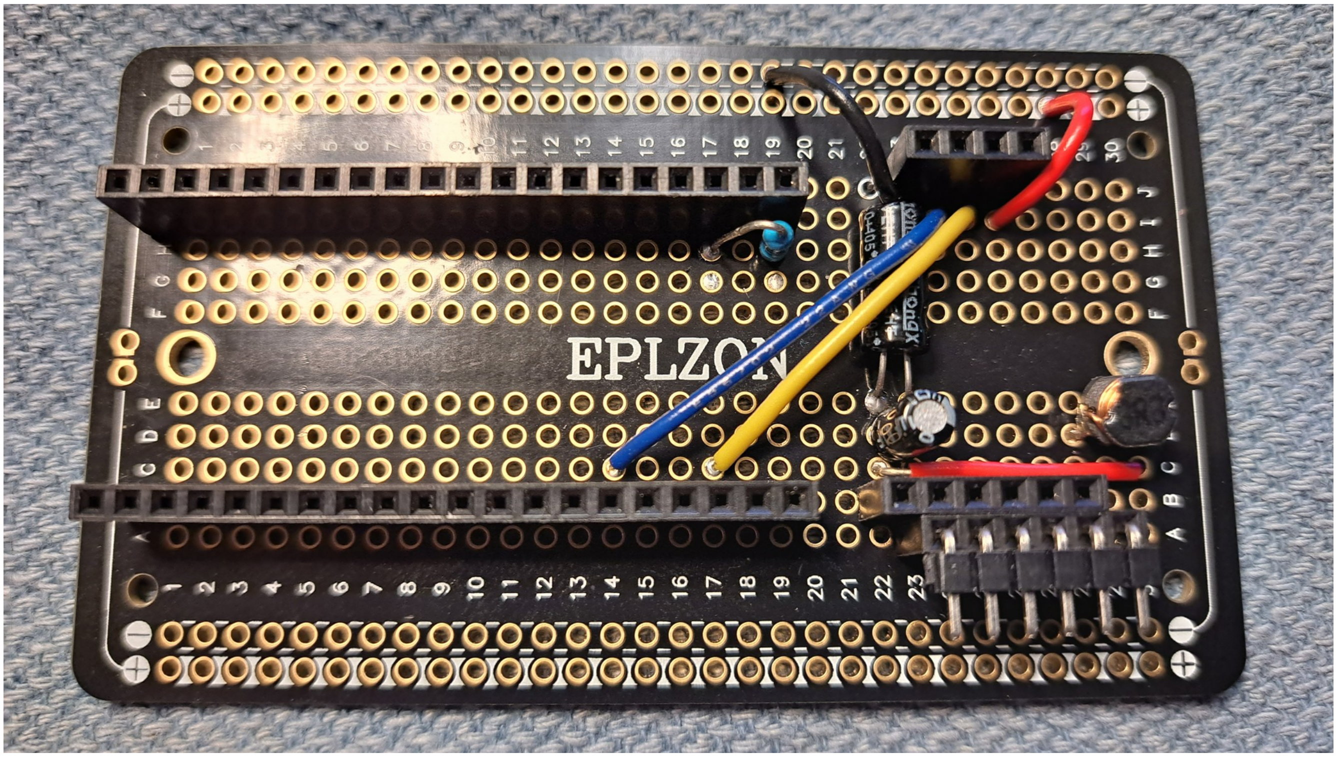
I almost always base my projects on PCB clones of breadboards to make planning easier. In rare cases, I will use plain old point-to-point boards if it doesn't involve a lot of jumper connections. Here's a link to the boards I used in the photos.

https://www.amazon.com/gp/product/B0BP28GYTV/



As you can see, there are a few external components used. From PCB pins 17H to 19H there is a 4.7K pull up resistor which is from the 3.3V pin of the ESP32 to GPIO 36 for the DS18B20 OneWire temperature sensor.

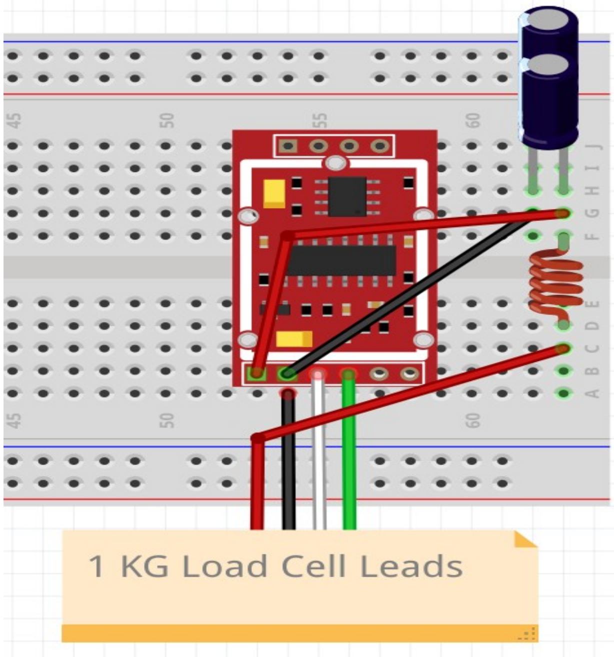
NOTE: Some ESP32 boards don't work with OneWire sensors on GPIO 36, so the current source code now has it on GPIO 15. I absolutely cannot explain this.

