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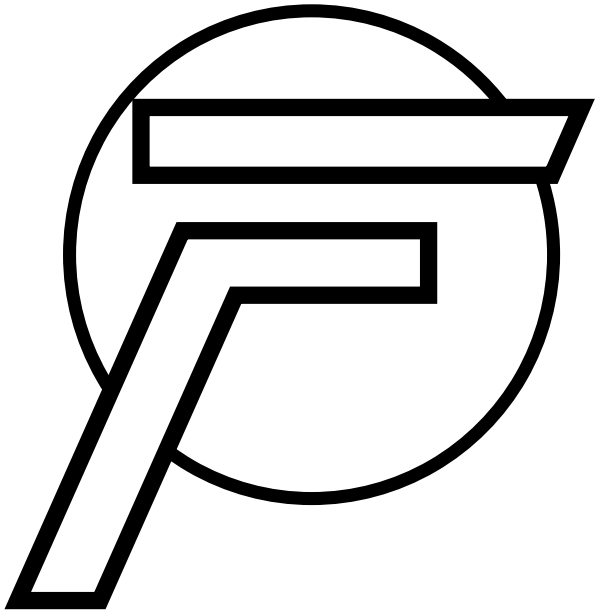

FLUGLICHT

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Titel:
"Vortrag/Demo Fluglicht - ein fliegendes Exoskelett"

Text:
"
Tags: open hardware Exoskelett, Arduino, Hardware als Gamecontroller, Funkfernbedienung hacken, Modellflugzeug modding/Selbstbau, Zukunft des Fliegens

Wie baut man eigentlich ein Exoskelett? Und wie kann man damit fliegen wie ein Vogel? Solche und andere Fragen beantworten wir heute abend. Dabei zeigen wir unser selbst gebautes Exoskelett, und wie man damit diverse Sachen steuern kann. Unter anderem ein selbst gebautes Modellflugzeug, das mit den Flügeln schlagen kann und per (gehackter) Funkfernbedienung mit dem Exoskelett gekoppelt ist. Wir zeigen, wie die Funkbrücke funktioniert und unser (to be) open hardware Exoskelett nachgebaut und mit dem Computer verknüpft werden kann (for the lolz!). Und zum Schluss gibts noch nen kurzen Abriss über die Zukunft des Fliegens, wie wir sie sehen."

- Kurzes Intro wer wir sind und was mir vor haben (Zukunft des Fliegens hier schon)
- Exoskelette
- Das exoskelett, wie es aufgebaut ist, wie wir es gefertigt haben
- Flieger, konzept, Steuerung
- Interfaces (Serial, HID, TrainerSocket, PPM, iBus)
- Das vollständige System
- Exoskelett und Computer (4-way ultimate Pong)
- where to get the stuffs (links zum code und zu den Blueprints)
- useful links, kontakt (unsere website, rc-groups)

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Our goal: a flying exoskeleton

