

Issues with old 218 PDB

designing a new power distribution board for ME218

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- requires a USB battery
- 3x100mA @3.3v is limiting
 - line sensors draw 30mA each
- not enough plugs
 - old PDB has:
 - 2x 14v plugs
 - 12x 3.3v or 5v plugs
 - a majority of teams had to splice branches
- LP2950 hard to solder
 - pins too close together
- old pdb was 2.5x2.5”
 - Question: what’s a good size?
 - is a thicker PDB a problem?

looking at schematics and trying to guess how many components use each voltage

| | 3.3 volt | 5 volt | 14 volt | 3.3v+5 | |
|----------------|----------|--------|---------|--------|---|
| atom | 10 | 3 | 2 | 13 | |
| scratpack | 11 | 3 | 3 | 14 | |
| lawn destroyer | 6 | 4 | 2 | 10 | |
| nuttinspecial | 5 | 4 | 4 | 9 | |
| simpbot | 6 | 5 | 2 | 11 | |
| nimby | 8 | 8 | 4 | 16 | |
| sealteam6 | 8 | 6 | 3 | 14 | |
| roboscrat | 9 | 10 | 2 | 19 | |
| wacked | 9 | 3 | 3 | 12 | |
| 24t2 | 10 | 5 | 3 | 15 | |
| babygotbaxter | 4 | 10 | 2 | 14 | |
| dumbo | 7 | 7 | 3 | 14 | |
| MI218 | 8 | 7 | 2 | 15 | |
| CAT | 10 | 6 | 2 | 16 | |
| todd | 17 | 5 | 3 | 22 | |
| botx | 13 | 7 | 2 | 20 | |
| ckp | 5 | 4 | 3 | 9 | |
| creature | 10 | 1 | 2 | 11 | |
| ledecky | 10 | 2 | 3 | 12 | |
| karUR | 7 | 4 | 3 | 11 | |
| blipperblop | 10 | 6 | 2 | 16 | 1 |

Voltage Regulator Research

- DC-DC switching regulator (battery voltage down to 5 volts)



- AKA "HW-411"
- On AliExpress and Amazon they are less than a dollar each
- seems cheaper than its parts, a great deal for a buck converter module
- I used one of these to power servos last year
- 2 amps
- one issue is that the output voltage is adjustable with a knob, so students would need to set the knob to 5 volts while building the board



Voltage Regulator Research

- Linear regulator (5 volts down to a clean 3.3v)
- previously [LP2950](#)
- [LD1117V33](#)
 - max of 800mA
 - available as through-hole TO-220 package
 - \$0.35 (very similar price to the LP2950 regulators the old pdb used)
 - fixed 3.3v output
 - needs 100nF on input 10uF on output
 - says it has a current limit, but doesn't say it has short circuit protection
- [MCP1702](#)
 - max of 250mA
 - available as through-hole TO-92 (small) package
 - \$0.5
 - if short circuited, turns off for "a short period" then restarts
- Question:
 - **what do we want the 3.3v regulators to do when they are short circuited?**
 - this is actually the most important slide, I should have researched this for longer

do we like molex plugs?

- Servos be plugged into molex plugs.
 - (they won't latch but they do fit)
- Question: the old PDB has 3v,gnd,5v on every plug, how attached are we to that pinout?

how should the power switches work?

Question:

The old pdb had the motors on one switch and everything else on the other switch. Now, we have more options, but what options do we want the PDB to have?

Why do switches have such low current limits?