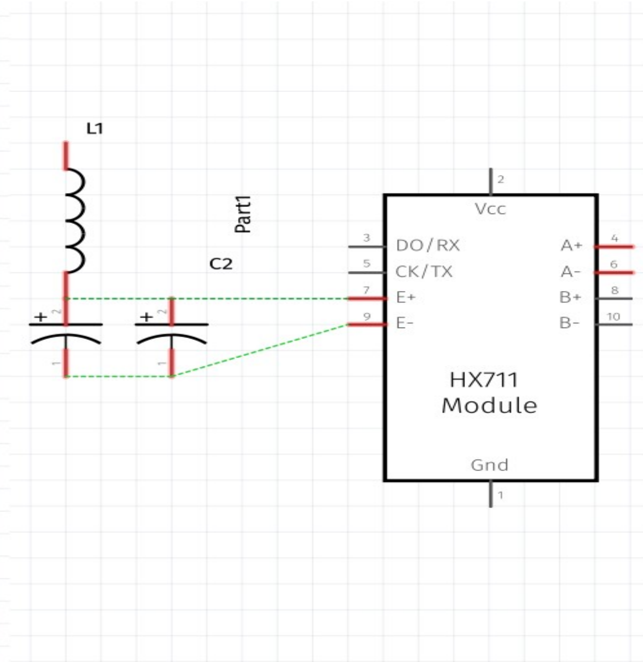
To the right of the ESP32 socket, there Is a socket for an HX711 load cell amplifier board. Below its 6-pin row, there is another 6-pin socket offset by one pin to the right. This is where the load cell connects, but it is offset so that a noise filter can be inserted into the path of the red wire (E+) of the load cell.

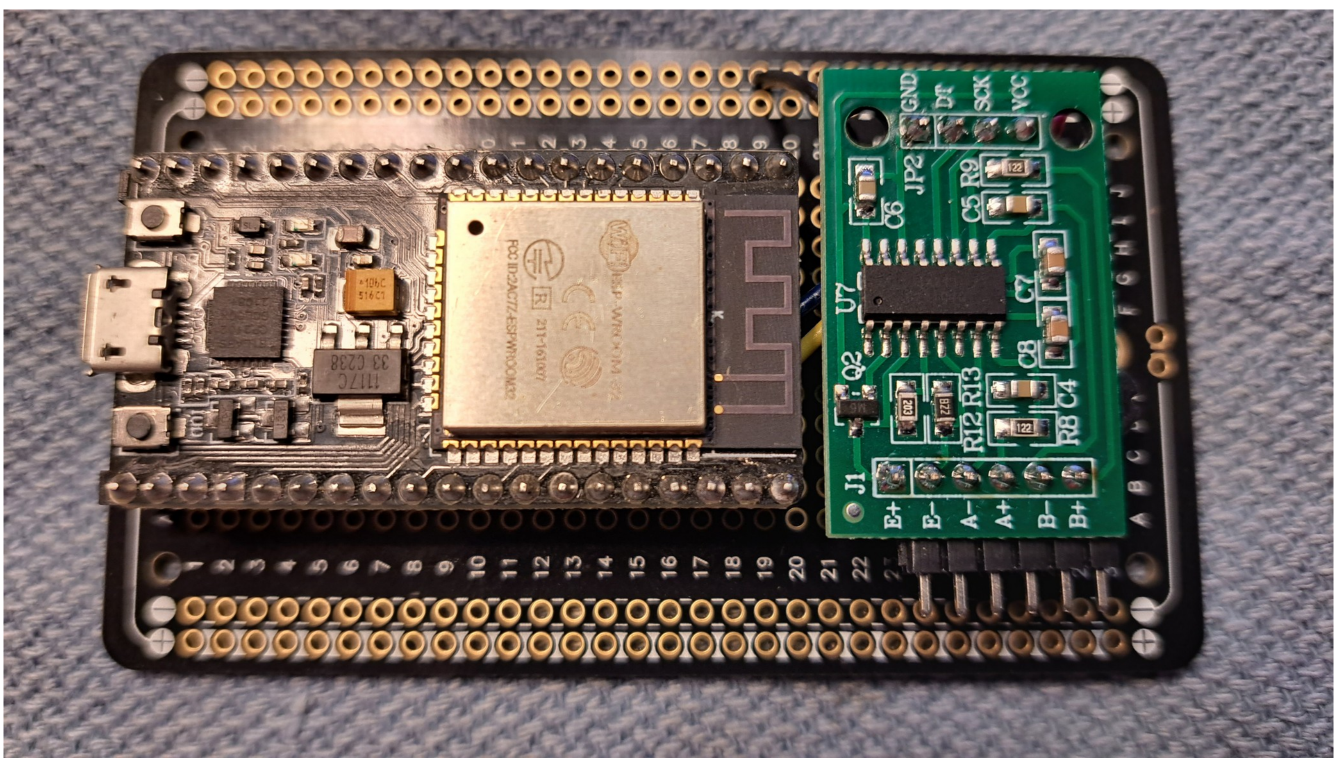
The pins on the load cell socket are black (E-), white (A-), green (A+), skip two pins, and red (E+) at the far right end.