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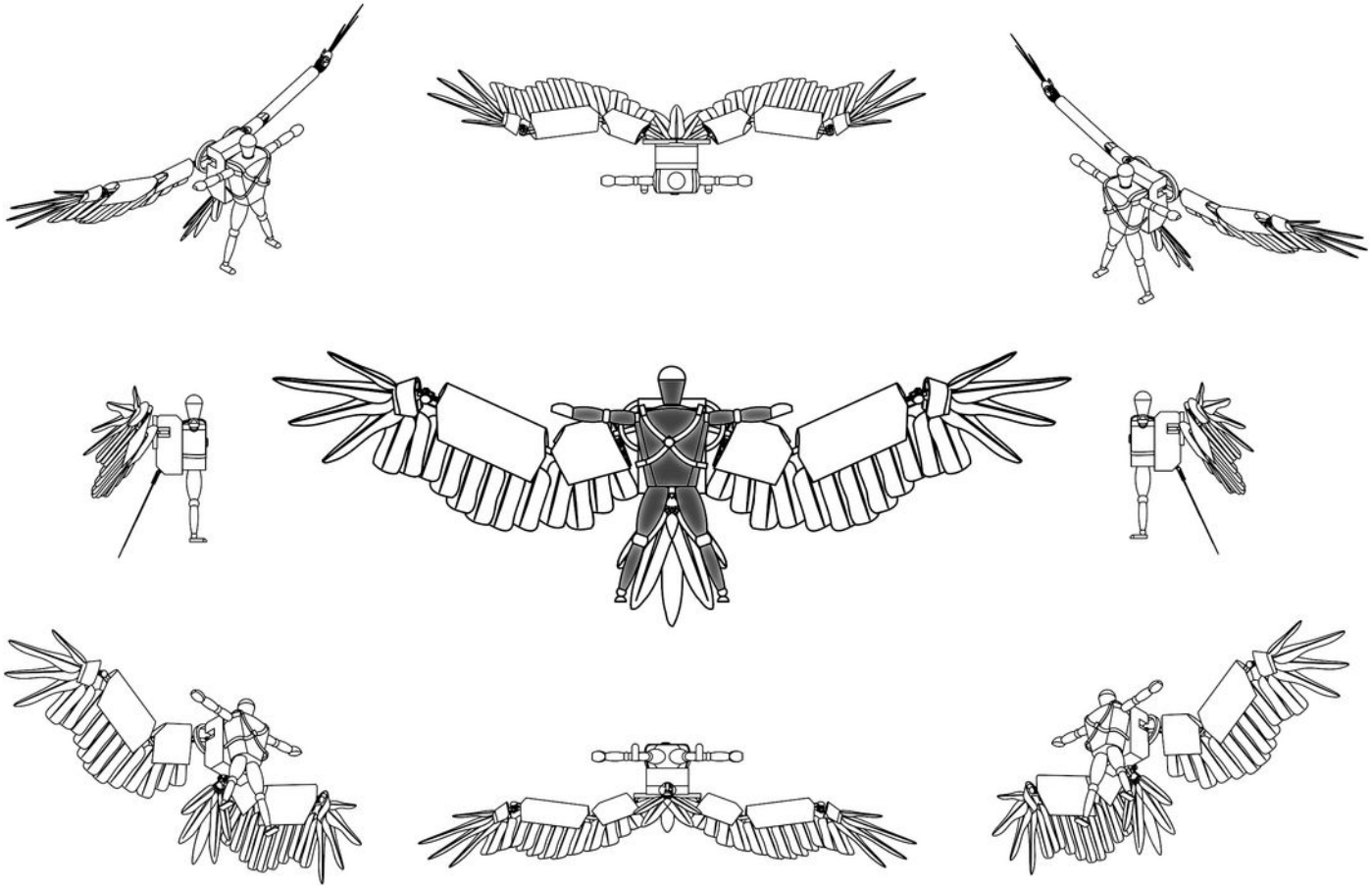

The concept involves an exoskeleton for the arms and ankles, as well as a pair of robotic birdwings. The wings are coupled to the arms electronically via a force-feedback system.

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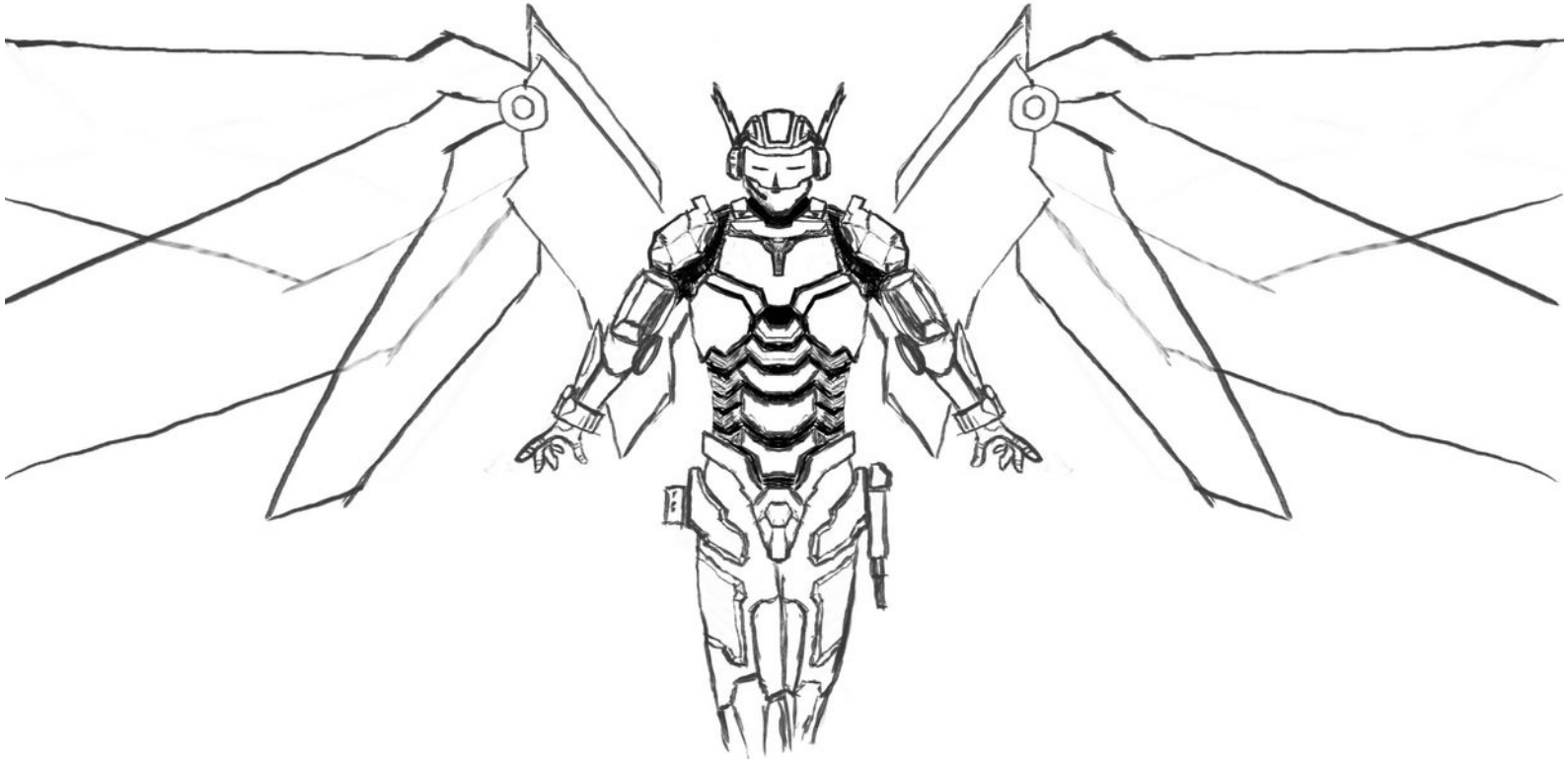