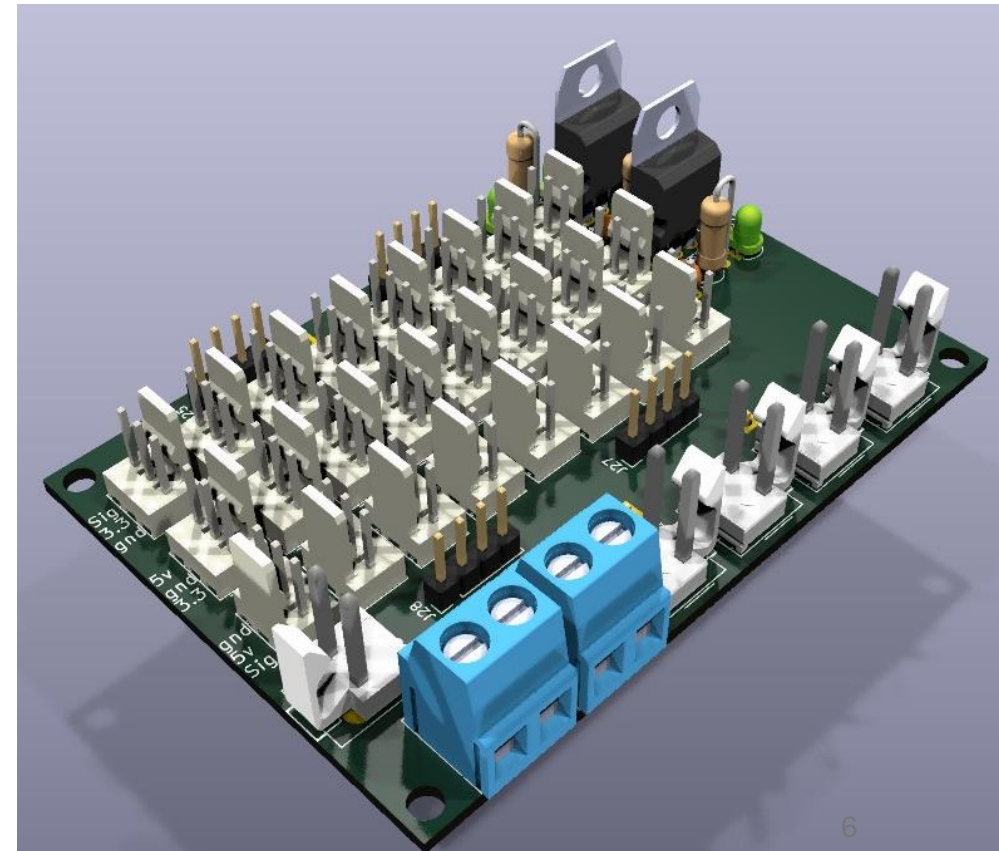
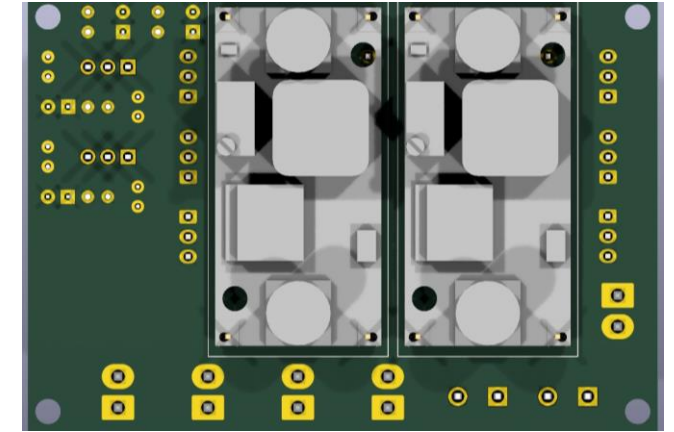
PCB “design-A” (naming things is hard)

I haven't drawn traces in KiCAD yet, this is just a mockup

See [readme](#) for a list of questions I have about this design and a to do list

3d model <https://github.com/joshua-8/218-pdb/blob/design-A/218-pdb.stl>

- 3.15 x **2.18** inches (10% larger area, ~2x taller)
- buck converters on back
- 24 plugs + 4 14v plugs
- each row is different, see schematic
- connects signals (can stop cutting servo plugs off?)