The noise filter is Sparkfun's design, not mine. The red (E+) wire first runs through a 3.3 uH inductor before connecting to the E+ pin on the HX711. Two capacitors in parallel are placed across the E+ and E- pins of the HX711. This is because there is no such thing as an 10.1 uF capacitor, so you need to use a 10 and a 0.1 in parallel. I have no idea how they arrived at that value, but I'll just go along with it and do what they did.

The top row of pins are connected to the 5 volt supply and the I2C GPIO pins of the ESP32. Yellow to clock (GPIO 22) and blue to data (GPIO 21).

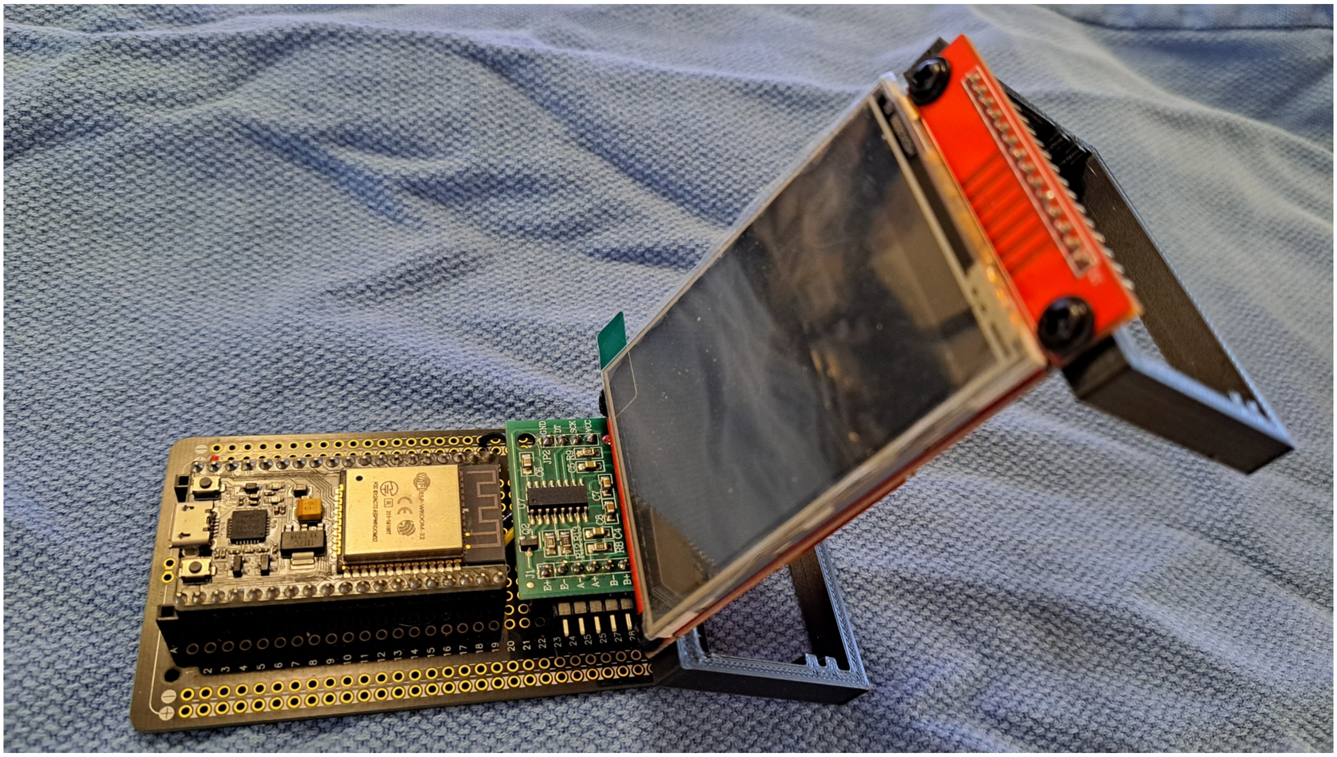






As you can see, the ESP32 and HX711 fit nicely on the board and the pins for the load cell are easily accessible to solder the load cell wires onto. Not pictured is the 5 volt supply wire to the top left pin of the ESP32 (whoops, and ground, I forgot).

