

This is still an ongoing project

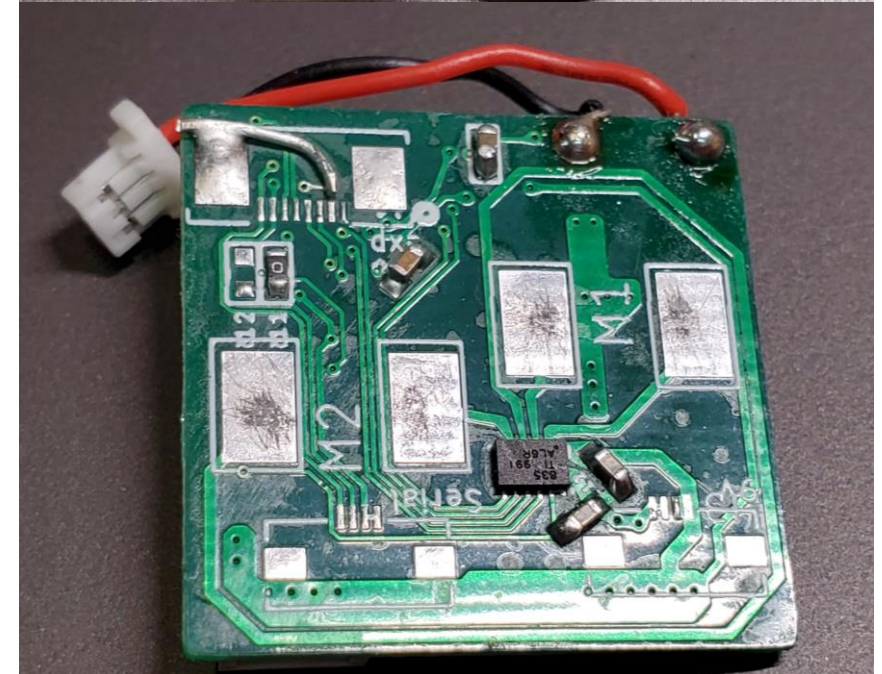
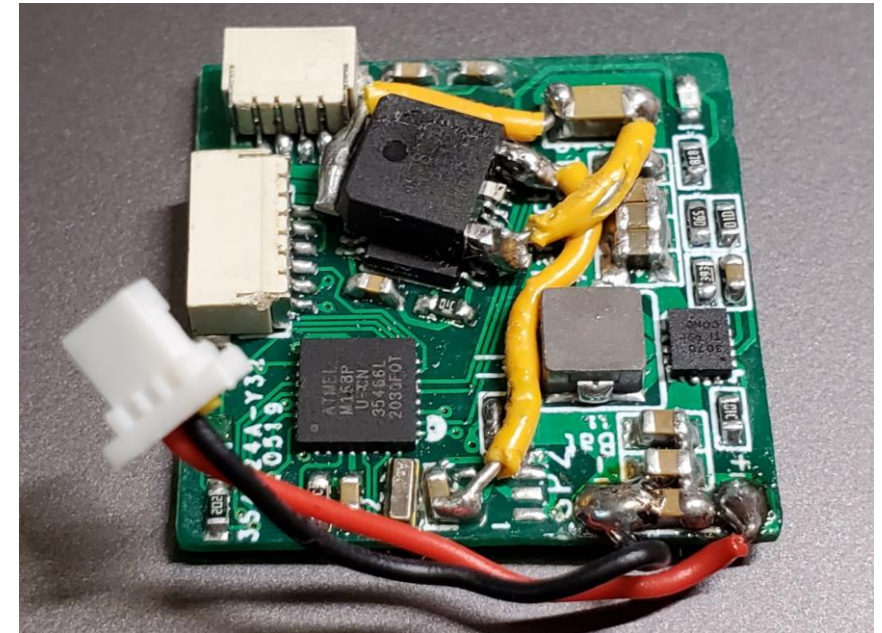
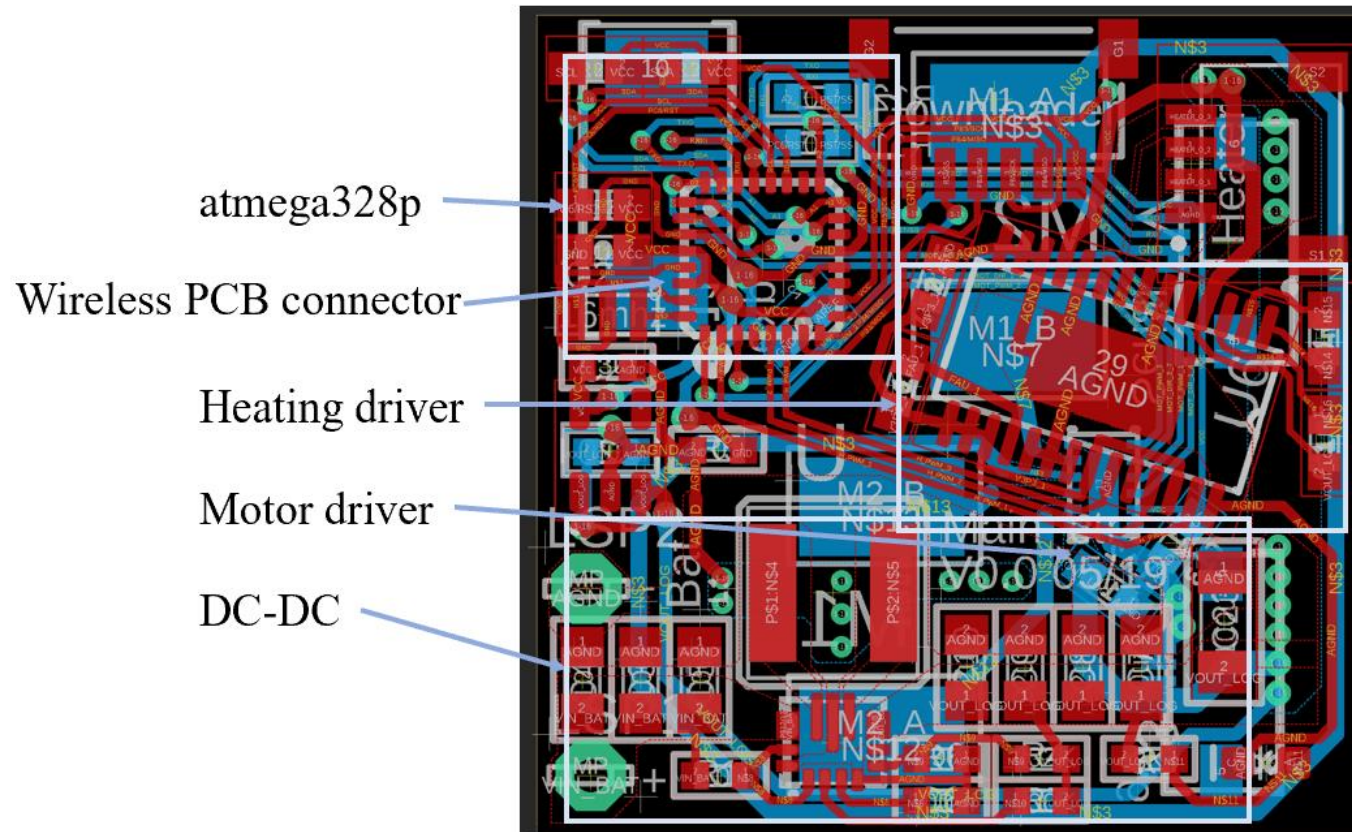
Controller PCB