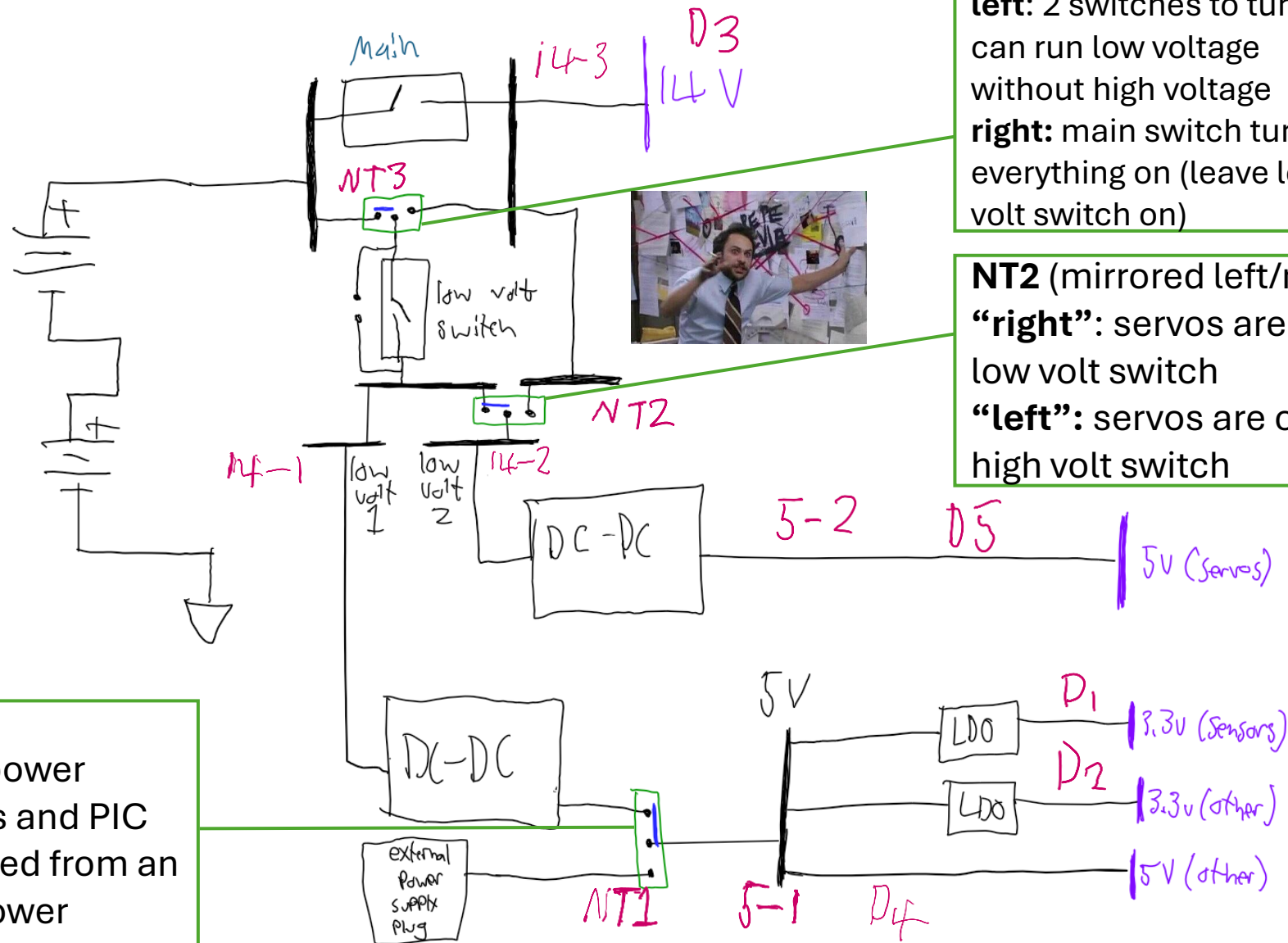
design A

“Ask me how to make your robot more complicated.”
– Joshua Phelps

I’m trying to design the PDB to almost force separation between servos and sensors.

green boxes:
jumpers to
select what
paths the
power follows

better diagram on slide 7



NT3

left: 2 switches to turn on,
can run low voltage
without high voltage
right: main switch turns
everything on (leave low
volt switch on)

