

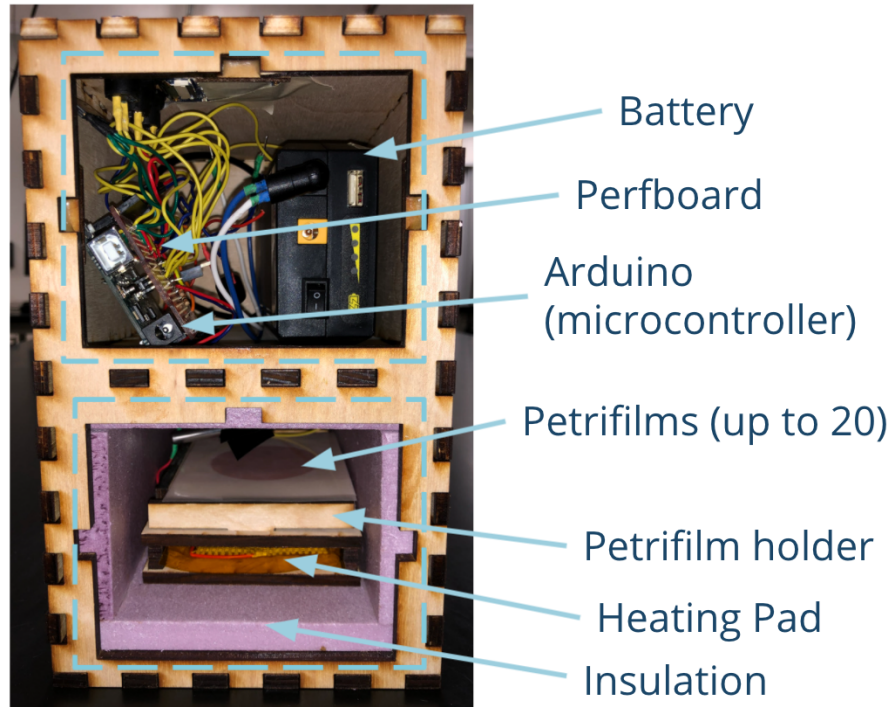
Our Box

Our current design features a double-layered box, with the insulated heating chamber on the bottom and the electronics chamber above. It looks like this:

Final Design (open)

