ID_13 PHYSICAL INTERFACES

work portfolio

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1. Inspiration

When picking what I would like to build for this module, I felt I should expand on “Iotop”, our main project for the semester. To build something, that through human interaction, improves the current, measured conditions of our plants.

The first idea was to create a “light catching” game, in order to find the perfect light conditions for a certain plant. The user would hold the plant and an additional device, walking around their flats, trying to find the perfect spot... But how about when it’s cloudy out? Or scorching sunshine? Looking at my own apartment, I was wondering - but what about my other plants? Do I rearrange them all according to the light? No. I wanted to find a more universal solution, something that makes a certain condition better for every - or at least, most - plant in the room.

Something that has caught my attention while testing our device, was the low humidity readings. Having relatives struggling with the virus around the same time, suffering from endless cough-attacks, which only seemed to pass when they increased their surroundings' humidity a bit... That's it! Increasing humidity levels must be beneficial for plants and humans alike:

There are three key components to healthy air. It must be fresh, clean, and have the proper humidity. Humans are sensitive to humidity because the human body uses evaporative cooling, enabled by perspiration, as the primary mechanism to rid itself of waste heat. Humans can be comfortable within a wide range of humidity depending on the temperature—from thirty to seventy percent but ideally between 50% and 60%. Very low humidity can create discomfort, respiratory problems, and aggravate allergies in some individuals. In the winter, it is advisable to maintain relative humidity at 30 percent or above. [1]

So, how difficult can it be to build a humidifier myself?

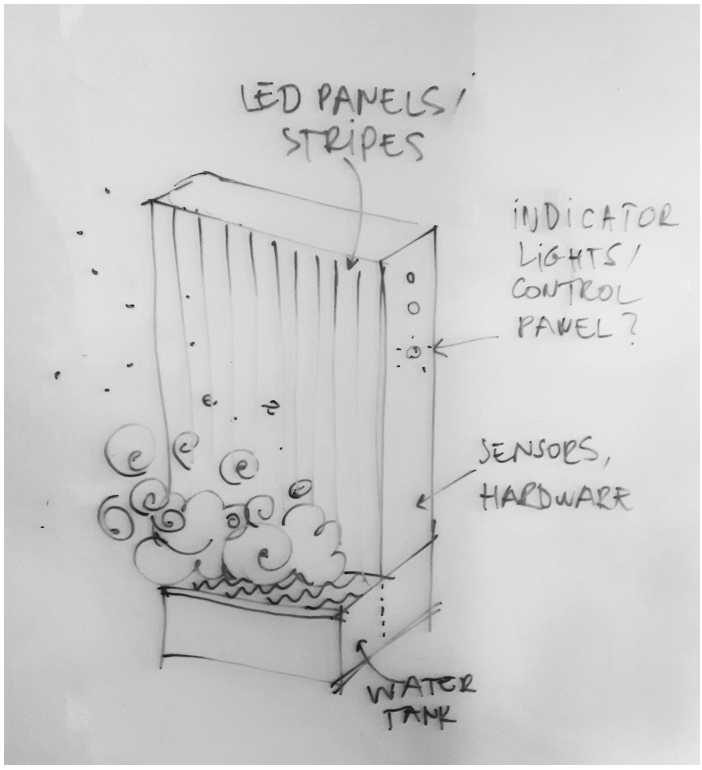
Attending the LU gave me the confidence I could probably make it happen. Google, watch youtube videos, order the parts, put it together - right?! While I have found a quite promising - detailed enough - youtube video, I was worried about which parts I needed to order. Will it arrive on time? Will I be able to hook it up?

[1] https://www.hackster.io/taifur/smart-humidifier-dac66f

2. mood board


rainforest
digital
waterfall
tinkering
houseplants
arduino
monitoring
and sensing
human touch
sensible automation

