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ACED RED 2 B Parts List – High School Team Experiment

Abridged Parts List:

* SPS30
* HAT PCB (proprietary)
* M2.5 6mm Hex Standoffs (x4)
* M2.5 Nuts (x2)
* M2.5 6mm Screws (x2)
* M2.5 12mm Screws (x4)
* 5mm through-hole pi GPIO Header
* 5 pin connector (JST ZH 1.5)

SPS30 – Particulate Matter Sensor, main component of the experiment.

* Team modifications
  + Inside of the SPS30 is a small fan. We have disabled this fan following our given requirement of having no moving parts. After conducting tests with this fan disabled, we demonstrated that the SPS30 still functions accurately without the fan. This was seen best in our vacuum testing. All information and testing data/analysis has been communicated to UAH throughout the course of this project.
    - Disabling the fan – options:
      * Unplug it
        + While we are not electrical engineers, we consulted two electrical engineers about our problem citing concerns about power/load changes. They both said that simply “unplugging” or disconnecting the fan from the power source on the board should suffice. Currently, we have followed this method to disable the fan and noticed no negative effects in testing or otherwise.
      * Capacitors and Resistors
        + This solution is above our expertise and equipment level, but it was proposed nearly identically by both electrical engineers. They suggested connecting the power and control line to ground with a very tiny capacitor and a resistor. This implementation would have to be done by UAH or with UAH assistance, as we have neither the equipment, skills, or experience to attempt this. I hope this explanation makes sense, or at least provides a valuable idea.
  + The SPS30 came with a metal casing that can be removed to access the sensor internals. It appears to be a simple aluminum sheet held in by small clips.
    - The team was not satisfied that the original casing with solder anchors would hold the sensor in place.
    - I drilled holes through the plastic bottom of the SPS30 and added two screw/nut configurations to mount the sensor more securely to the HAT board.
      * UAH should not need to adjust this configuration as it passed all vibration testing, but it can be modified if needed. In other words, the mounting configuration does not affect the sensor function so long as the intake is not blocked.
    - On the bottom of the casing, 2 screws and 2 nuts hold the SPS30 onto the pi HAT.
* See the SPS30 folder for all manufacturer provided documents including:
  + Mechanical Design and Assembly
  + STEP file
  + Certificates
  + Sample Code
  + Other documents (flyers, compressed datasheet, etc.)

Pi HAT PCB – A very simple board, simply electrically connects the SPS30 to the pi. I jokingly say it is just a glorified wire.

* See attaching details for instructions on how to attach the HAT to a pi 3B+
* Attached should be a gerber file with the a printable HAT schematic.

Standoffs and Nuts – Exactly what they sound like, not much to them.

* Standoffs
  + M2.5
  + 6 millimeters.
  + Four, one in each corner.
  + The exact type does not matter, any M2.5 standoff that is 6mm should work well.
* “Nuts”
  + There are two nuts holding the SPS30 to the pi HAT PCB, and they were actually made from a standoff.
  + I did not have two M2.5 nuts, so I cut a standoff roughly in half and used the two halves as nuts.
    - Obviously, if this is not satisfactory, UAH can purchase two M2.5 nuts for less than a dollar at any hardware store.

Corner Screws – Screws in the corner of the pi HAT that hold the HAT to the pi and baseplate.

* M2.5
* 12 millimeters.
* Machine screws (flat head).
* Four, one in each corner.
* The exact type does not matter, any M2.5 screw longer than 10mm should work well.
  + The length of the screw depends on the needs of the AR2B mounting equipment.

SPS30 Mounting Screws

* M2.5
* 6 millimeters.
* Machine screws (flat head).
* Two, anchoring the SPS30 to the pi HAT PCB.
* The exact type does not matter, any M2.5 screw 4 to 6mm should work well.
  + These screws are not important to the experiment configuration, just are used to hold the SPS30 to the HAT PCB.

GPIO Header 2x20 Short Female Header

* Purchased from Adafruit.com, essentially raises our HAT 6mm off the surface of the pi PCB
  + 1mm GPIO base on 3B+.
  + 5mm pin height.
* Dimensions: 51mm x 8mm x 5mm / 2.0" x 0.3" x 0.2"
* Pin Length: 3mm
* Pin Spacing: 2.5mm / 0.1"
* Pin Thickness: 0.6mm / 0.02"
* Weight: 2g
* We soldered the pins on this short header to our HAT PCB.

5 pin connector - JST ZH 1.5 5 pin connector

* This is an unusual connector standard, and we had some difficulty finding preassembled wires for sale online.
* We were able to get a set of 10.
  + Blue – 5V Power
  + Green – SDA
  + Yellow – SCL
  + Red and Black – Ground
* The colors **DO NOT** correspond to their normal associations
  + RED IS NOT 5V
* Please take care not to accidentally “flip” or invert the 5 pin connector if resoldering is needed.
  + If resoldering is needed, please test all connections with a multimeter continuity check before proceeding.