The wings follow the movement of the arms and, via the force-feedback, it is possible to feel the air-forces at the arms. Consequently one can beat the arms and the wings also beat, which allows one to fly. Further detail can be found for instance in the patent (e.g. PCT/DE2019/000101).

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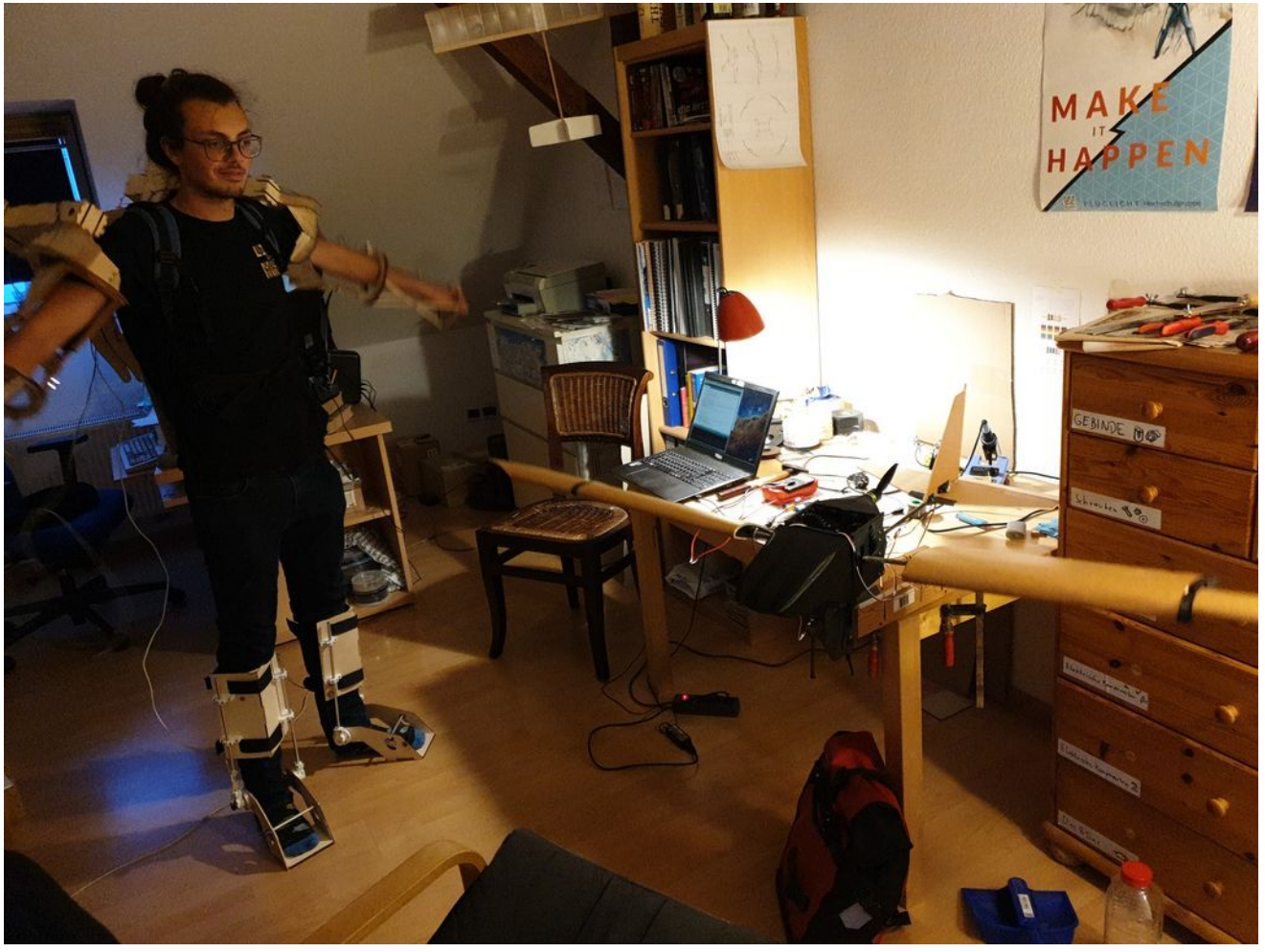

