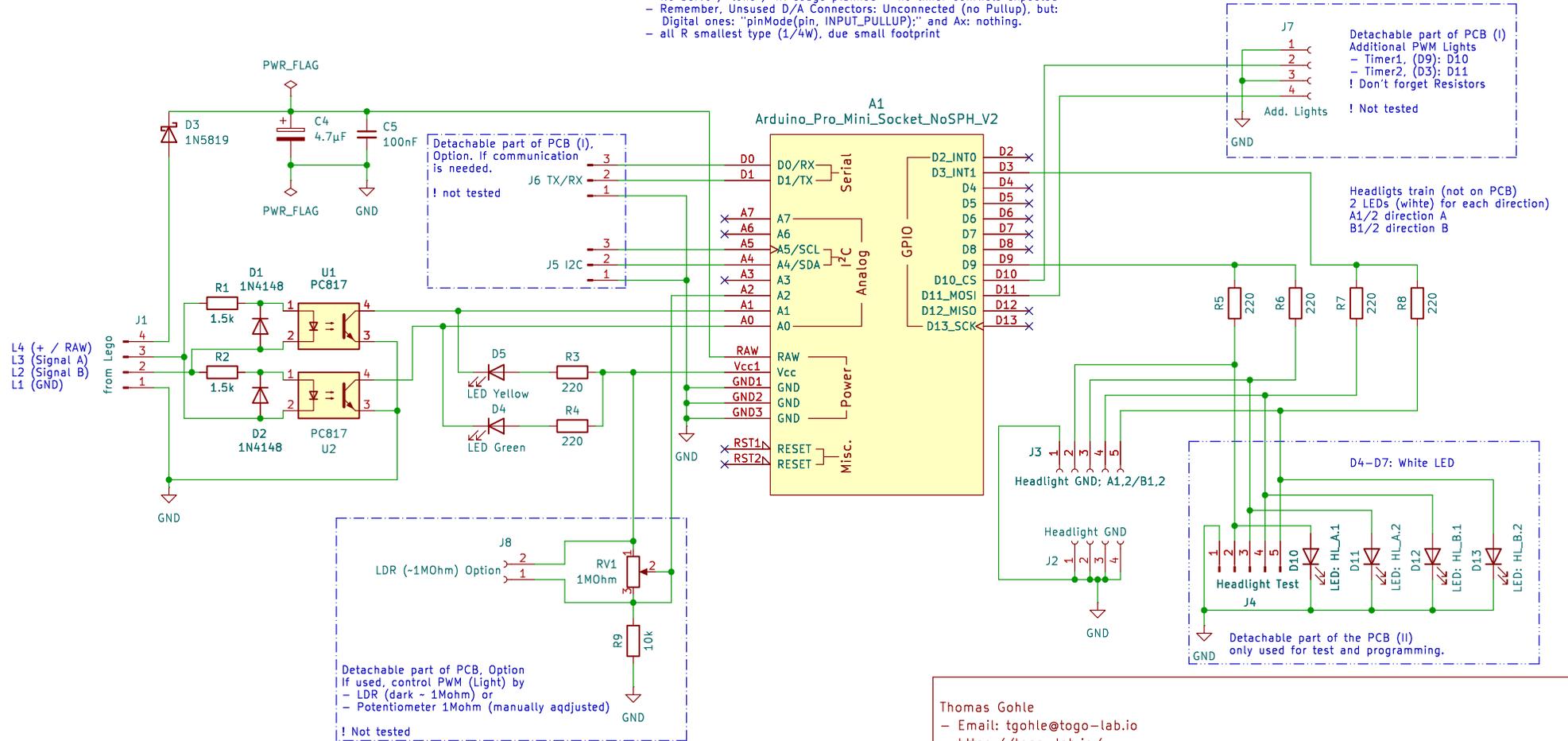PWM LED drive - Arduino Pro Mini (ATmega328P)
- PWM pins used: D3 (Timer2, 8-bit) and D9 (Timer1, 16-bit)
- Control via analogWrite() → 0-255 on both timers (no practical difference for LEDs)
- Each PWM pin drives 2× white LEDs in parallel, each LED with its own 220 Ω resistor
- Approx. current per LED ≈ 7-8 mA, per pin ≈ 15 mA → safe for MCU
- D0/D1 (TX/RX) free for later communication
- Timer0 untouched → millis()/delay() unaffected
- No Servo / tone / IR usage planned → no timer conflicts expected
- Remember, Unused D/A Connectors: Unconnected (no Pullup), but:
   Digital ones: "pinMode(pin, INPUT_PULLUP);" and Ax: nothing.
- all R smallest type (1/4W), due small footprint

PWR_FLAG
C4 4.7μF
C5 100nF
PWR_FLAG
GND

D3 1N5819

J7
1
2
3
4
GND
Add. Lights

Detachable part of PCB (I)
Additional PWM Lights
- Timer1, (D9): D10
- Timer2, (D3): D11
! Don't forget Resistors
! Not tested

A1
Arduino_Pro_Mini_Socket_NoSPH_V2

Detachable part of PCB (I),
Option. If communication
is needed.
! not tested

J6 TX/RX
3
2
1

D0
D1

D0/RX
D1/TX
Serial

D2_INT0   D2
D3_INT1   D3
D4   D4
D5   D5
D6   D6
D7   D7
D8   D8
D9   D9
D10_CS   D10
D11_MOSI   D11
D12_MISO   D12
D13_SCK   D13

GPIO

Headligts train (not on PCB)
2 LEDs (white) for each direction)
A1/2 direction A
B1/2 direction B

A7
A6
A5/SCL
A4/SDA
A3
A2
A1
A0
Analog

J5 I2C
3
2
1
A5
A4

RAW   RAW
Vcc1   Vcc
GND1   GND
GND2   GND
GND3   GND
Power

RST1   RESET
RST2   RESET
Misc.

D1 1N4148
R1 1.5k
U1 PC817

R2 1.5k
D2 1N4148
U2 PC817

J1
4 L4 (+ / RAW)
3 L3 (Signal A)
2 L2 (Signal B)
1 L1 (GND)
from Lego

GND

D5
LED Yellow
R3 220
D4
LED Green
R4 220

GND

R5 220
R6 220
R7 220
R8 220

J3
1 2 3 4 5
Headlight GND; A1,2/B1,2

Headlight GND

J2
1 2 3 4
GND

D4-D7: White LED

J8
2
1
LDR (~1MOhm) Option
RV1 1MOhm
2
3

R9 10k
GND

Detachable part of PCB, Option
If used, control PWM (Light) by
- LDR (dark ~ 1Mohm) or
- Potentiometer 1Mohm (manually aqdjusted)

! Not tested

D10 LED: HLA.1
D11 LED: HLA.2
D12 LED: HLB.1
D13 LED: HLB.2

Headlight Test
J4
1 2 3 4 5
GND

Detachable part of the PCB (II)
only used for test and programming.

Thomas Gohle
- Email: tgohle@togo-lab.io
- https://togo-lab.io/
ToGo-Lab

Sheet: /
File: 0004-DenshaBekutoru_v0.2.kicad_sch
Title: DenshaBekutoru 電車ベクトル (Train Vector)
Size: A4
Date: 2026-03-08
Rev: #005 1st bld.
KiCad E.D.A. 8.0.9
Id: 1/1