ATmega 168/328

DRV8313 for heating element

DRV8835 for motor driver

DC-DC buck-boost convertor

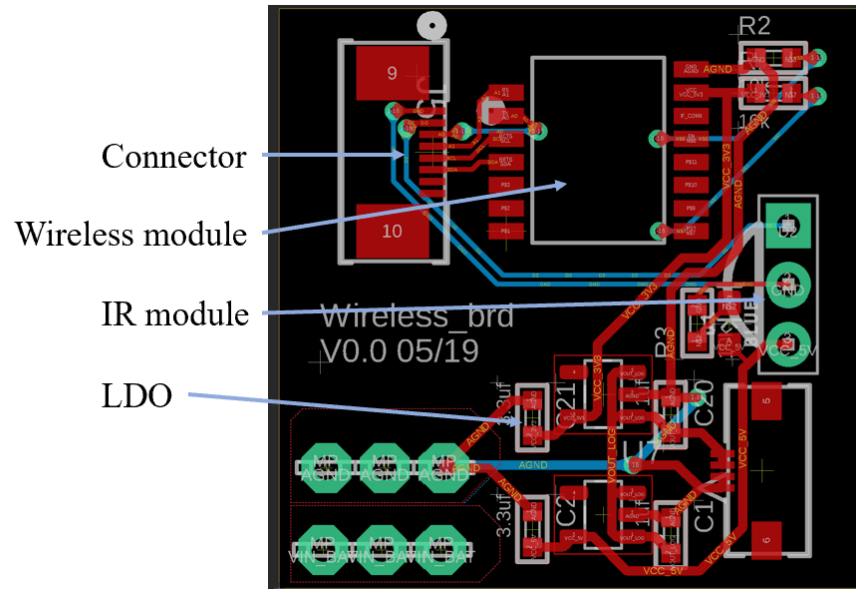


Moving block prototype

Wireless PCB

IR/Bluetooth

Combine with main controller PCB in next design



Battery

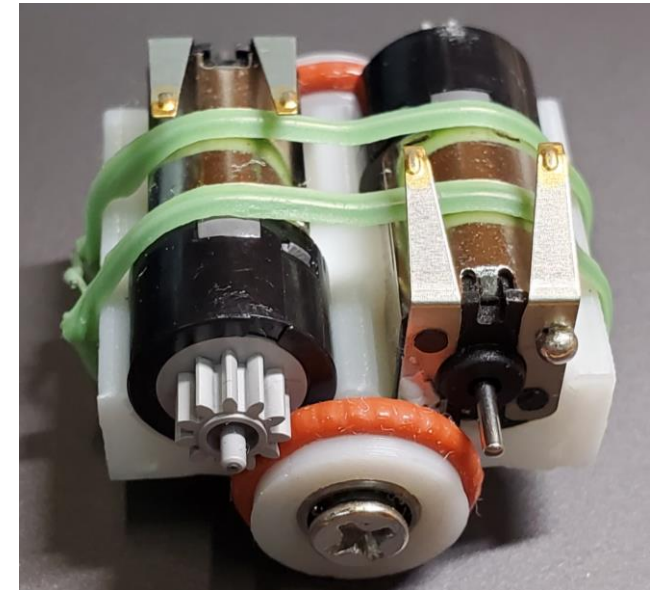
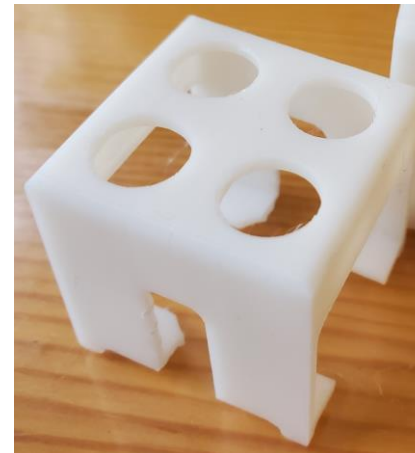
3.7V 300/700mah



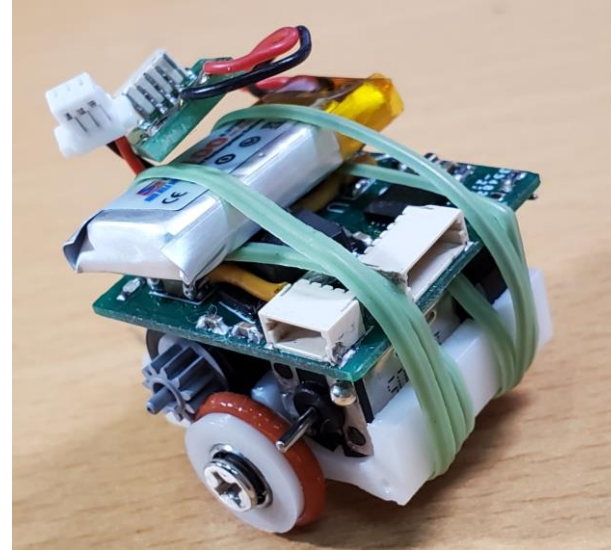
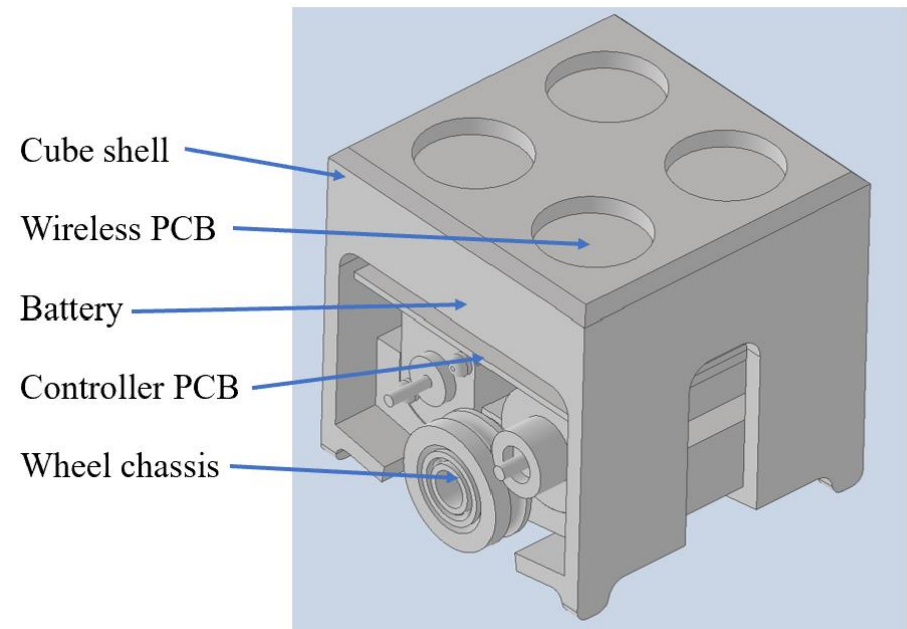
Cube shell/Chassis

Connection magnetics

Connection to soft part



Assembled block prototype



With 100mah battery



With 700mah battery

Wireless communication

Zigbee module cc2530

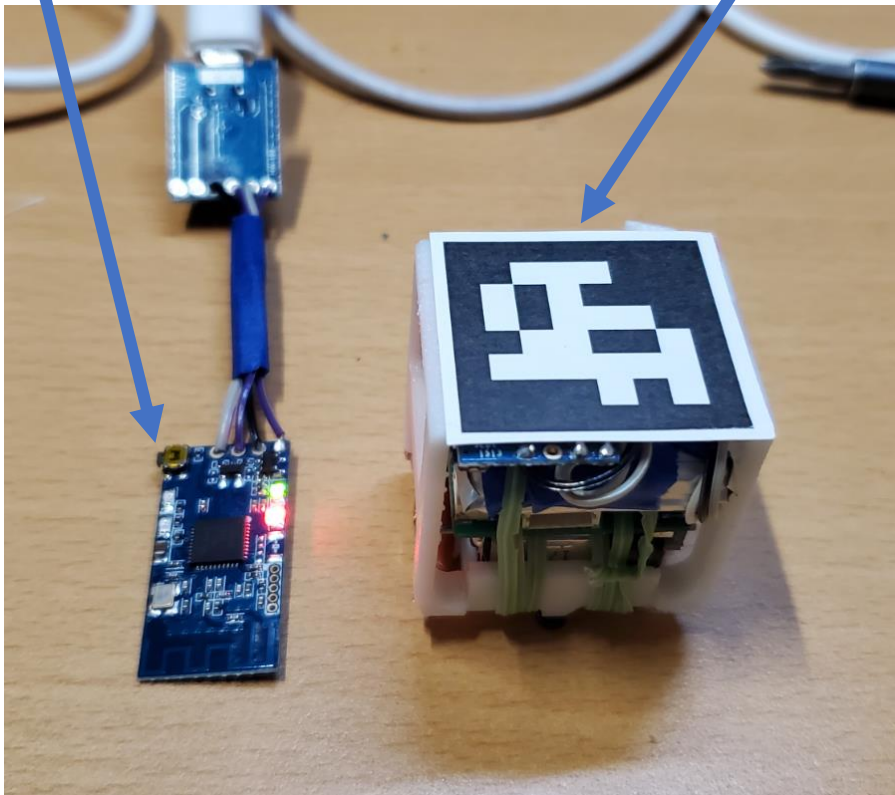
Transparent virtual serial, max distance 800m