Current Status

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One functional exoskeleton prototype.

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One model/rc-airplane that can beat its wings. Can be flown with first-person view using the exoskeleton.

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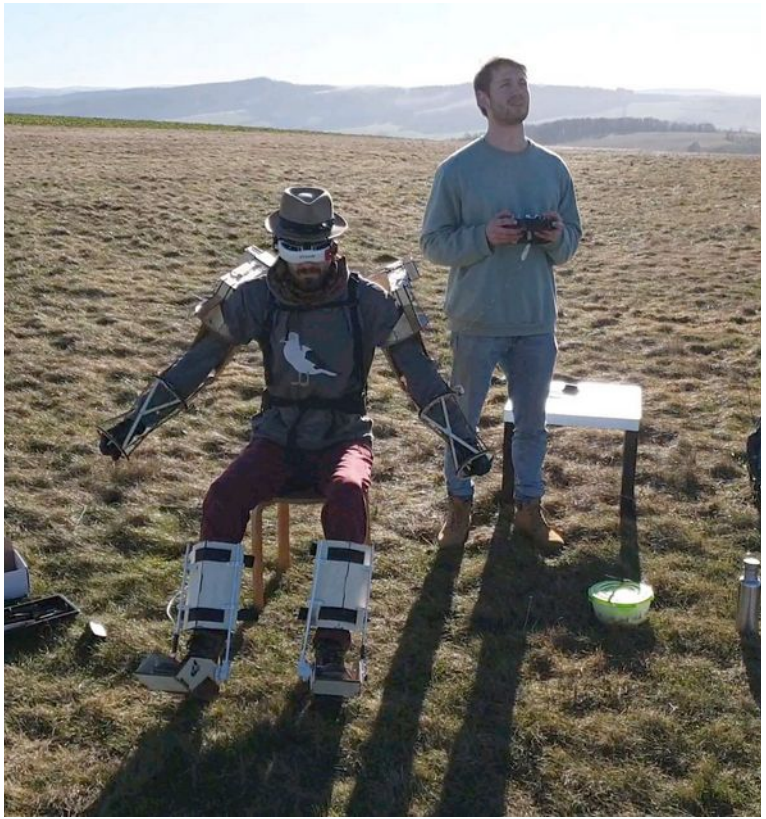

