatur auch die Luftfeuchtigkeit als Rohwert aus, wobei die Ausgabe wahlweise über I2C- oder über SPI-Schnittstelle erfolgen kann.

Mit Hilfe von 18 im Sensor gespeicherten Kompensationsparametern kann dann aus den Rohwerten der Luftdruck am Standort (Stationsniveauluftdruck), die Luftfeuchte und die Umgebungstemperatur ermittelt werden.

BME280 Mini_Breakout_s.jpg

Ausblick nächster Workshop

Raspberry Industrie

https://www.elektronikpraxis.vogel.de/warum-raspberry-pi-3b-ideal-fuer-die-industrie-ist-a-717988/

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Note :

ARDUINO Workshop for Yaskawa

11.2018 ; Meier A.