16 channels

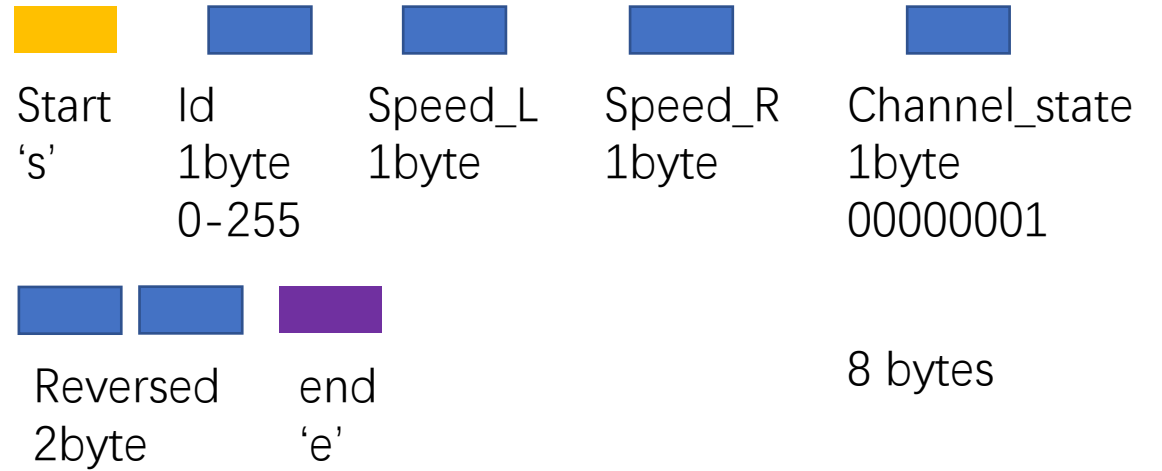
Point to point/broadcast

Computer node

Moving block



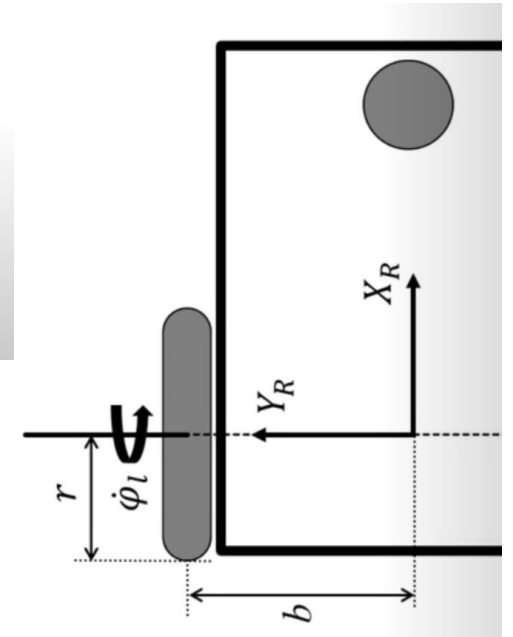
Command format



Wheel ik

Inverse differential kinematics

$$\begin{bmatrix} \dot{\phi}_r \\ \dot{\phi}_l \end{bmatrix} = \begin{bmatrix} 1/r & 0 & b/r \\ 1/r & 0 & -b/r \end{bmatrix} \begin{bmatrix} \dot{x} \\ \dot{y} \\ \dot{\theta} \end{bmatrix}$$



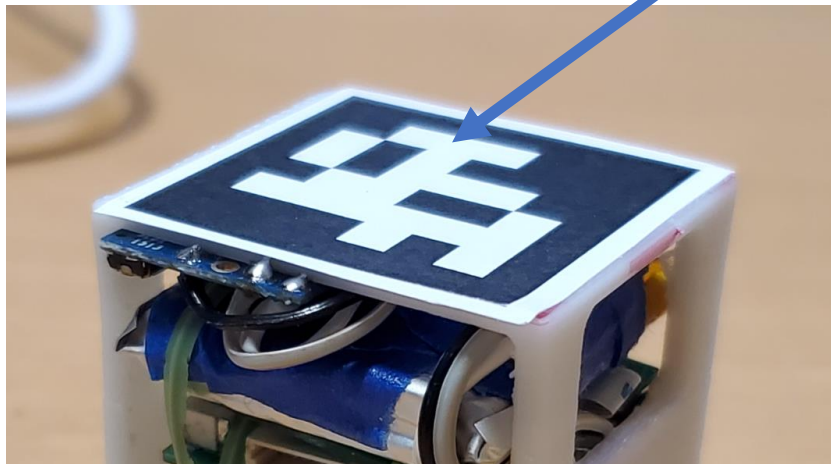
Cube tracking

Using apriltag for pose tracking

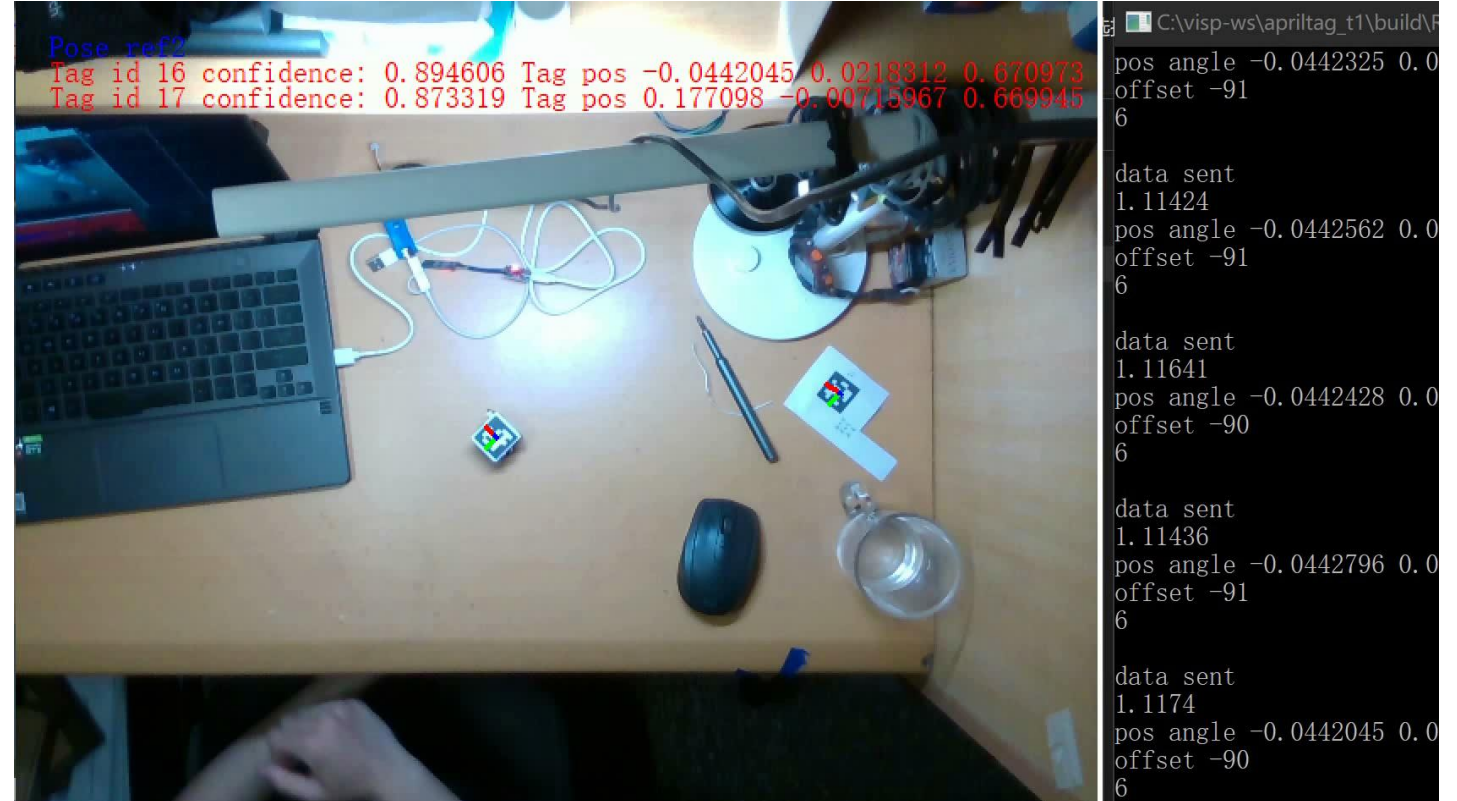


Tracking camera

Tag on cube



Get pose estimated xyz/rpy xy-yaw



~60ms for 20 tags

Lighting condition

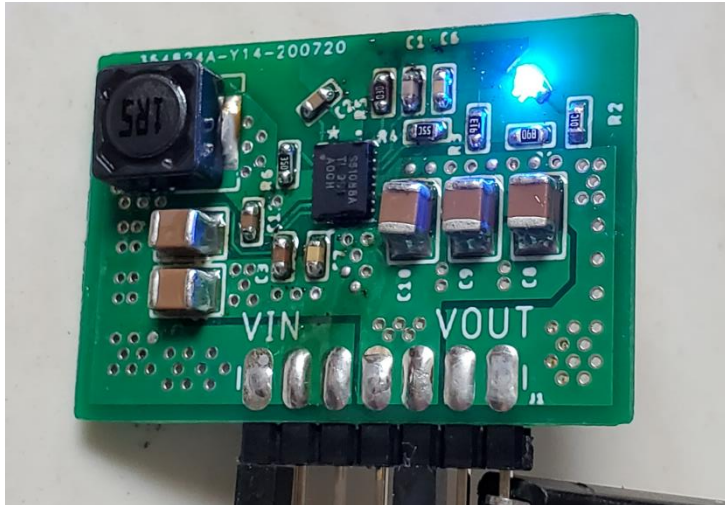
Small tags -> unstable rotation matrix estimated