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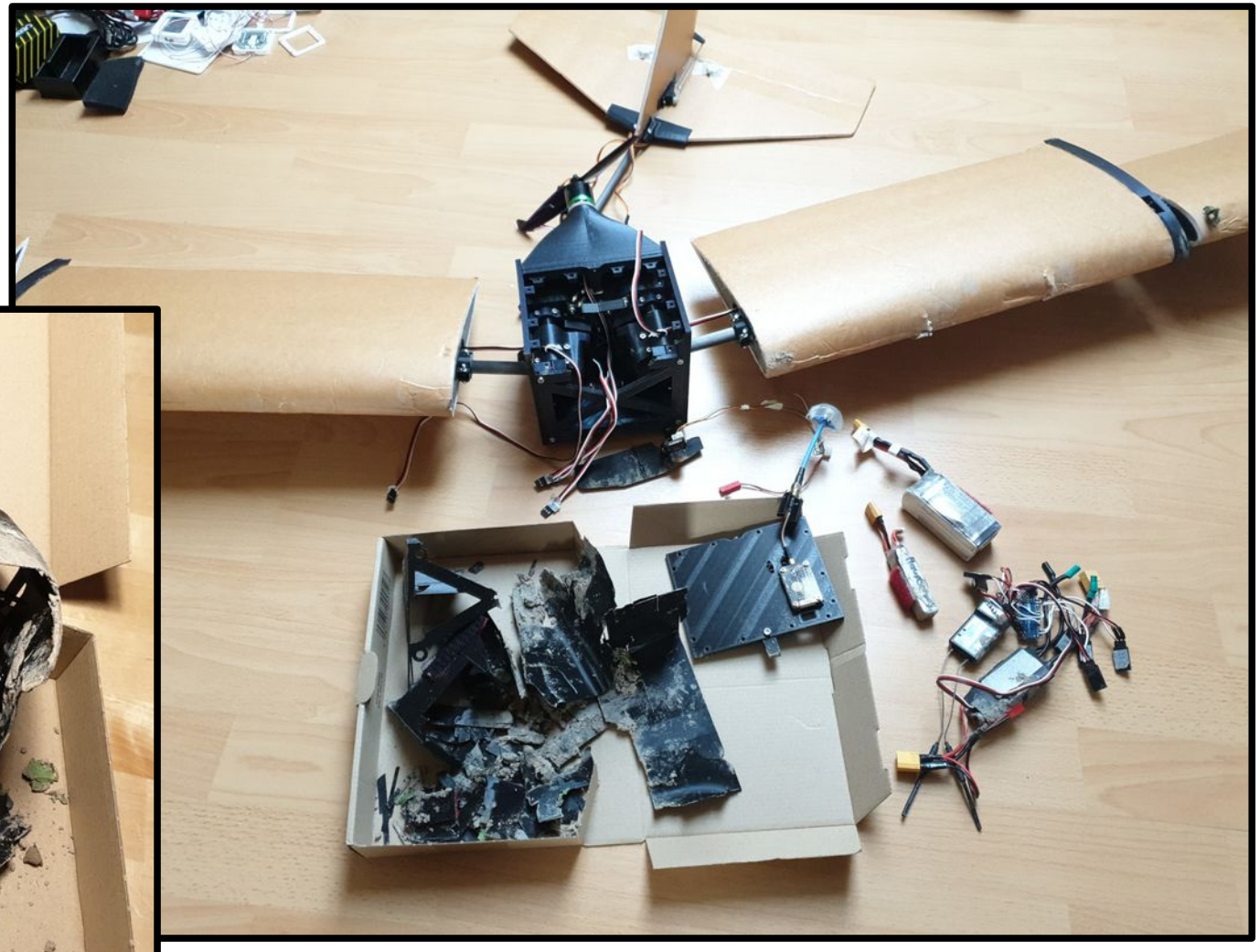

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The Future

1) Rebuild
2) Try again
3) Build it bigger
4) ...
5) Profit!

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Anyways… How does this system work?

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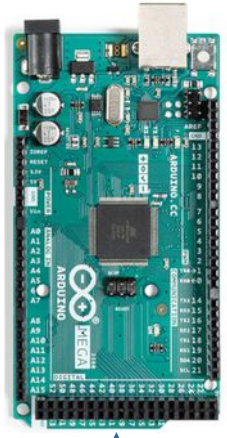
Arduino Mega 2560
(*not to scale)



PPM

Trainer
Port

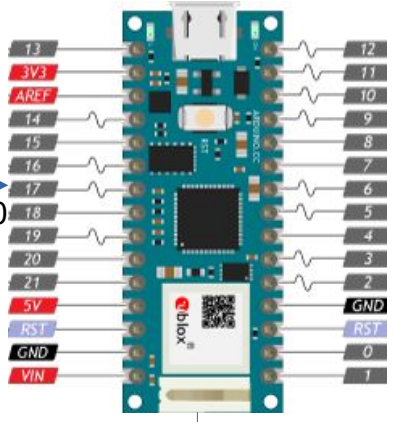
Flysky FS-i6X Transmitter
with OpenTX mod
(*not quite to scale)

Flysky FS-IA6B
Receiver
(*almost to scale)

iBus

sercom 0

Arduino Nano 33 IoT
(*certainly to scale!)