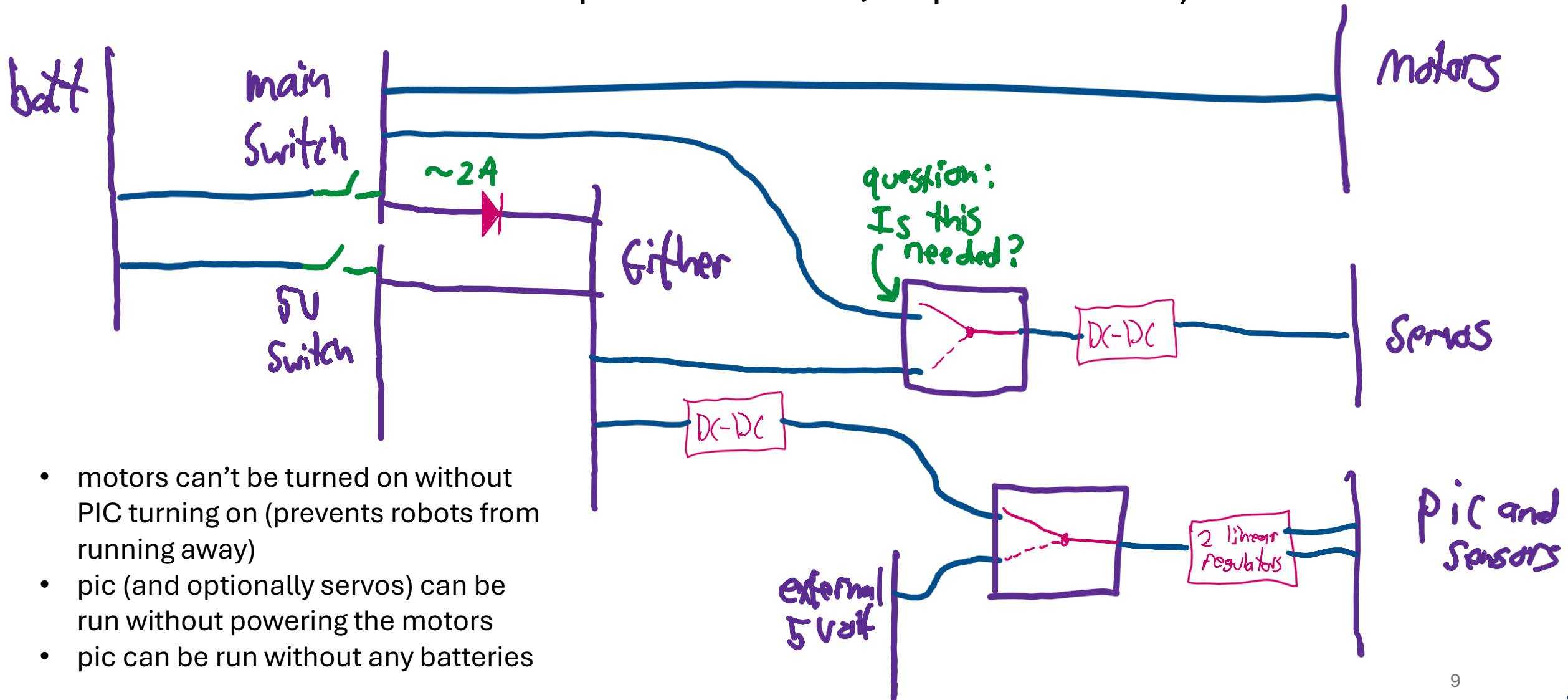
NT2 (mirrored left/right)

“right”: servos are on
low volt switch
“left”: servos are on
high volt switch

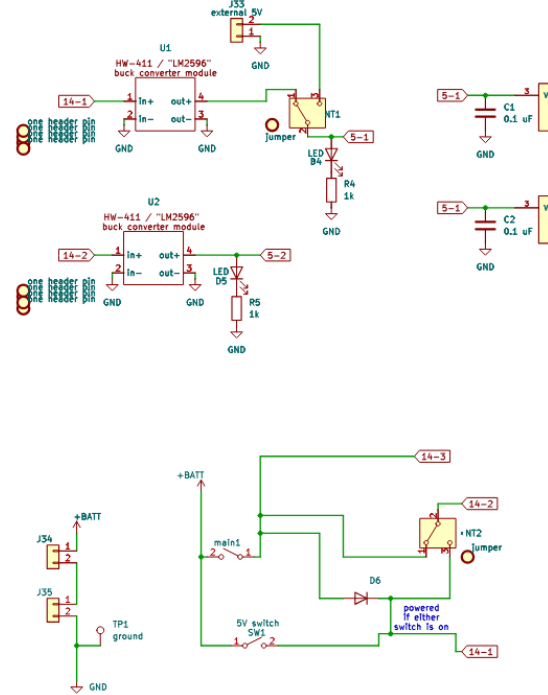
NT1

left: battery power
right: sensors and PIC
can be powered from an
external 5v power
supply for benchtop
testing