Gen2 controller

DC-DC TPS63070->TPS61088

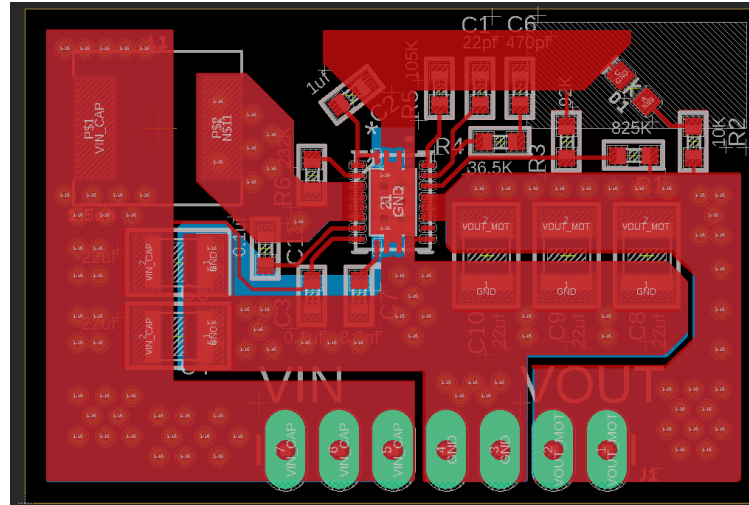
1 Features

- Input Voltage Range: 2.0 V to 16 V
- Output Voltage Range: 2.5 V to 9 V
- Up to 95% Efficiency
- +/- 1% dc accuracy in PWM mode
- +3% / -1% dc accuracy in PFM mode
- 2 A Output Current in Buck Mode
- 2 A Output Current in Boost Mode

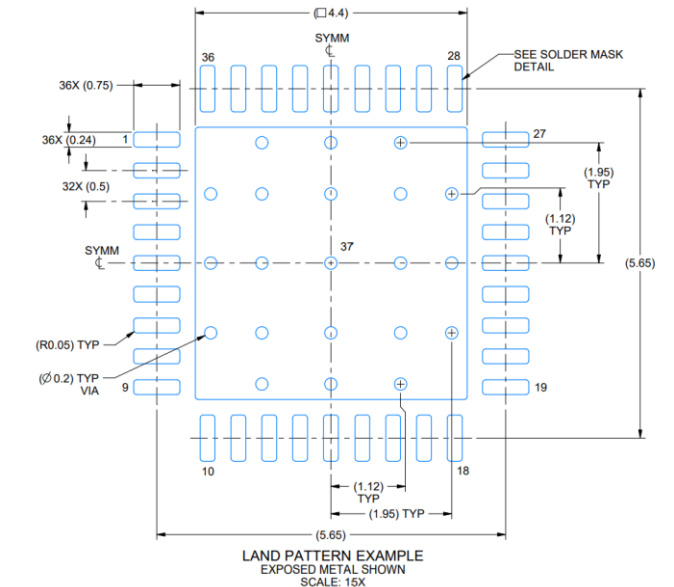
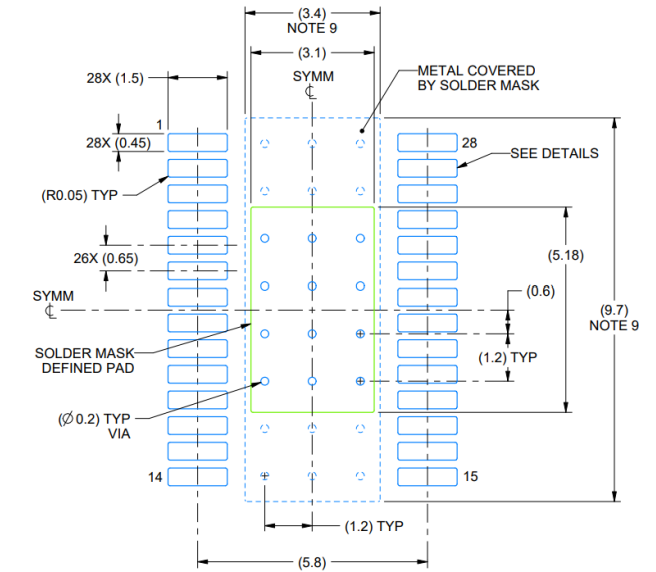


Features

Input Voltage Range: 2.7 to 12 V
Output Voltage Range: 4.5 to 12.6 V
10-A Switch Current
Up to 91% Efficiency at $V_{IN} = 3.3\text{ V}$, $V_{OUT} = 9\text{ V}$,
and $I_{OUT} = 3\text{ A}$



Smaller heater controller in QFN package



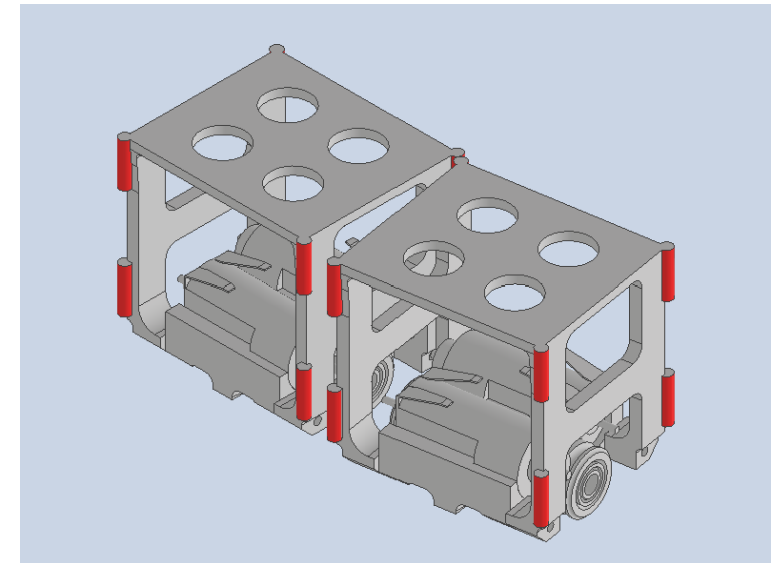
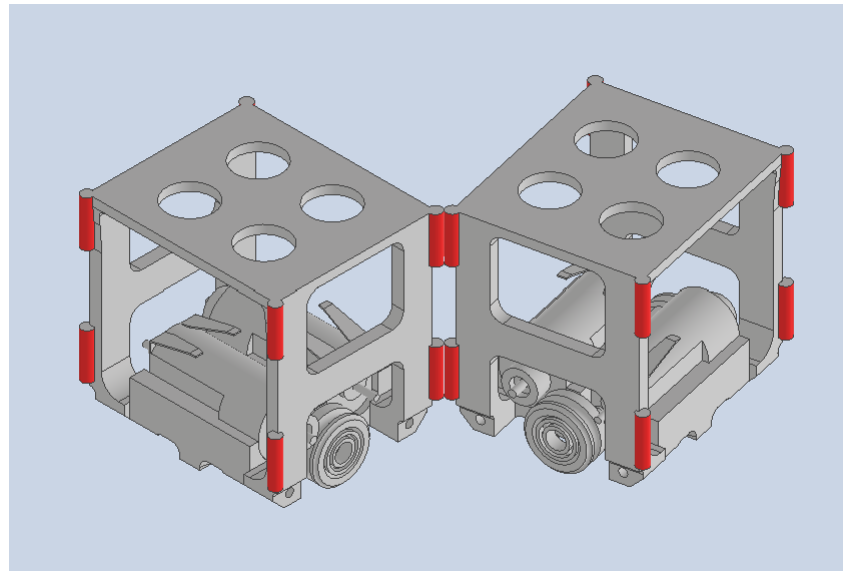
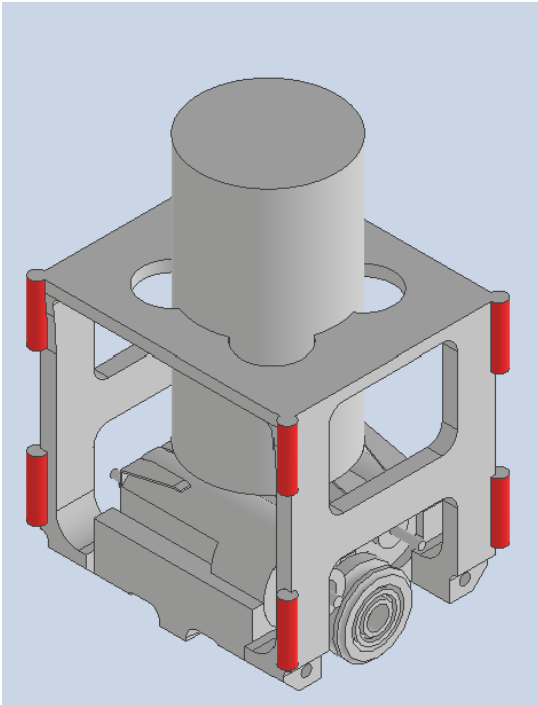
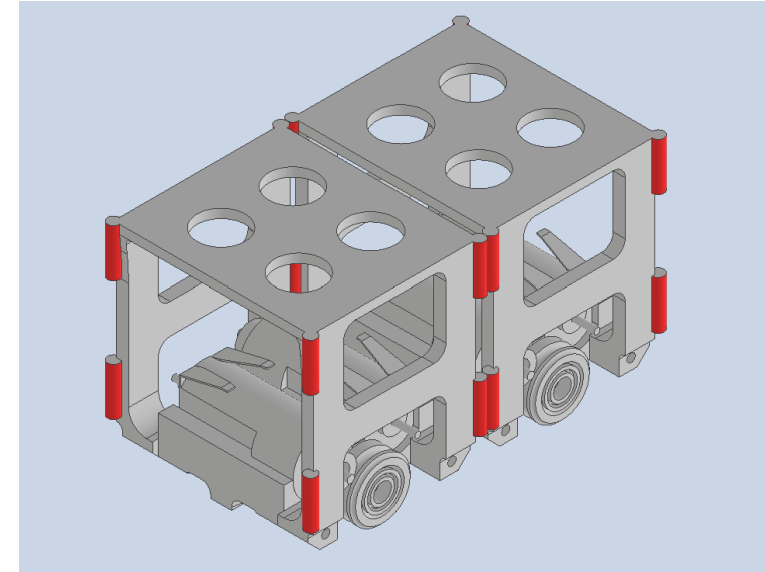
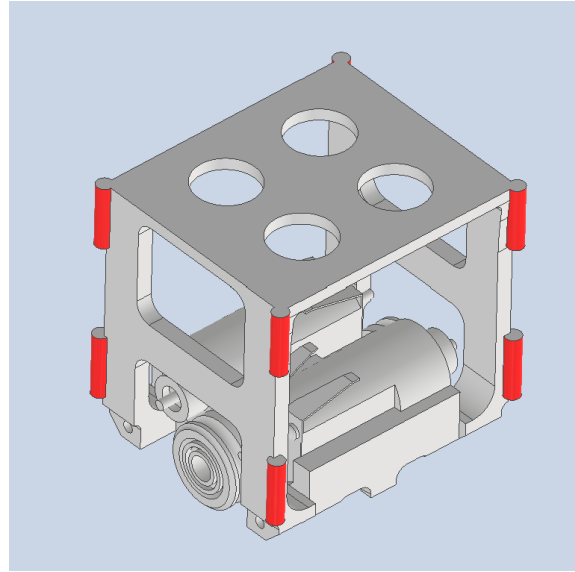
Gen2 controller