measuring Potis and
Rotary Encoders

to servos

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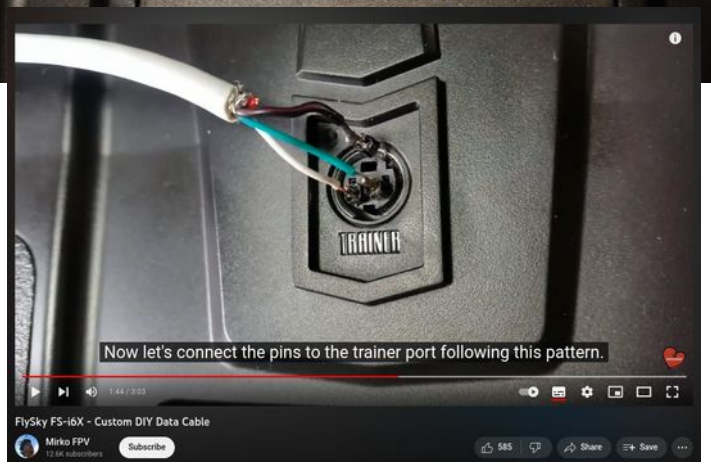
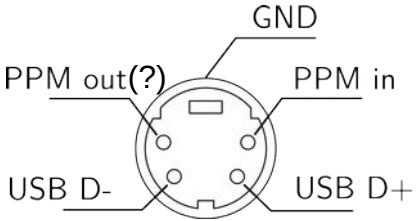
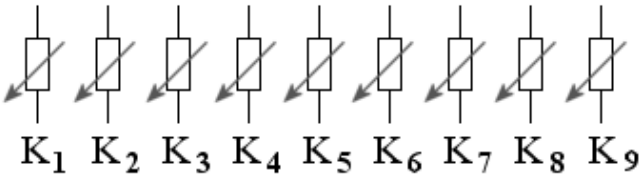
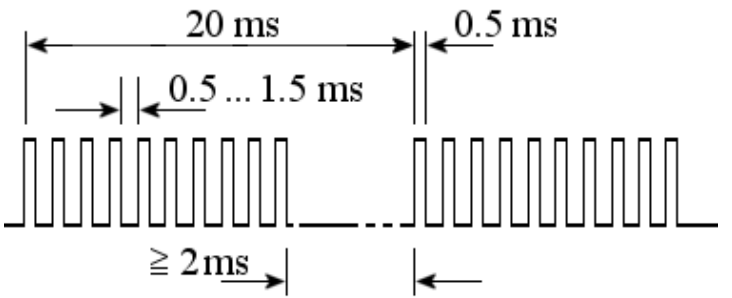


Trainer Port: Mini-DIN 4 plug



PPM: Pulse Position/Pause Modulation





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Feature	FlySky i6X	OpenTX i6X
Channels	6/10	16
Mixers	3	32
Models	20	16 / unlimited[1]
Protocols	AFHDS, AFHDS2A, PPM	AFHDS2A, PPM, CRSF
Trainer	PPM	SBUS, PPM
Logical switches	_	✓
Global variables	_	✓
Timers	_	✓
Voice annoucements	_	✓[2]
Use trims as buttons	_	✓
ExpressLRS ready	_	✓
Telemetry mirror	_	✓

Better Firmware:
https://github.com/OpenI6X/opentx

PPM on Arduino:
https://github.com/schinken/PPMEncoder

BUT: FlySky vanilla firmware PPM deviates from the PPMEncoder timings!

Flysky i6X OEM firmware:	PPMEncoder standard:
20 ms frame	22.5 ms frame
400 µs pulse width	500 µs pulse width

→ config in: ~/Arduino/libraries/PPMEncoder/PPMEncoder.h!

see also: https://www.rcgroups.com/forums/showthread.php?3792327-Controlling-Flysky-FS-I6X-with-an-arduino-via-trainer-port

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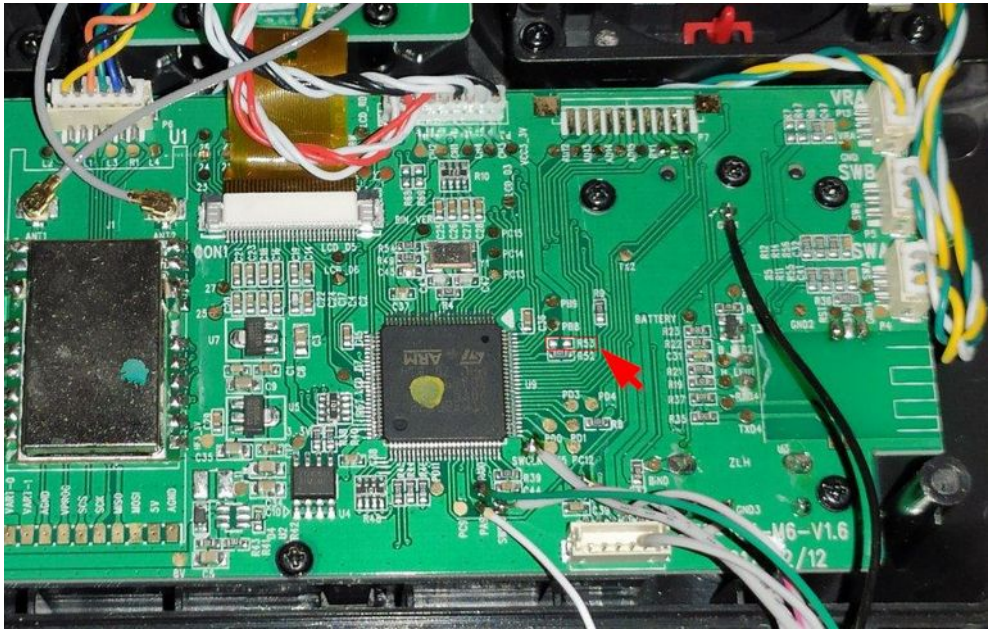
Flashing the Transmitter



Model Setup Navigation:

Prime Source: https://github.com/OpenI6X/opentx

See also: https://github.com/open-flysky/opentx

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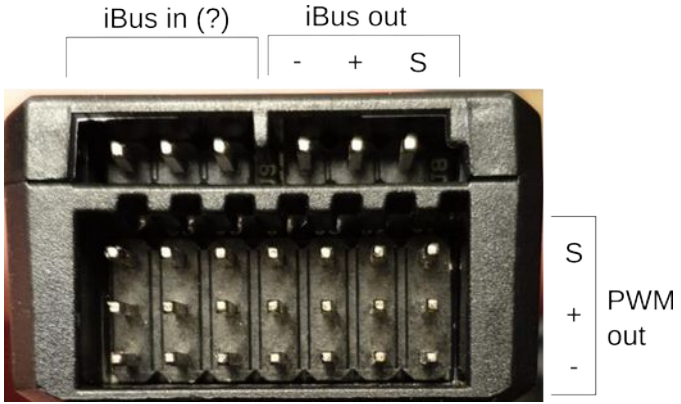
Receiver Readout



Flyskys iBus:

- Serial protocol
- Usable on Arduino with library
  - https://gitlab.com/timwilkinson/FlySkyIBus
- BUT: needs modificaton for Nano 33 IoT, because of SAMD architecture/sercom...

→ Uart iBusSerial (&sercom0, 6, 7, SERCOM_RX_PAD_0, UART_TX_PAD_2)

```
/*
  Define Serial Interface for IBus input.
  definition: Uart Name (SERCOM *_s, uint8_t _pinRX, uint8_t _pinTX, SercomRXPad _padRX, SercomUartTXPad _padTX);
  sauce: https://github.com/arduino/ArduinoCore-samd/blob/master/cores/arduino/Uart.h
  Possible values for SERCOM_RX_PAD_.. and UART_TX_PAD..,
  s.:https://github.com/arduino/ArduinoCore-samd/blob/master/cores/arduino/SERCOM.h

  see also: https://github.com/ostaquet/Arduino-Nano-33-IoT-Ultimate-Guide
  and: https://docs.arduino.cc/tutorials/communication/SamdSercom
  and: https://github.com/arduino/ArduinoCore-samd/blob/master/variants/nano_33_iot/variant.cpp
*/
```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Weeks of soldering (and removing solder and resoldering) later...

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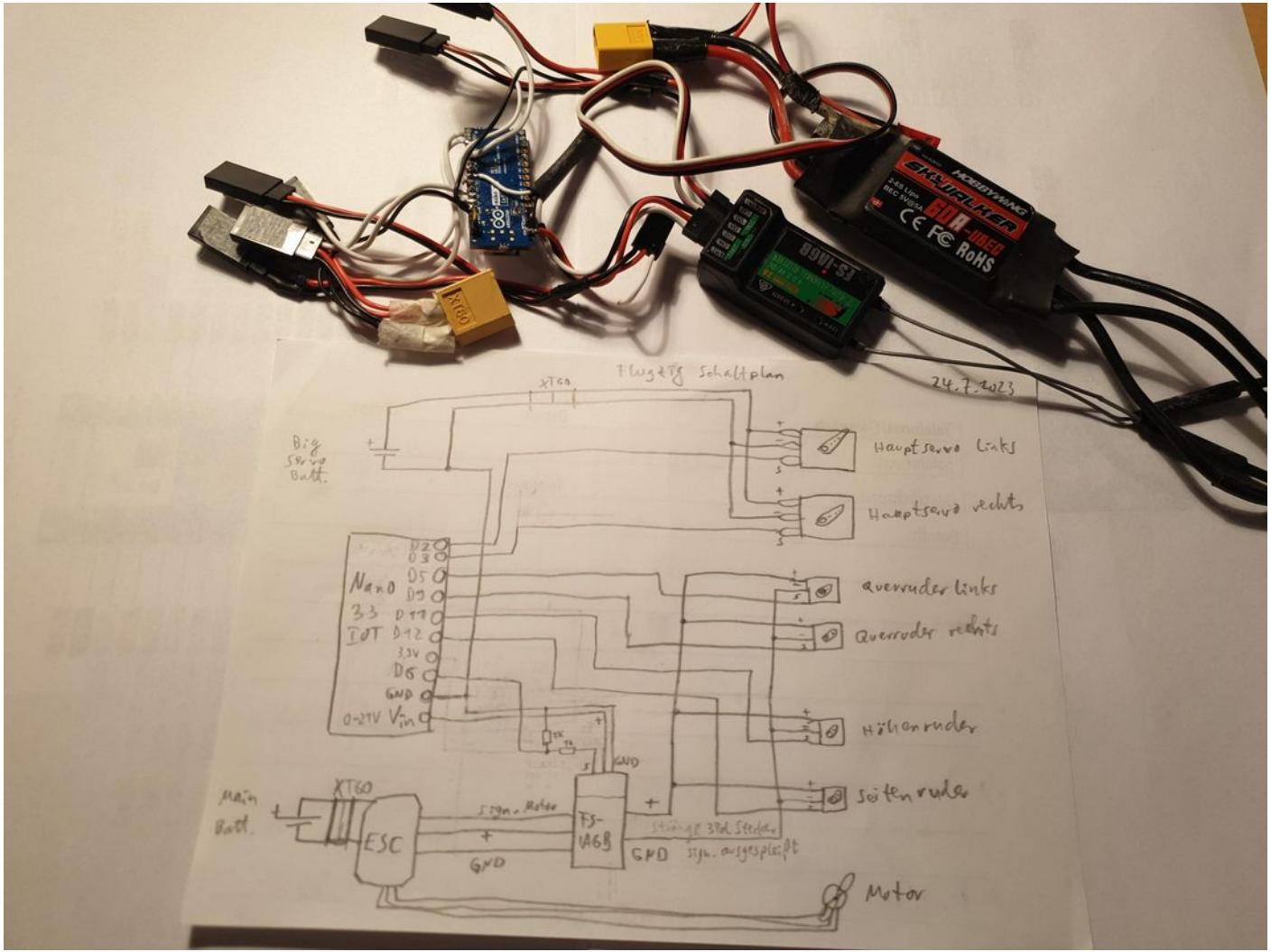