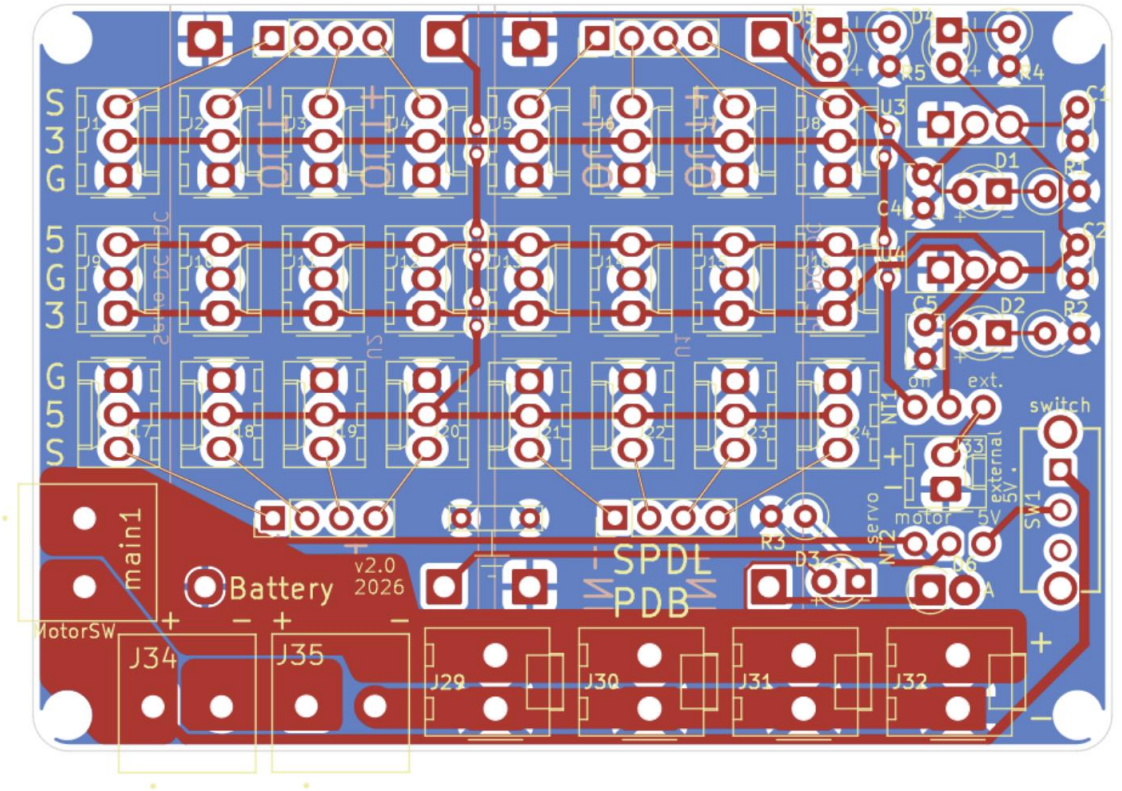
design B (small variation on design A, has different options for the switches and routes that power can take, requires a diode)