Battery 18350 power battery
Easier charging process
High power density 20c -



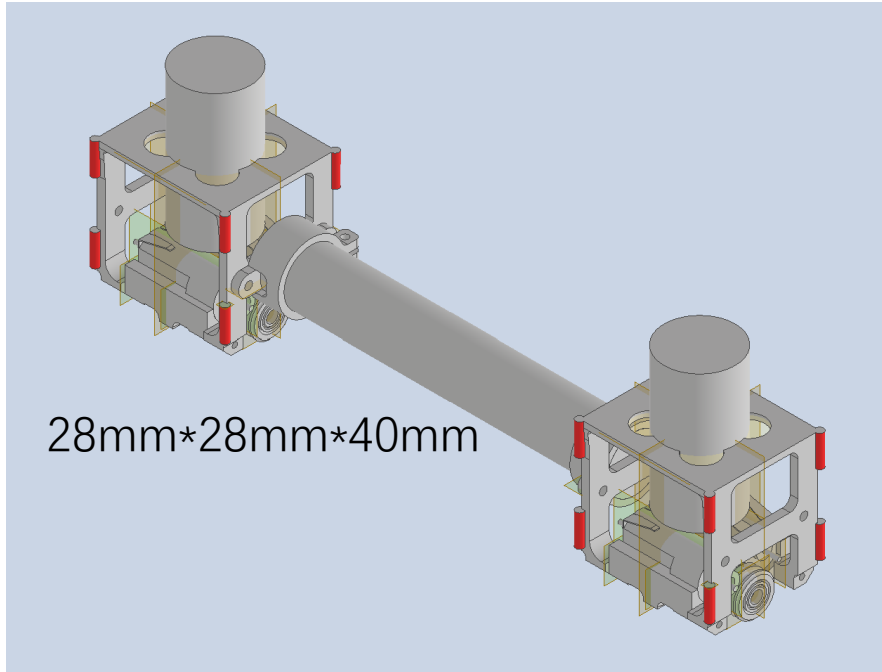
Docking magnet

Cylinder magnet on each side, passive docking



0622-0702

Soft part connector



28mm*28mm*40mm

IIC extendable AD

MCP3424 4channel AD*2

Docking

For permanent magnet, once they've docked with each other, undocking becomes a tough task