Next you will want to 3D print a pair of the “Hydrometer LCD and PCB Carrier.stl” models and mount them to the LCD display as shown in the photo below. No need for high resolution printing here, plain old standard resolution is just fine.

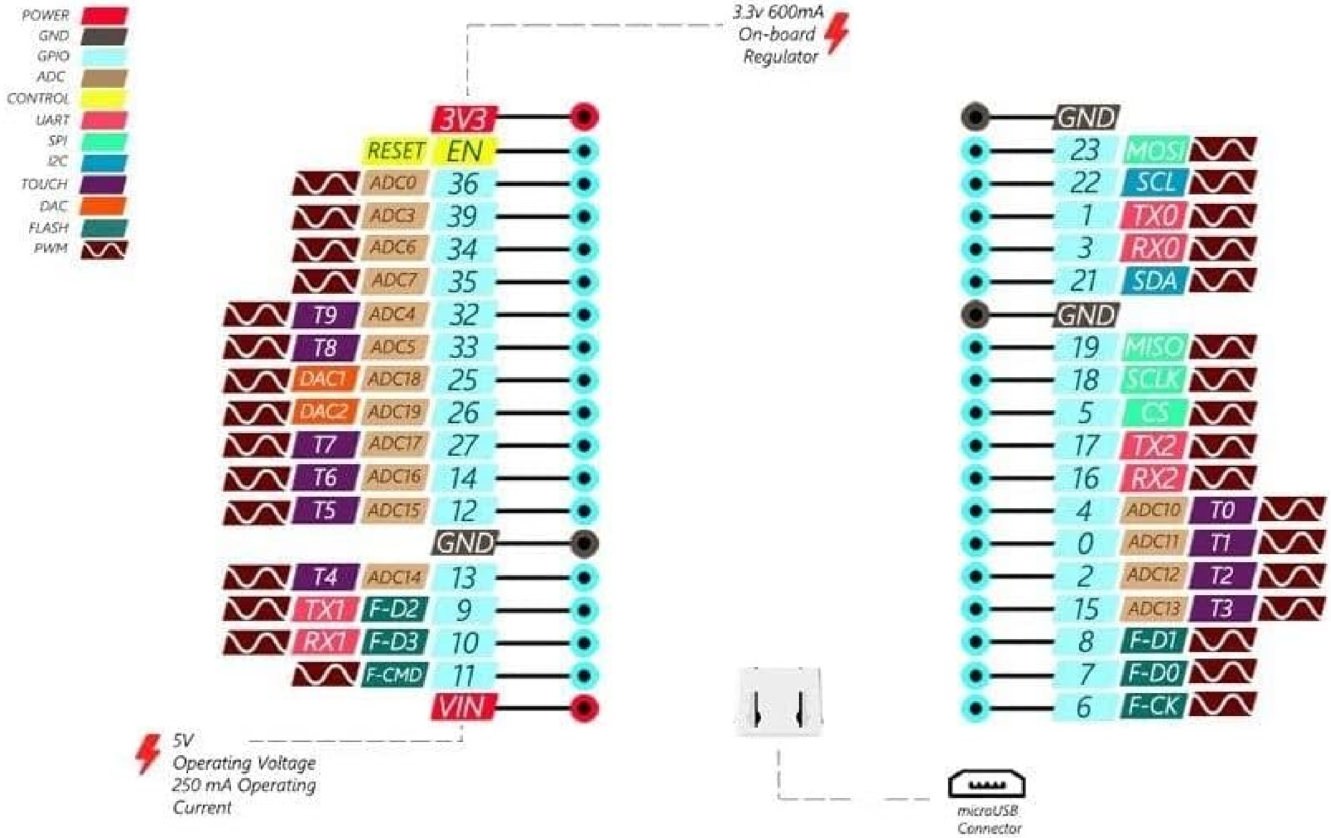


The display that I’m using here is the ever so common ILI9341 320x240 color LCD/TFT display that uses SPI communications. Here’s an Amazon link for it.