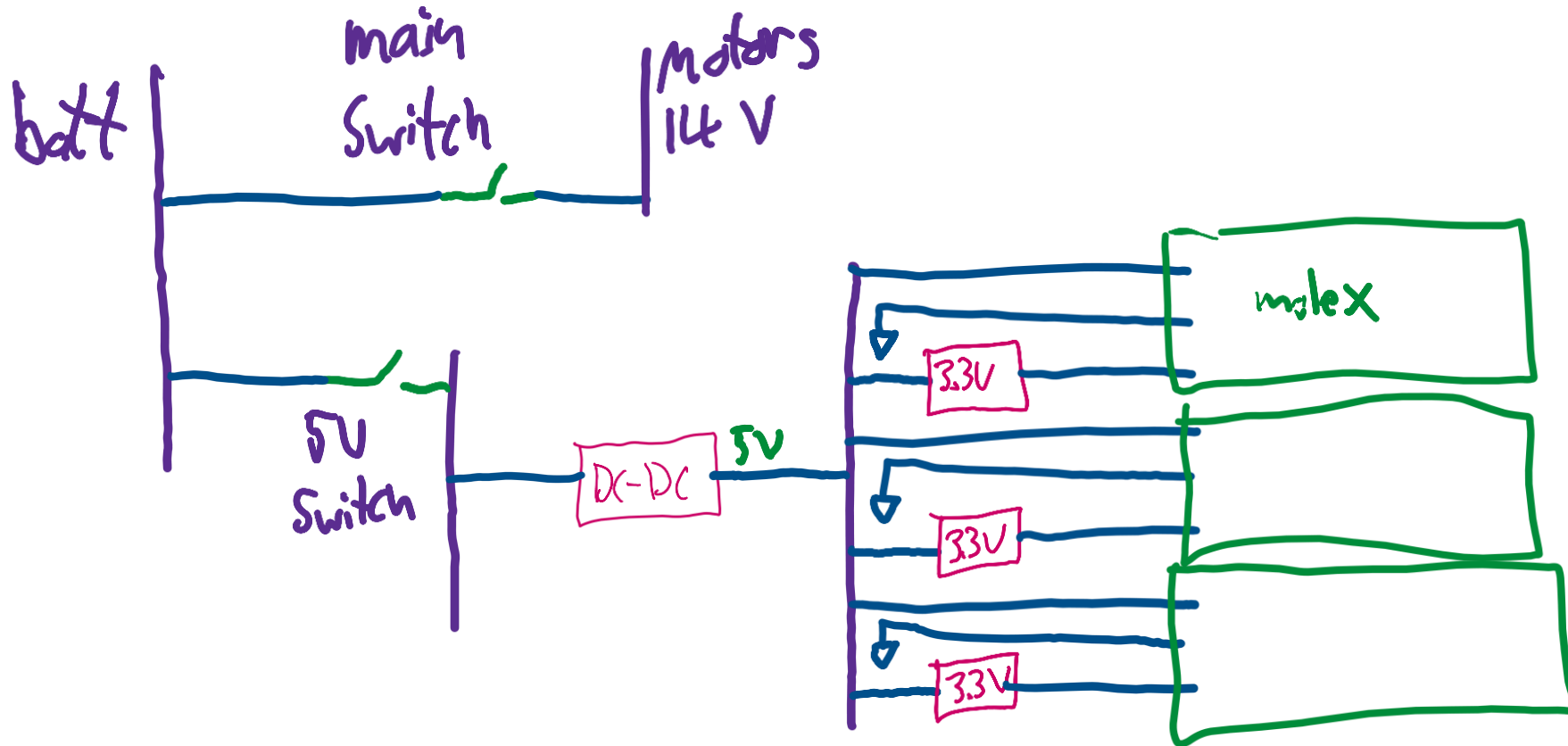
B



| NT1 | NT2 | motors | servos | PIC and sensors |
|-------|-------|---------|------------------|-------------------|
| LEFT | LEFT | main sw | main sw | main sw OR 5V sw |
| LEFT | RIGHT | main sw | main sw OR 5V sw | main sw OR 5V sw |
| RIGHT | LEFT | main sw | main sw | external 5V / off |
| RIGHT | RIGHT | main sw | main sw OR 5V sw | external 5V / off |



design C simpler, like the old PCBs, no KiCAD yet



cost estimate

- Digikey list (everything except HW-411 regulators and PCB)
 - [link](#) (estimate, and SPDL has many of the parts in stock already)
 - \$8 per board at 25 boards
- HW-411 buck regulators
 - \$2 for 2 regulators (if bought \$20 at a time)
- PCBs
 - JLCPCB and PCBWay estimate around \$2.5 per PCB (but tariffs ☹)
- I'd estimate new PCBs can be made for \$15 each