Controlled magnet for active docking

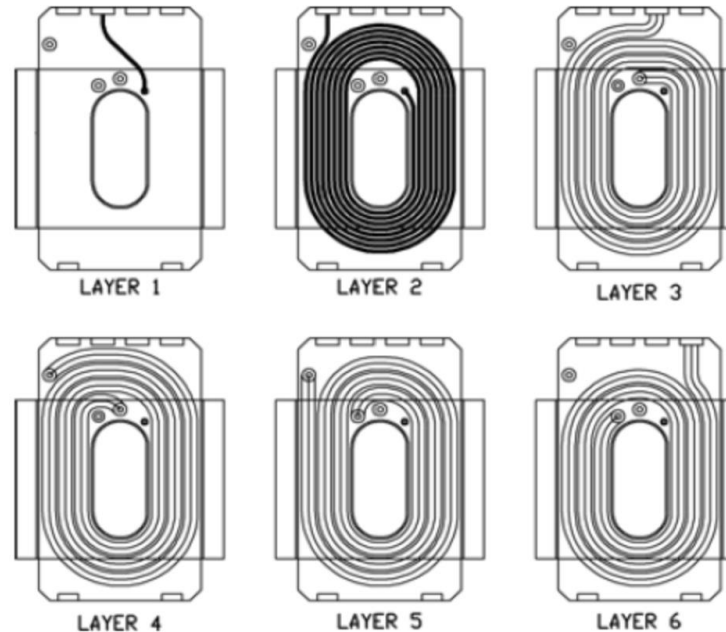
space

power consumption

connection force

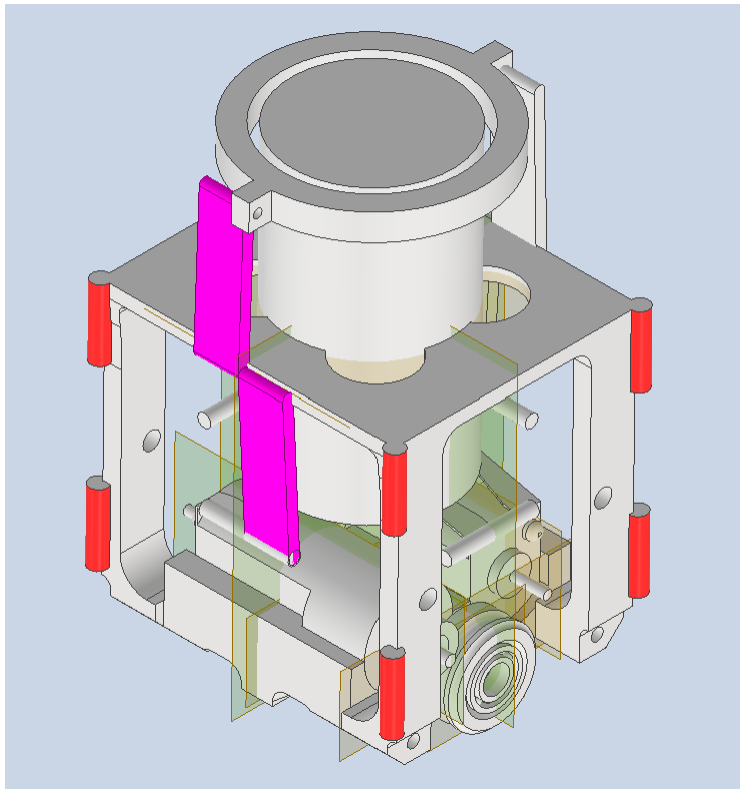
Plan A

eletronic magnet

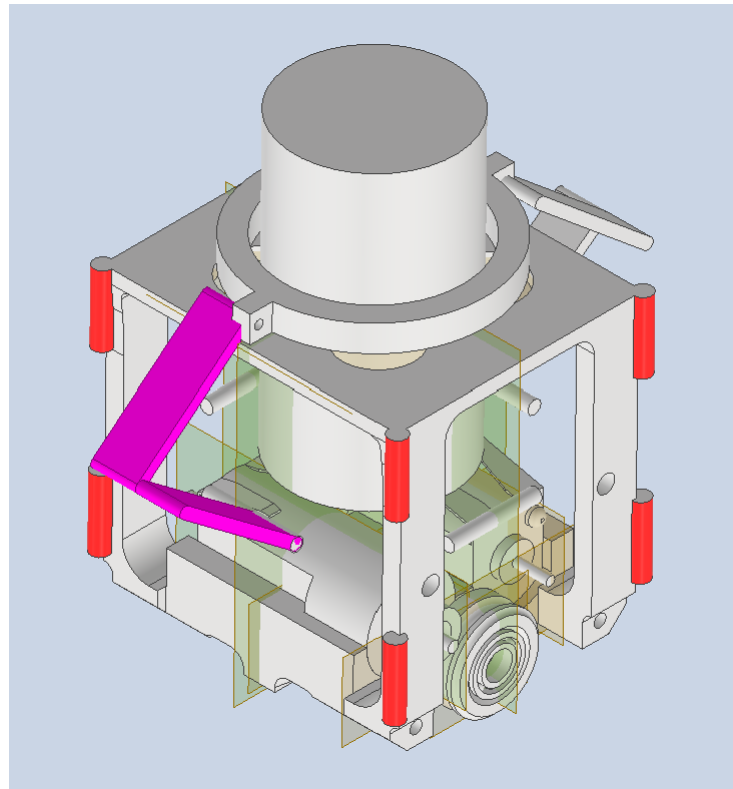


Plan B

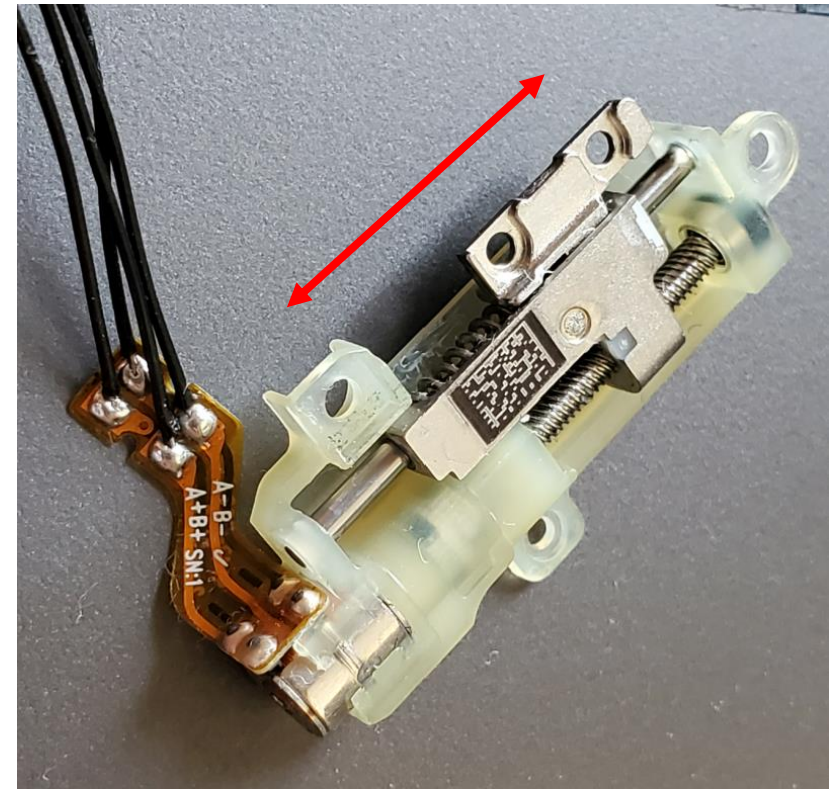
step motor controlled gripper



Fold



Push



Moving block prototype

Controller PCB gen2