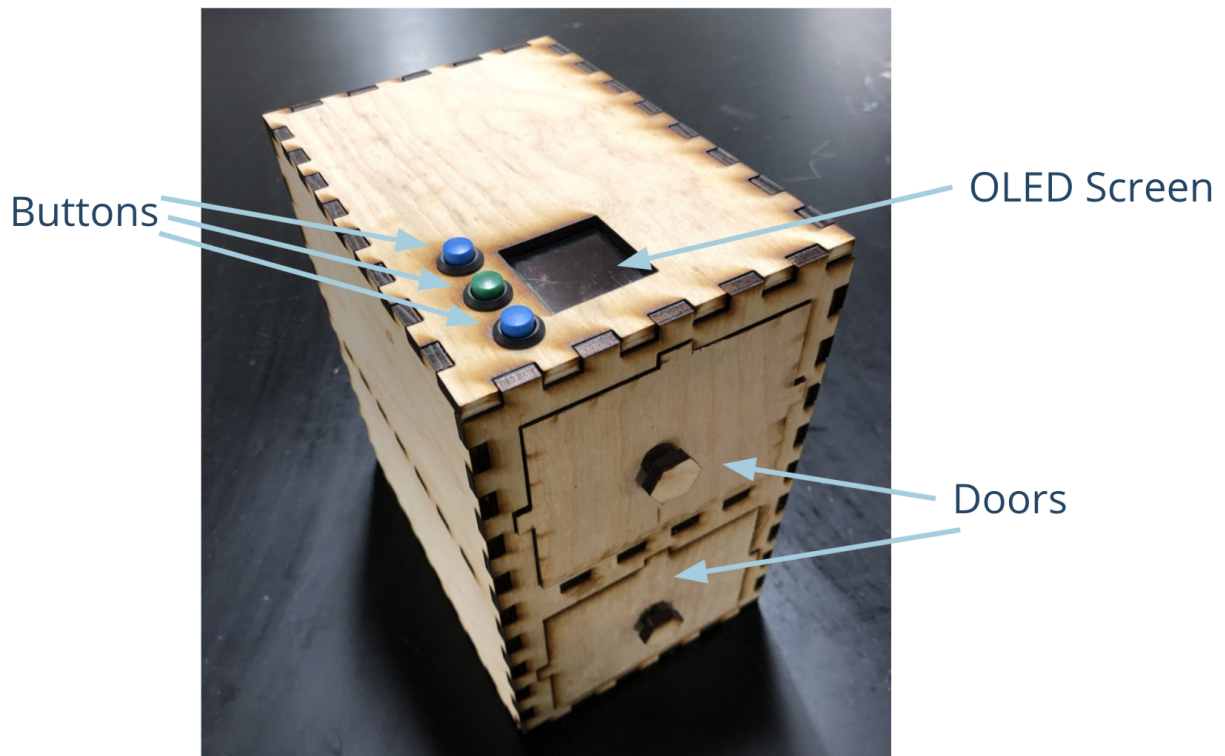
Electronics Chamber

Insulated Heating Chamber



When it's closed (during incubation), the user interface looks like this:

Final Design (closed)



Laser Cutting

Two AI files are needed for this design: vertical box.ai, and doors and knobs.ai. We used an Epilog laser cutter to cut it out of $\frac{1}{4}$ inch plywood. Be sure to measure the thickness and curf and adjust the width of the box joints. When assembling this box, you will need to add a small hole in the wall that separates the two chambers, to allow the wires for the thermometer and heating pad to pass through. This can easily be done with a hand drill. The handles will also needed to be glued onto the door— any wood glue should do the trick here.

For the petrifilm scaffolding, use the platform.pdf file, and glue the railings into the platform for stability you can use any short pieces of plywood to separate the two shelves-- it's important that the heating pad not touch either the insulation or the petrifilms.

Assembly

Once you have cut all the pieces, it should be relatively intuitive to fit them together and use wood glue to connect them. Before glueing, however, insulation needs to be cut to line the heating chamber (the lower section of the box). We used 2cm thick polyiso insulation for this, and cut six pieces— two should be 17.8cm by 12cm, these are the top and bottom pieces, two should be 6.7cm by 17.8cm, these are the side pieces, and two should be 6.7cm by 9cm, these are the front and back pieces. All of the pieces should be glued to the walls from the heating chamber, except for the front piece which should be glued to the door. We used five minute epoxy as our glue.

For the electronics chamber, the first thing to do is attach the screen and buttons. The buttons should fit into the three holes from the outside, and they each have a nut on the back that can be screwed on from the inside to secure them in place. The screen is a bit harder to attach— the best method we found was to carefully attach a small shelf for it to sit on, making sure to avoid blocking the SD card slot underneath the screen. After attaching the screen and buttons, it's time to install the rest of the electronics. The wires for the heating pad and thermometer should come up through the hole from the heating chamber, and the whole circuit, whether it's on a breadboard, perfboard, or custom PCB, should go above this hole. The battery should go next to it, with the power switch and plug facing the door.

Operation

First things first, to use the device, the battery must be charged. Open the door to the upper chamber (this is the electronics chamber). Make sure the battery is switched off, and then plug the charger into the barrel socket on the battery, and into the wall on the other end. When the battery is fully charged, unplug the charging cable.

To incubate samples, open the door to the lower chamber (this is the heating chamber) and place a stack of no more than 20 petrifilms on the wooden shelf above the heating pad. Then close the door to this chamber. Open the door to the upper chamber, and switch the battery on. The display screen should turn on. You can now close the door to the electronics chamber.

The details of navigating the screen with the buttons can be found in the user interface section, but it should be fairly intuitive— the three buttons are up, down, and select.

There is also a micro SD card located in a slot under the OLED screen, which can be accessed by opening the door to the electronics chamber and reaching under the screen to remove the SD card.. During incubation, the program will save data points to the SD card, so when you plug it into a computer, it should automatically open an excel spreadsheet with all of the data points.