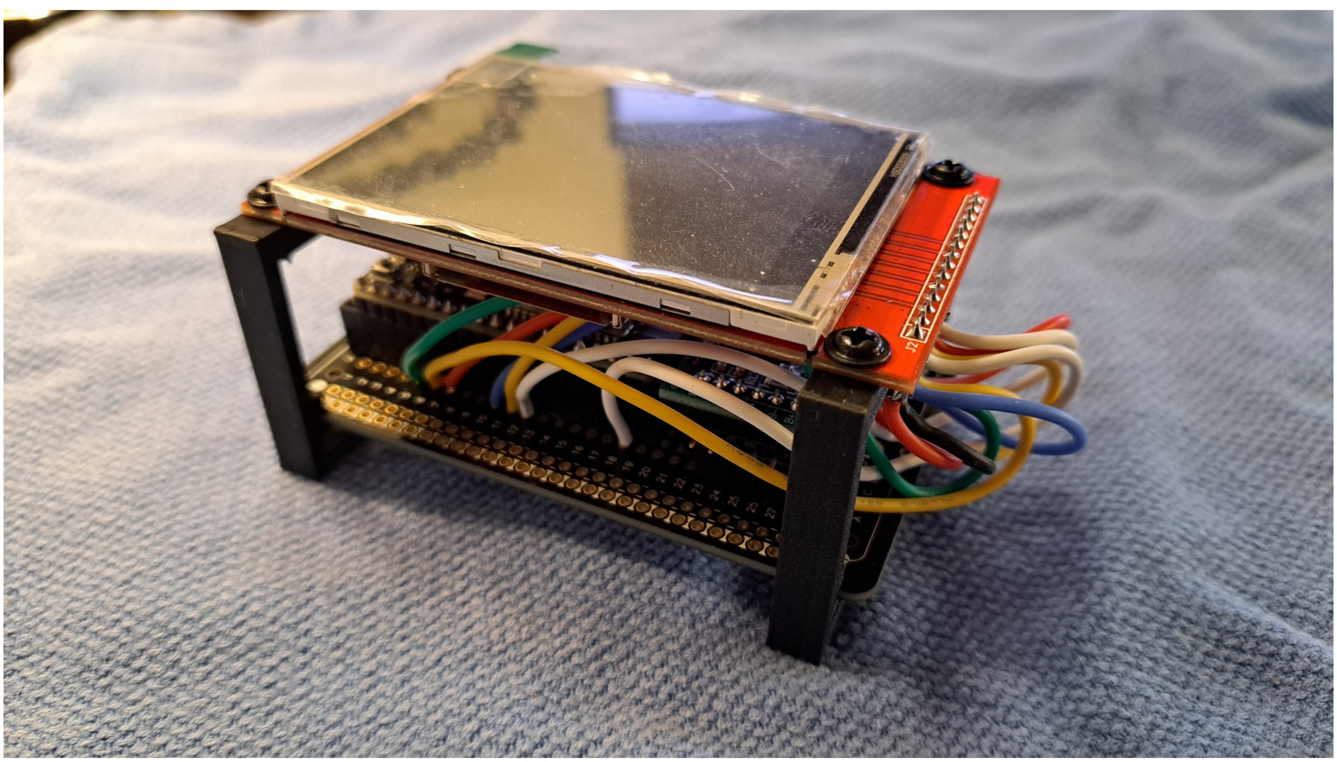
https://www.amazon.com/gp/product/B09XHJ9KRX/

The touch screen and SD card slot aren’t used here, so we only need to connect the first 9 pins on the unit. I simply solder wires onto the pins rather than using push-on connectors. If you want to install push-on connectors, have at it. I’m 50% blind and can’t get it right, so I gave up.

