# Changes to PCB for the second order

The new PCB will be as similar to the first one as possible. We will simply replace the non-working circuits with ones we have tested and know will work, and make some minor adjustments as well. Basically it should be guaranteed to work.

1. Arduino Footprint
   1. Make the holes for the arduino pin 0.9mm
      1. Will double check this is sufficient
   2. Accommodate the Arduino’s extrusions in the bottom
      1. Drill new holes where there are extrusions – **We may need to do this manually**
      2. Ensure no tracks go through the Arduino Footprint and that all tracks connect from the top layer so that we may drill new holes and enlarge existing ones if necessary
2. Connectors
   1. Replace the 14pin connector with a second 24 pin connector.
   2. Preferably Use the large pins for GND, 12V in, IGBT Out
3. Circuitry Changes:
   1. IAT and MAP Conditioning Circuits
      1. Replace these with non-inverting Amplifier Circuits
      2. Add tracks for raw signals to be fed into the Arduino as well (same as the IPG, CPG inputs etc)
   2. ECT Sensor circuit
      1. So we currently don’t have anything to read the Engine Coolant Temperature Sensor, which is completely fine, but given that it behaves exactly like the IAT I was thinking I could just copy the new IAT circuit and toggle the resistor values, so we have an additional circuit on board that makes it look more “full” and complicated.
   3. Fuel heater, Throttle, and ECT actuator
      1. I will just add a single track going from the Arduino to an output pin, supposing that our activation signal will be acted on by whatever special purpose controller these stuff have
      2. Added old throttle op amp just in case
   4. Fan
      1. Keep the old 12V and connection of the pan, but also add a new track connected to the Arduino and the 12V in pin for the fan which will allow the Arduino to toggle the voltage sent to the fan
         1. I am looking into how to do this with transistors, may not exactly work but even so the fan will just be on full power all the time
   5. On board Temperature Sensor
      1. Add two temperature sensor on the PCB to monitor the temperature near the IGBTS (highest), and near the Arduino (lower)
         1. May display temperature with a mini display mounted on the outside of the housing during the exhibition – (this wont be incorporated into the pcb)
   6. On board Humidity sensor?
      1. Added one ( we will have to manually solder it after buyig it from mouser)
4. Cosmetics
   1. Add text on silk layer to identify all components and pins
5. Layout
   1. Can change layout to place high voltage components closer to the connectors
6. Extras that were considered but won’t be added as they may cause unwanted behaviour
   1. Decoupling Capacitors
      1. Justify an appropriate value for the decouplign capacitor to cut off high frequency noise near critical components (IGBTS)
   2. Passive high pass filters
      1. Passive high pass filters for many (maybe all) the sensor circuits to cut high frequency noise
   3. More zener diodes
      1. Add zener diodes after op amps to ensure voltage is capped at 5V (strictly unnecessary because our gain values don’t allow it)