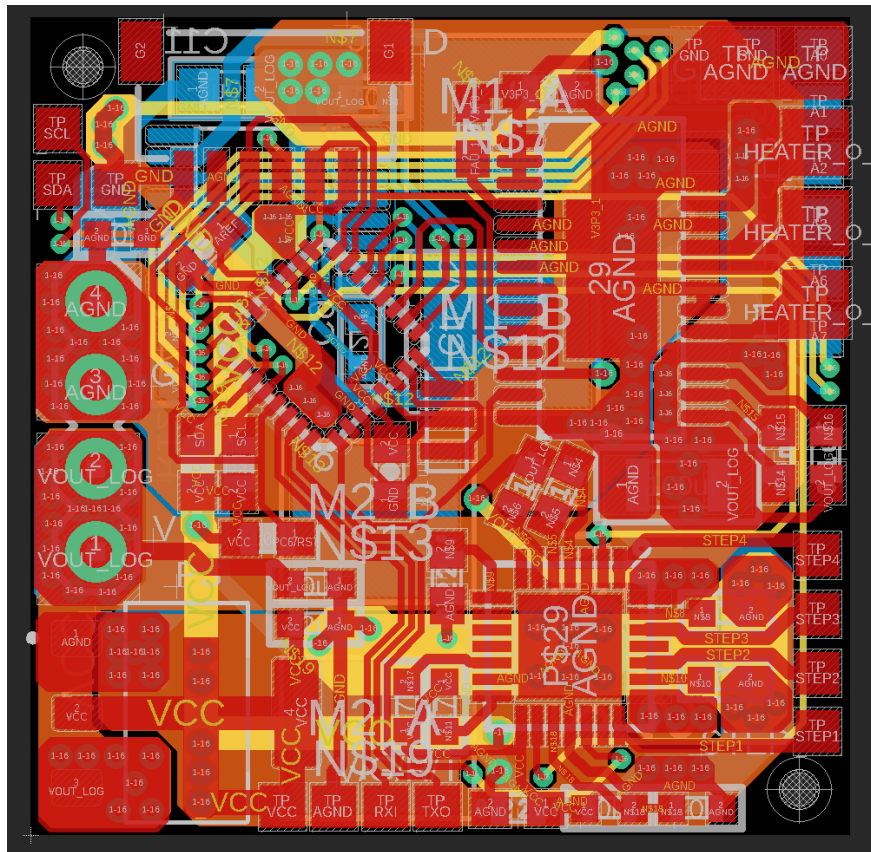
ATmega 168/328

DRV8313 for heating element

DRV8833 for motor driver

A4988 step motor driver

25x25mm

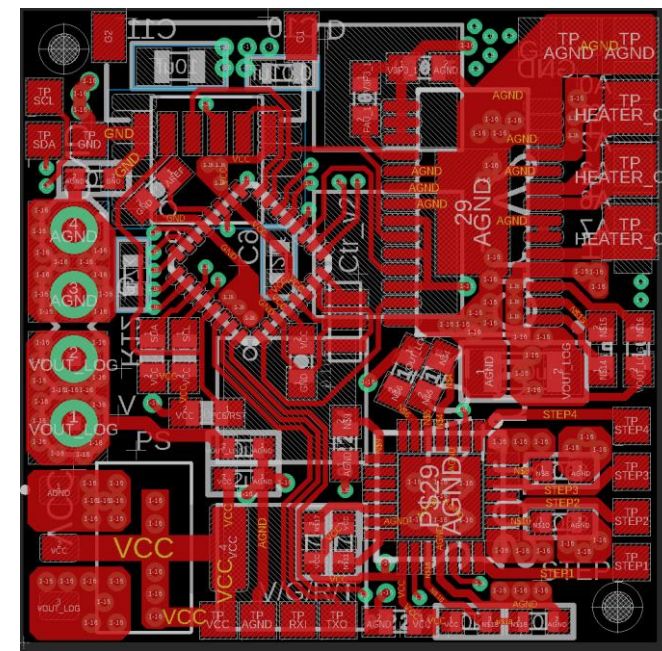


IIC

DC-IN

Heater-out

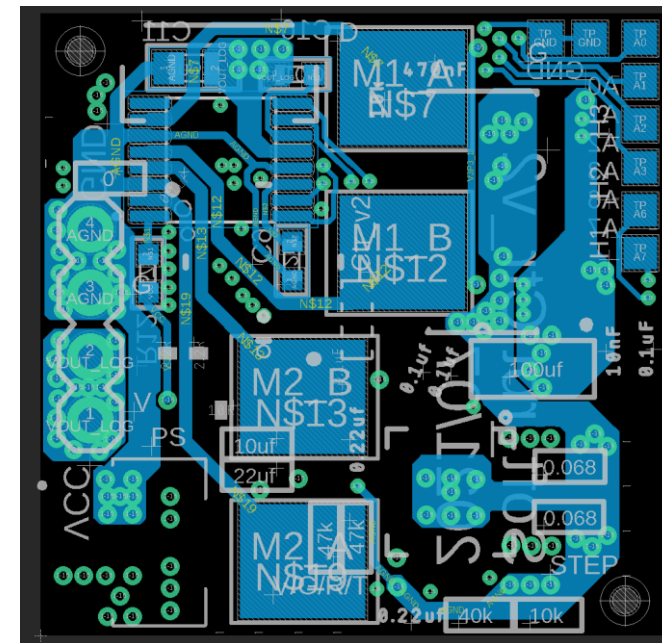
Step-out

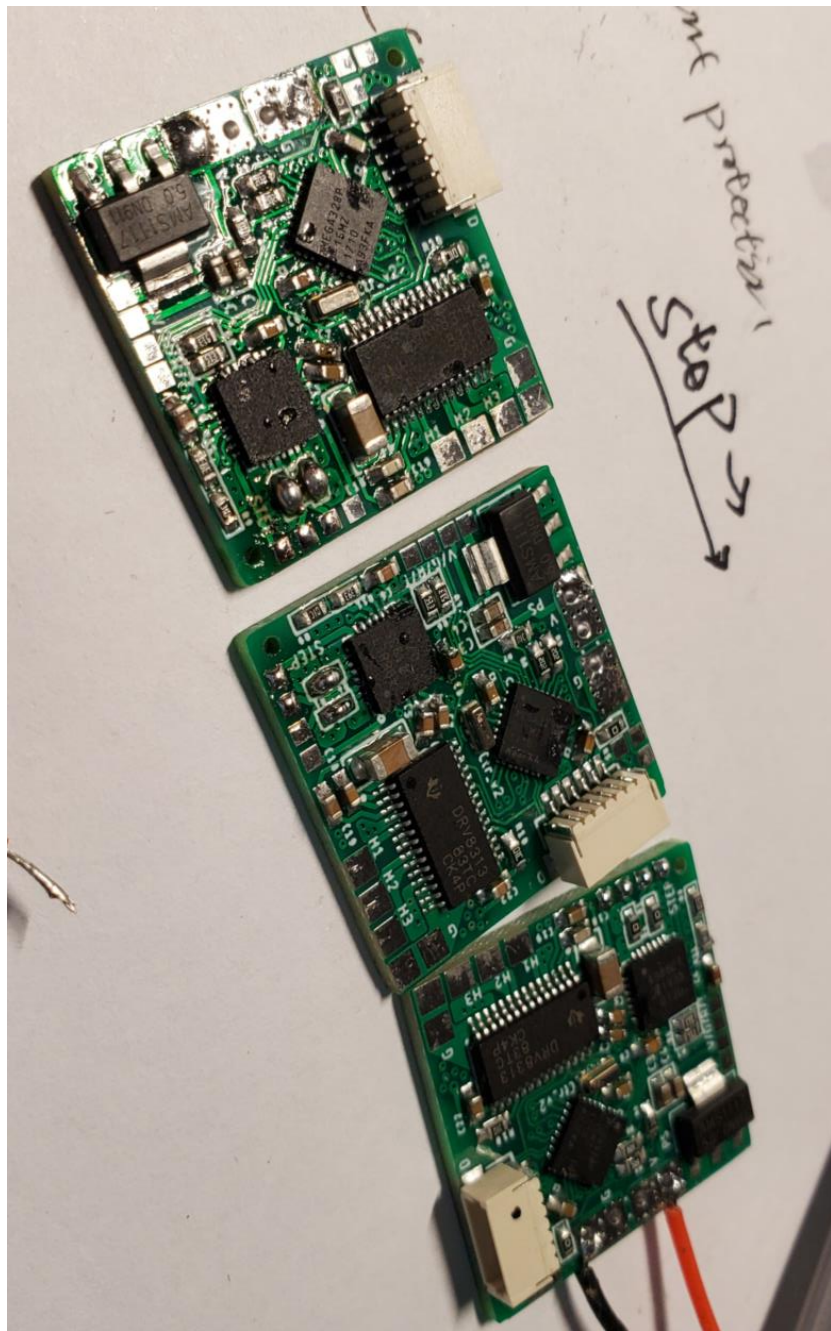


Serial

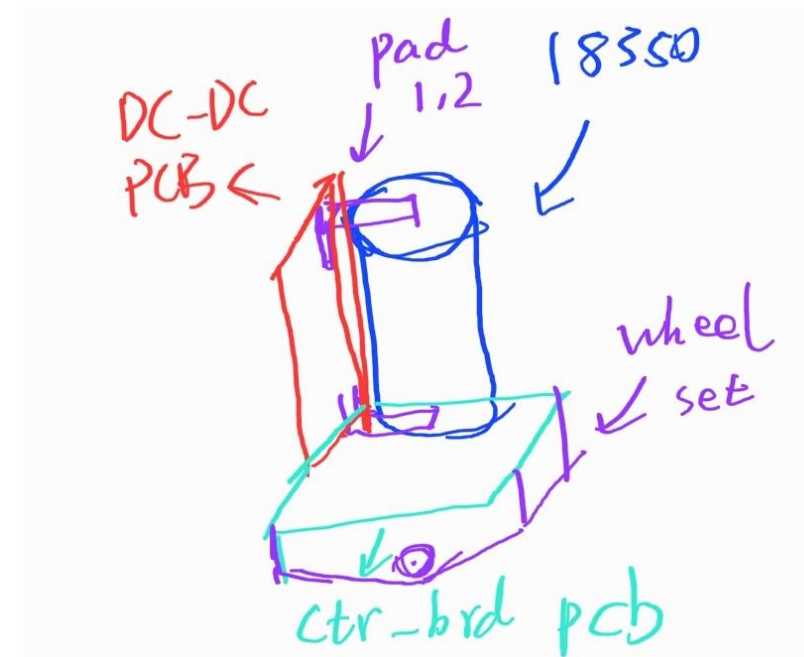
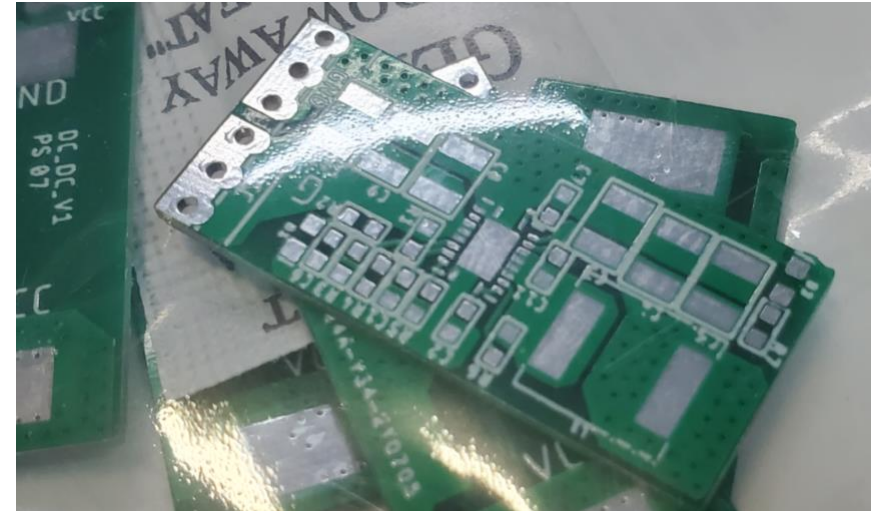
AD *6