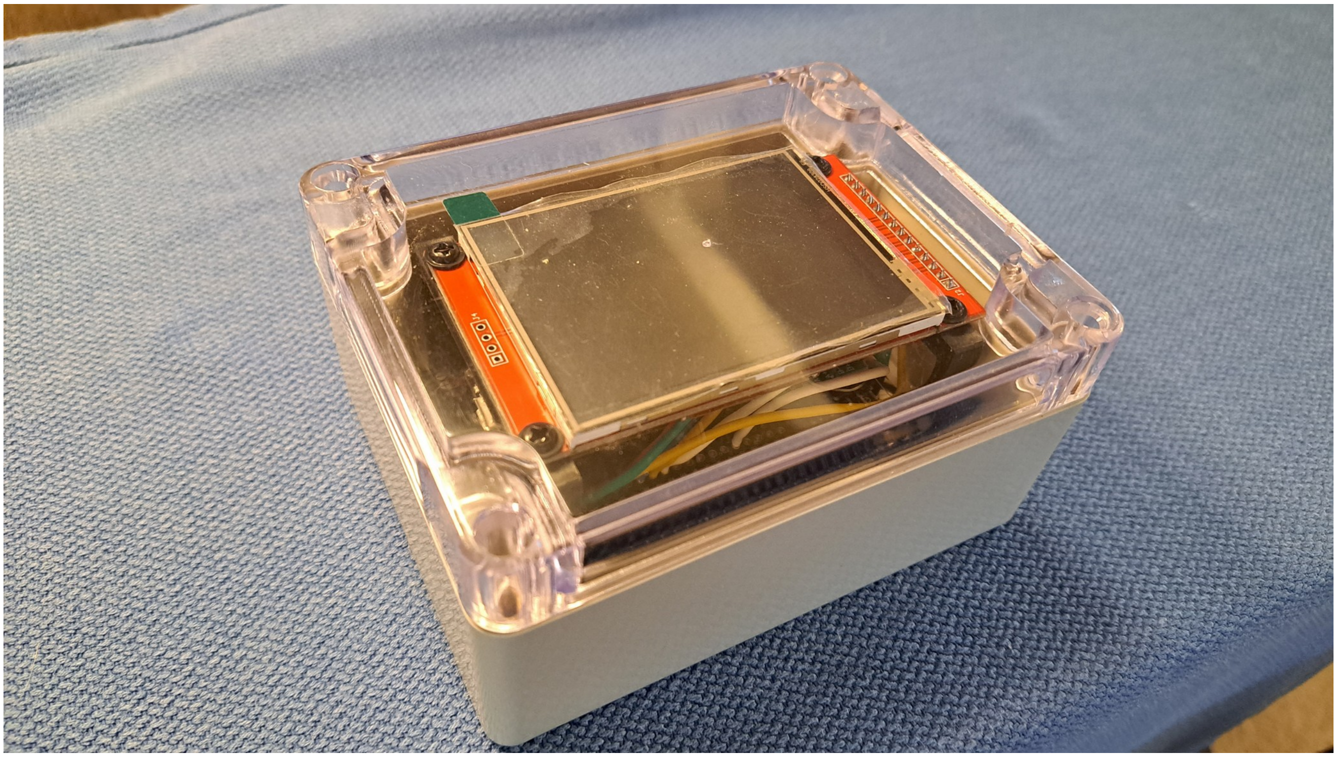
This is another reason why I use those PCB clones of a breadboard, the numbers on the rows and columns of pin holes really helps when connecting things to the GPIO pins of an ESP32. For example, I know the display’s CS line connects to GPIO pin 5 of the ESP32. I know that pin is 10th from the left in the above picture and that pin has a 10 right next to it on the PCB.



Above is the pin out of a 38 pin ESP32. Simply match up the constant definitions in the source code between the GPIO numbers on the light blue background with the pin labels on the back of the display.



The extra slack in the wires to the display will leave everything still serviceable after it is installed in the enclosure. If you ever need to reprogram the ESP32 or replace the HX711 load cell amplifier, just remove the screws from the display and pull them out of their sockets.



The enclosure is slightly over-sized, but this is necessary. Unfortunately, there is a mark in the middle of the top cover from the injection molding fill point. I have no idea if it's possible to polish it out, but I'm not going to bother trying. It's not that big of a deal to me. Below is an Amazon link to the enclosure.

https://www.amazon.com/dp/B07BPPKF2C/

We need to drill five holes in the back for the power and serial connector jacks and three smaller holes for the load cell, temperature sensor, and flow sensor leads. We will wait to do the soldering of these leads to the PCB after they are installed on the frame that holds everything together.

Before we go any further, you should 3D print the models "Flow Sensor Housing.stl" and "Condenser Feed Retainer.stl" at the highest resolution that your printer can do. These parts need to be precise, strong, and as waterproof as you can get them. I've broken off screw heads mounting high resolution 3D printed parts with 30% infill, breaking them off with pliers is by no means a simple task.