image credit: Andy Walsh
https://www.behance.net/gallery/67708801/Cthulhu-Rises/modules/395893039

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It works!

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Nice! what else can we do with this?

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Games!

(Try it later!)

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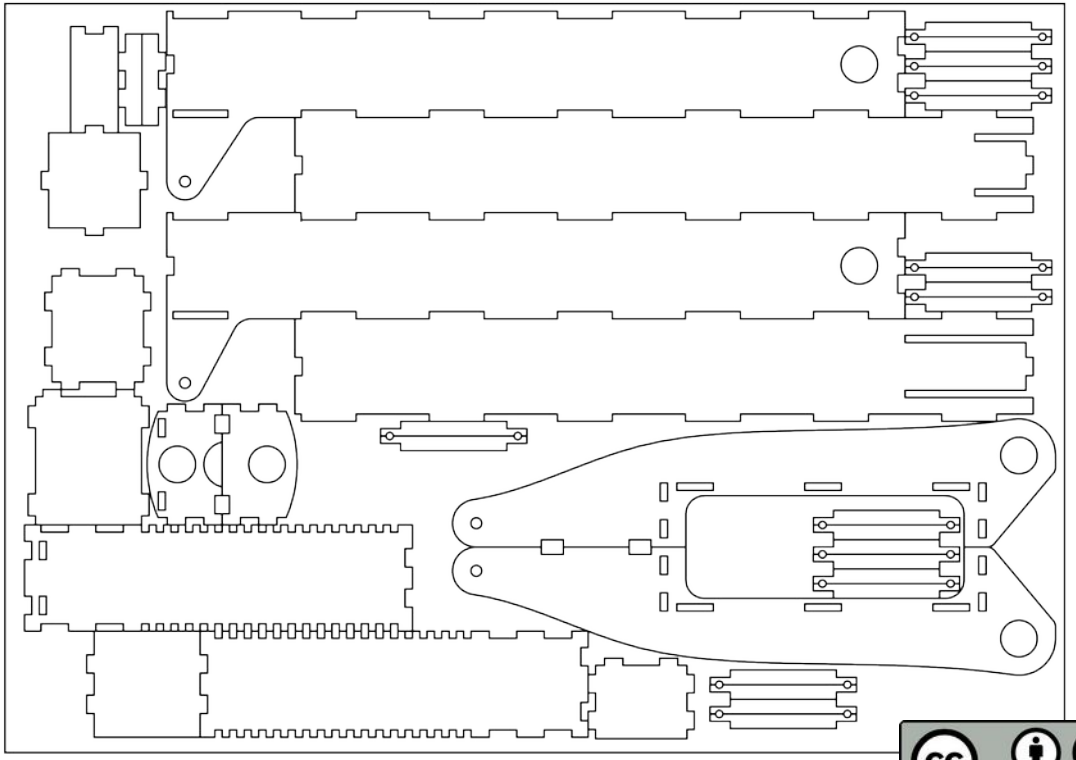
Open Source rulez!

Let’s give something back.

→ Make the Exo open hardware!

- The blueprints etc. will be shared under a CC 4.0 BY-SA licence.
- Arduino and python code will be shared with LGPL

(in the works… will be hosted on www.fluglicht.com and github)



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Contact

Peter Jüstel
Fluglicht Project Lead

https://www.fluglicht.com

Source: Alex Iby on Unsplash

Let’s go! Make it happen!

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