Motor
connection
pad

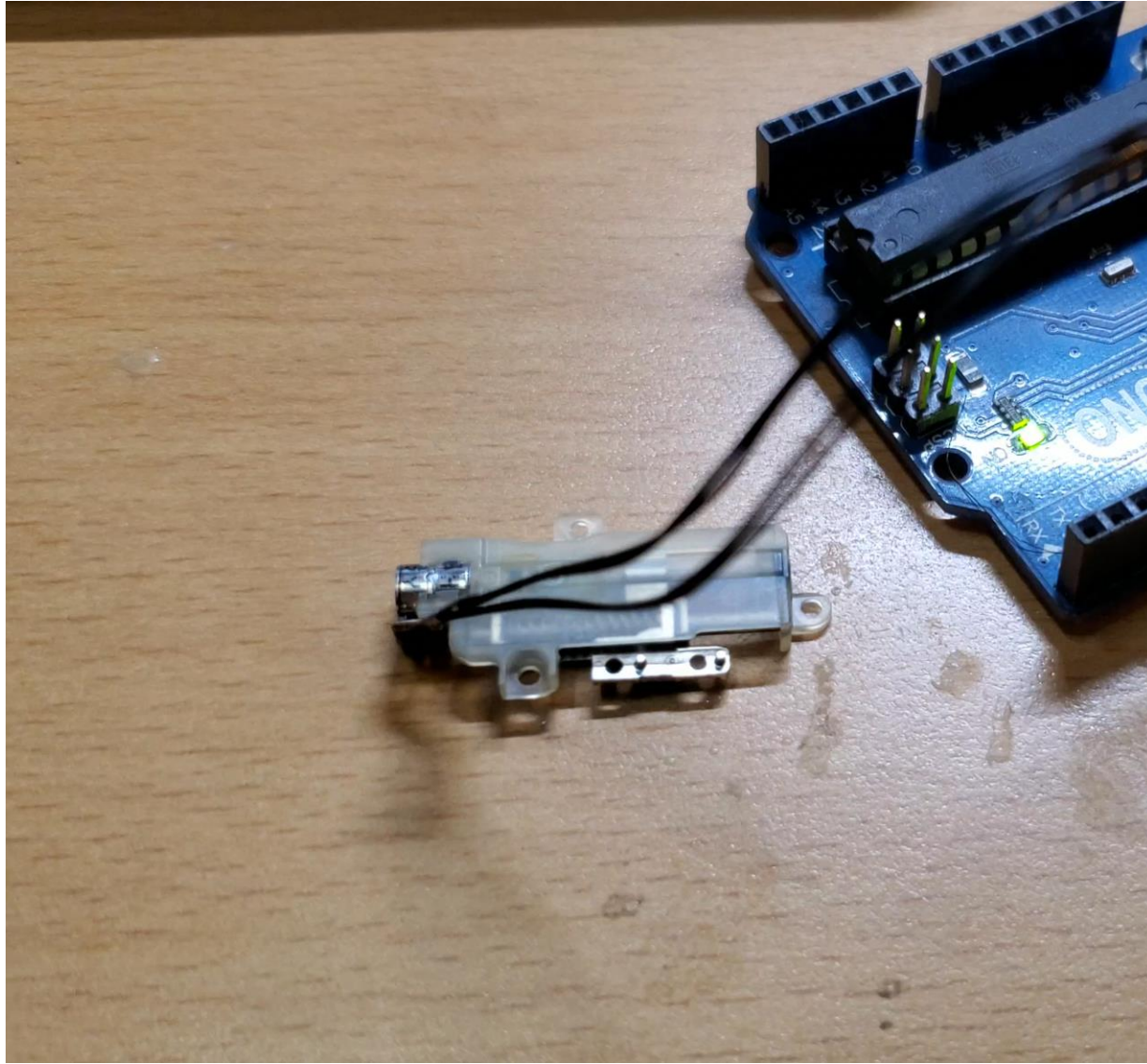




DC-DC TPS63070->TPS61088



Docking motor test



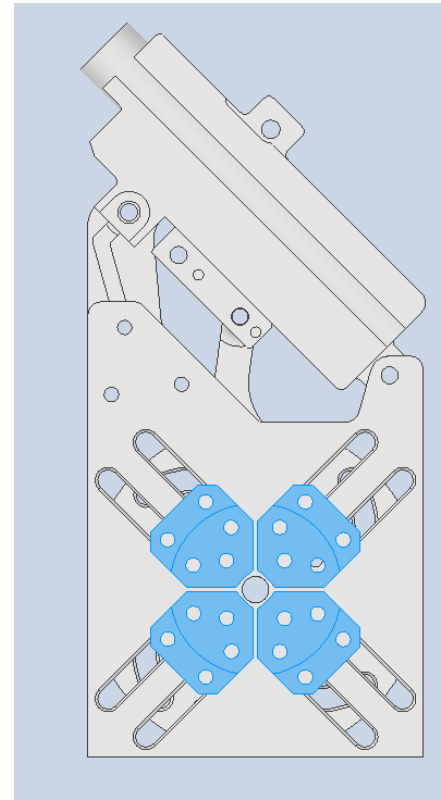
Docking interface

Silder mechanic

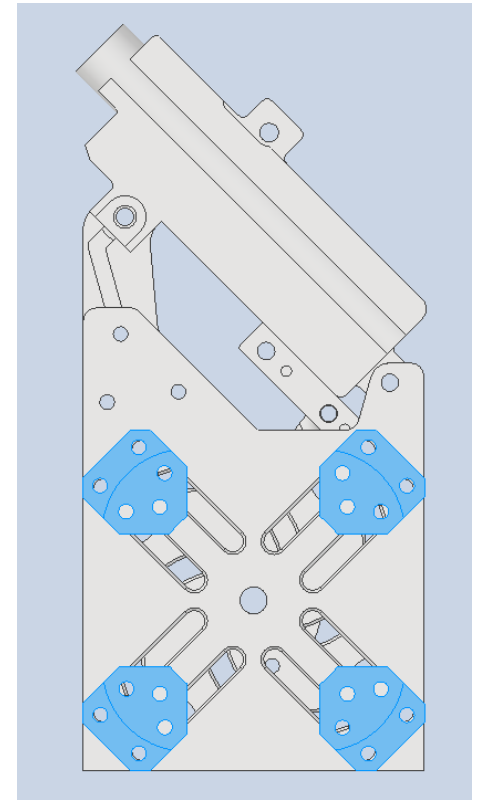
auto alignment

no need for magnet

reform into male/female type, no docking type limit

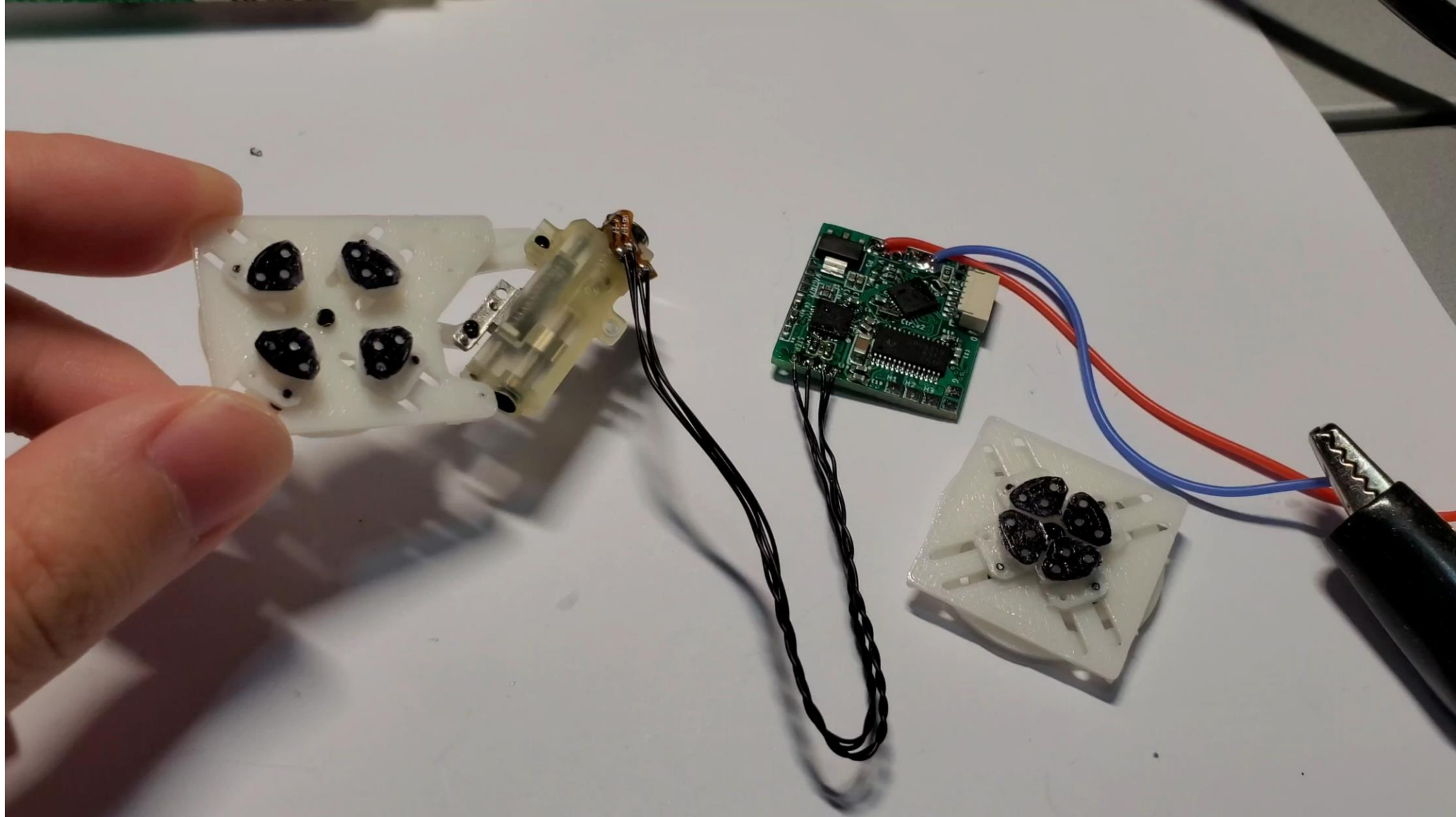


Type A

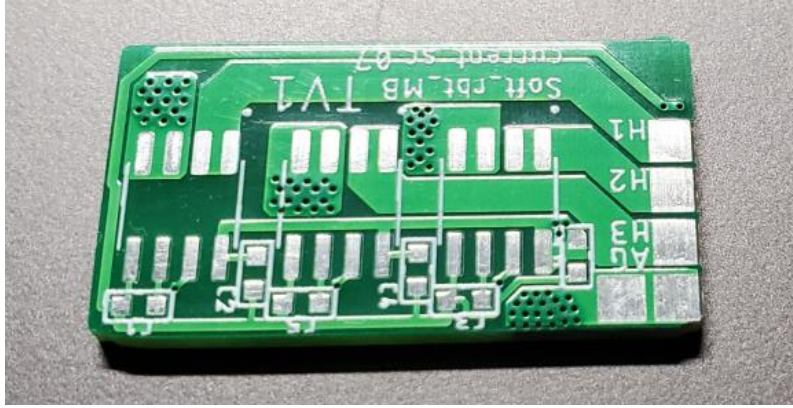


Type B

Docking interface



Current / temperature feedback pcb



Gen2 assemble cad