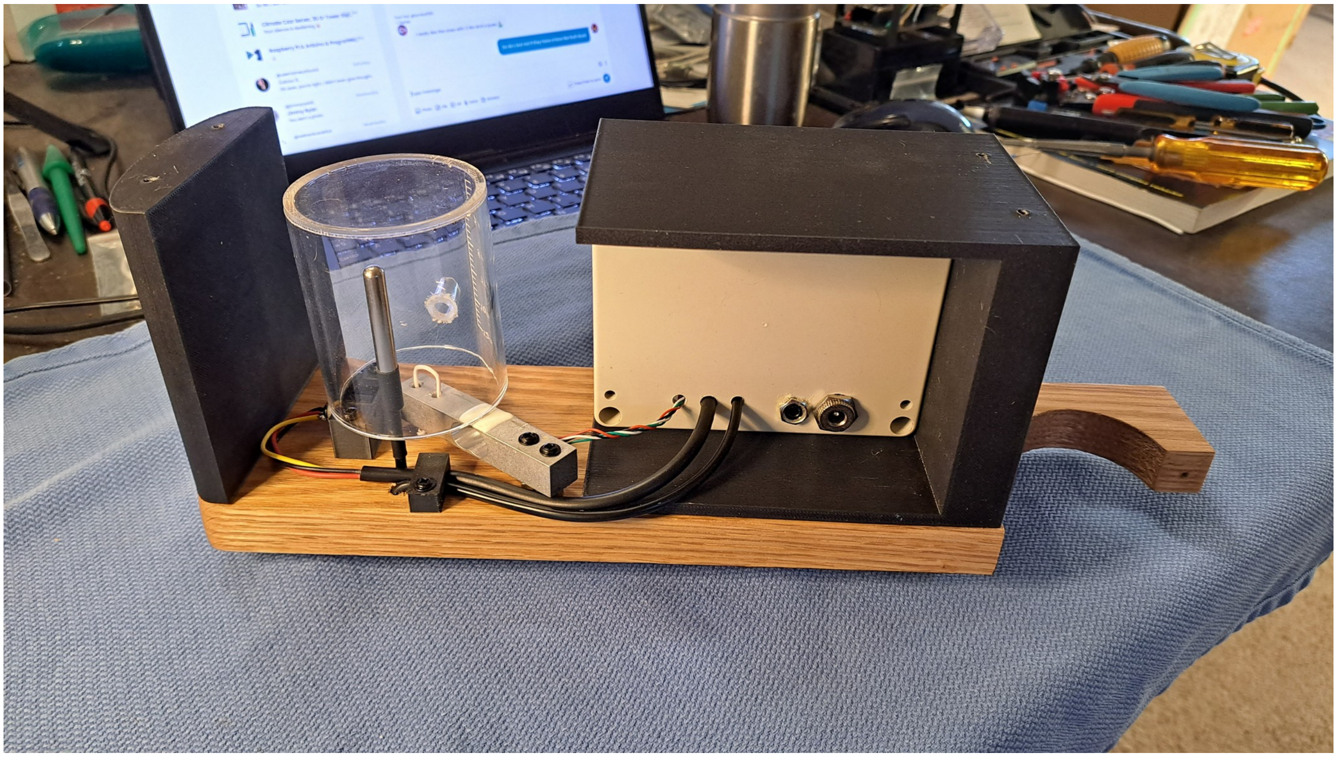
I don't expect everybody to use my design, mine is dual purpose so that it can be hung on the wall with picture hangers or around a 2" pipe such as a still column. So mine is made with two 14" pieces of a red oak 1x4 plank with the two models "Hydrometer Frame – Left.stl" and "Hydrometer Frame – Right.stl" on each end.

In the above photo, you can see a general idea of how the load cell and flow sensor are situated. The dot on the board between the two is where the hole for the DS18B20 temperature sensor cable is drilled to feed through.

As for the hydrometer frame end pieces, it’s up to you what resolution that you want to print them at, if you use this design plan. I just used plain old standard resolution because they’re only structural pieces and don’t need to be waterproof. The right side of the frame still took 14 hours to print at that resolution.

You will also need to 3D print “10mm Half Tunnel Wire Guide.stl” at any resolution you like, I just use standard resolution for things like that. There is also another wire guide named “Dual Cable Guide.stl” that has both 4mm and 5mm slots for cables. You will need these to lock down your cables from the flow sensor and the temperature sensor.

The load cell can’t have anything touching it because it will affect the reading of the reference weight. The code used here reads the reference weight down to the 100th of a gram. Anything touching the load cell can throw the readings off and just 4/100th of a gram of force can result in a 1% difference in the ethanol value.

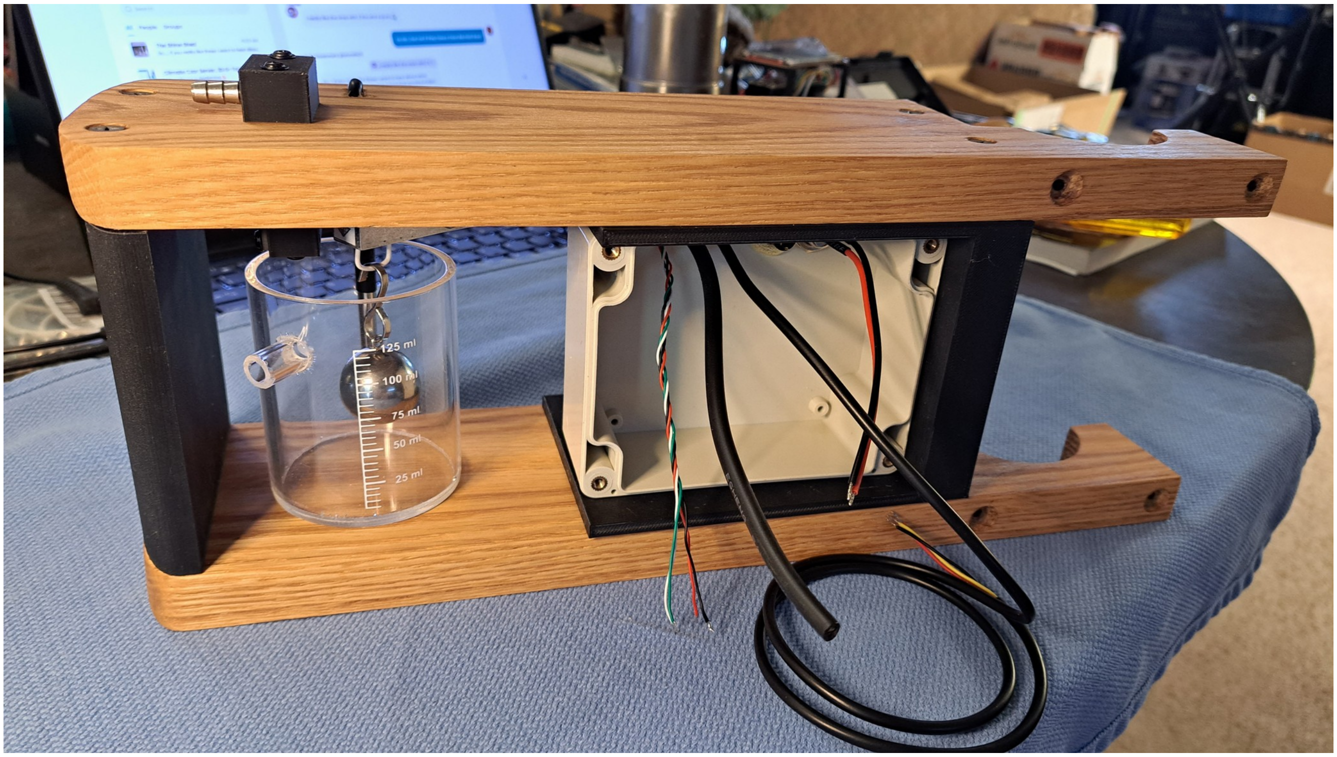


In the above photo, all of the parts are assembled that attach to the upper board of the frame. The load cell itself has two nuts on each wood screw to create a ¼” gap between it an the board. This allows it to float and the wires to run around it without making any contact with it. This also prevents the suspension wire that the reference weight hangs on from causing downward force on the load cell.

There are two holes for the temperature sensor cable so it runs up through the board and then back down through another hole. It then makes a right turn and the flow sensor cable is tied down with it using the 3D printed wire guide that I mentioned in the above. The position of the sensor keeps it far away from the reference weight so that it doesn’t touch it and interfere with readings.

The flow sensor housing is kept just far enough away from the load sensor so as not to make contact, but keeps the entire thing above the parrot cup so there is no chance of ethanol pooling on the bottom and dripping outside of the cup. The entire thing is completely ethanol safe, no part of it can be dissolved by ethanol and pollute your distillate.

To the right of that, you can see all of the holes drilled into the enclosure for the wires and the jacks for the power and serial communications plugs. The position of these holes allow everything to come though and stay out of the way of the display and PCB assembly.



This is the font view with the bottom board attached. You can now see the cable on the temperature sensor as it comes up through the top board and then back down through. The bottom of the reference weight and temperature sensor are at about the same level about 1” from the bottom of the parrot cup.

To the left of the cable, you can see where a ¼” stainless steel barbed elbow that feeds into the flow sensor housing. This is coupled to that housing with a small section of ¼” silicone tubing. You can assemble this and slice off the excess tubing with a razor blade before installing the optical sensor. The silicone tubing helps maintain a seal so that your distillate always runs through the path of the optical sensor.

The stainless steel barbed elbow is locked in place by 3D printed condenser feed retainer. This can be oriented in any direction, I just have mine oriented left since my still is on that side of the hydrometer. This setup is not absolutely necessary, you could just as easily come straight up with a collection cup like you would find on a conventional copper parrot.

As for the wires coming through the enclosure, I strip back the outer sheath so only about ½” of it comes through the enclosure and then put a couple zip ties on each one to act as a strain relief. This heavy sheath will only create obstacles in the enclosure, it’s much easier just to have the individual internal wires running around in there.

Other Pertinent Parts Used

38 pin ESP32 developer board
https://www.amazon.com/gp/product/B09J95SMG7/

1 KG load cell and HX711 amplifier
https://www.amazon.com/gp/product/B08KRV8VYP/

DS18B20 temperature sensor
https://www.amazon.com/gp/product/B00M1PM55K/

Optical switch used for the flow sensor
https://www.amazon.com/dp/B08977QFK5/

Stainless steel barbed elbow used for the condenser feed
https://www.amazon.com/dp/B09FJQZH71/

64 gram stainless steel ball used for the reference weight
https://www.amazon.com/dp/B09CYTBLW4/

Overflow cup used for the parrot
https://www.thomassci.com/Equipment-E-through-K-Education-Education-Physics/_/Clear-Acrylic-Overflow-Can

I don’t have links for things like capacitors, resistors, inductors, pin headers that I use for sockets, etc. I bought those items long ago and don’t remember where I got them. But you can find all of that stuff on Amazon or any electronic parts site.