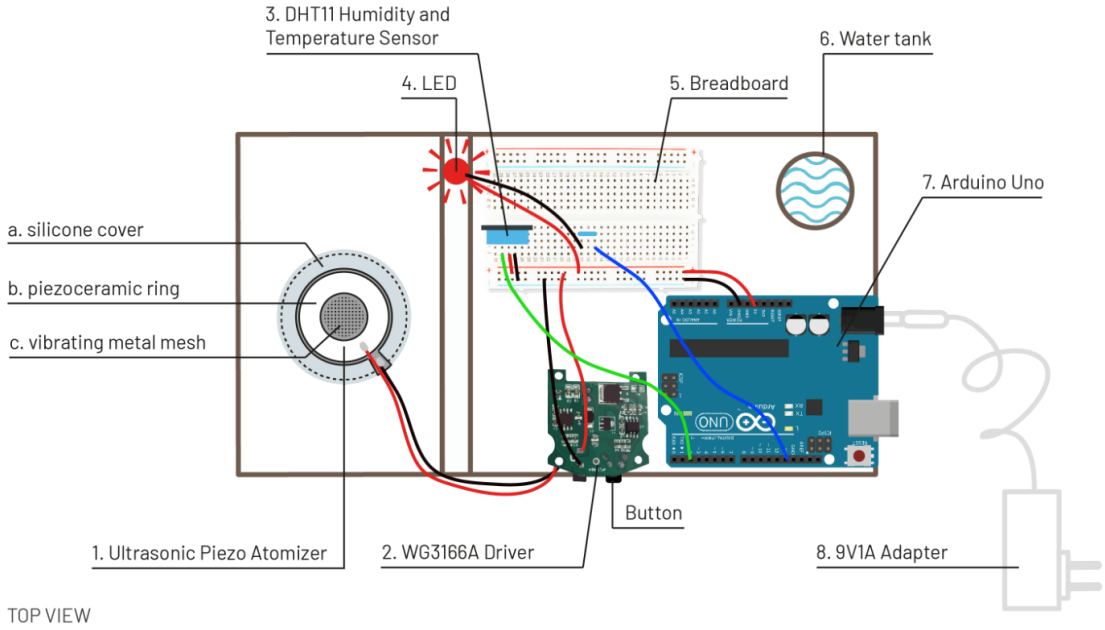
3. experiments / “sketching”



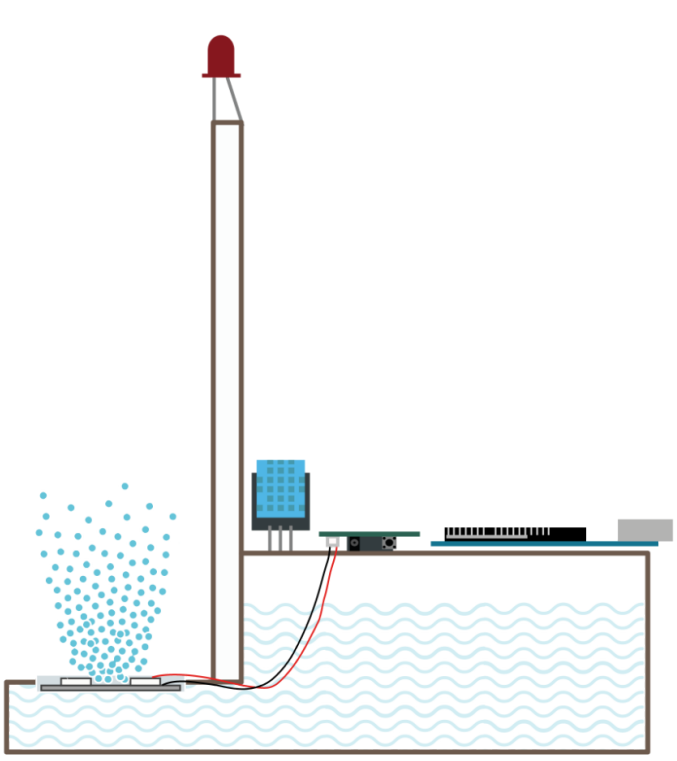
After a bit of research, I have worked out a more detailed plan:

- water tank on the bottom of the waterfall
- a water atomizer disk + module OR a regular humidifier that I take apart
- DHT22 Humidity and Temperature Sensor
- a fan to direct the mist away
- buttons/dials to turn on/off the mist creation
- single LEDs to indicate when action is required
- LCD panel to show measurements/instructions
- LED matrixes / LED stripes imitating the falling water

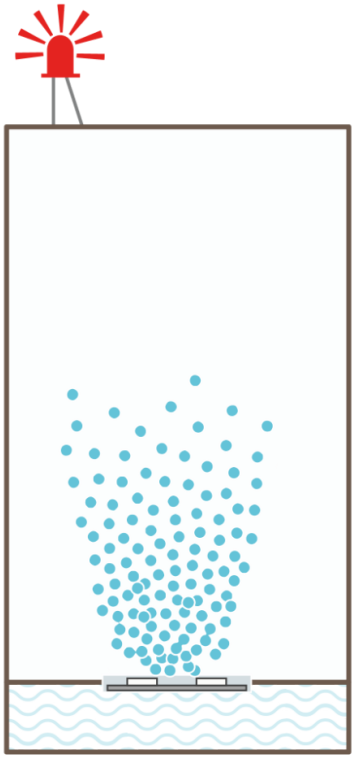
Once I ordered and received (most of) the elements, I was confident drawing up what seemed to be the final design, in terms of hardware, at least:



TOP VIEW



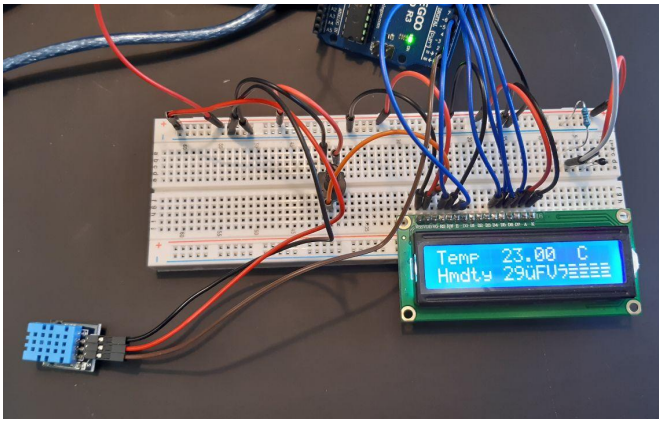
SIDE VIEW

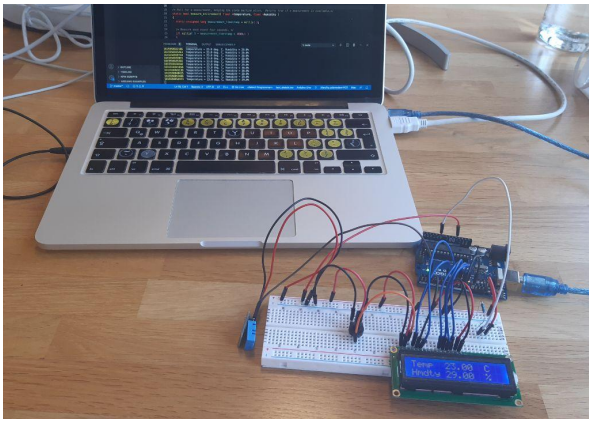


FRONT VIEW

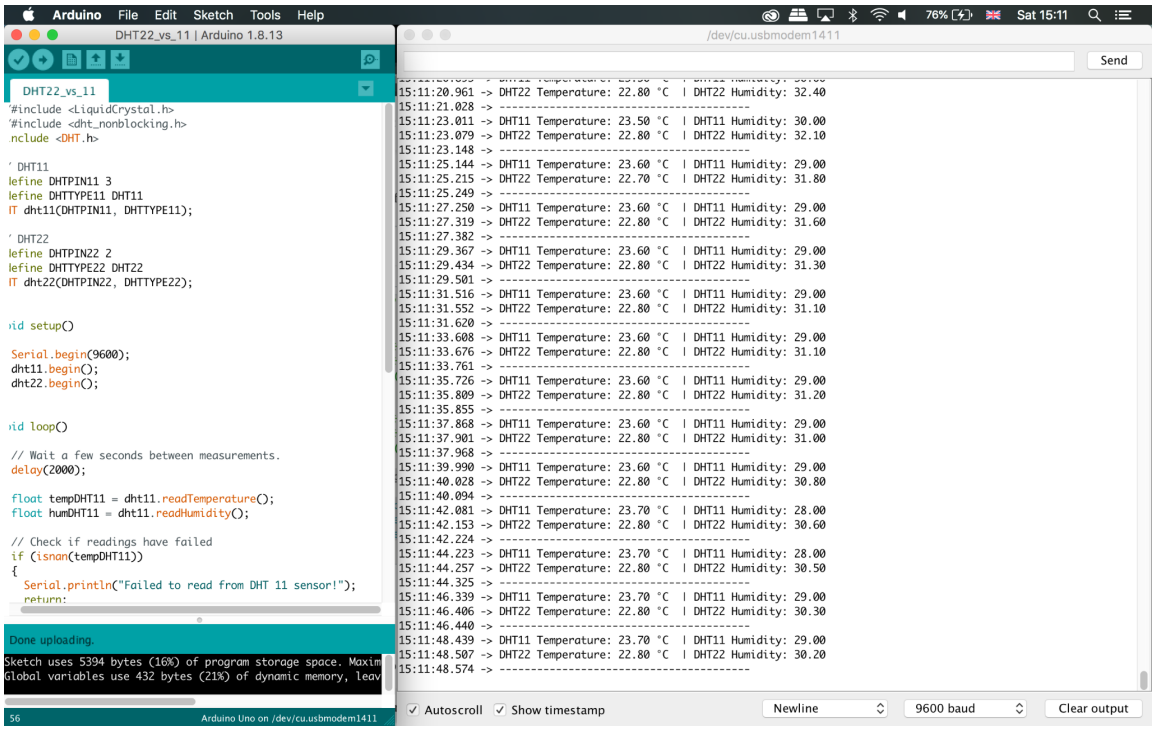
1. Ultrasonic Piezo Atomizer
2. WG3166A Driver Board
3. DHT11 Humidity and Temperature Sensor
4. A single LED
5. Breadboard
6. Water tank
7. Arduino Uno
8. 9V1A Adapter

Temperature/Humidity Sensor



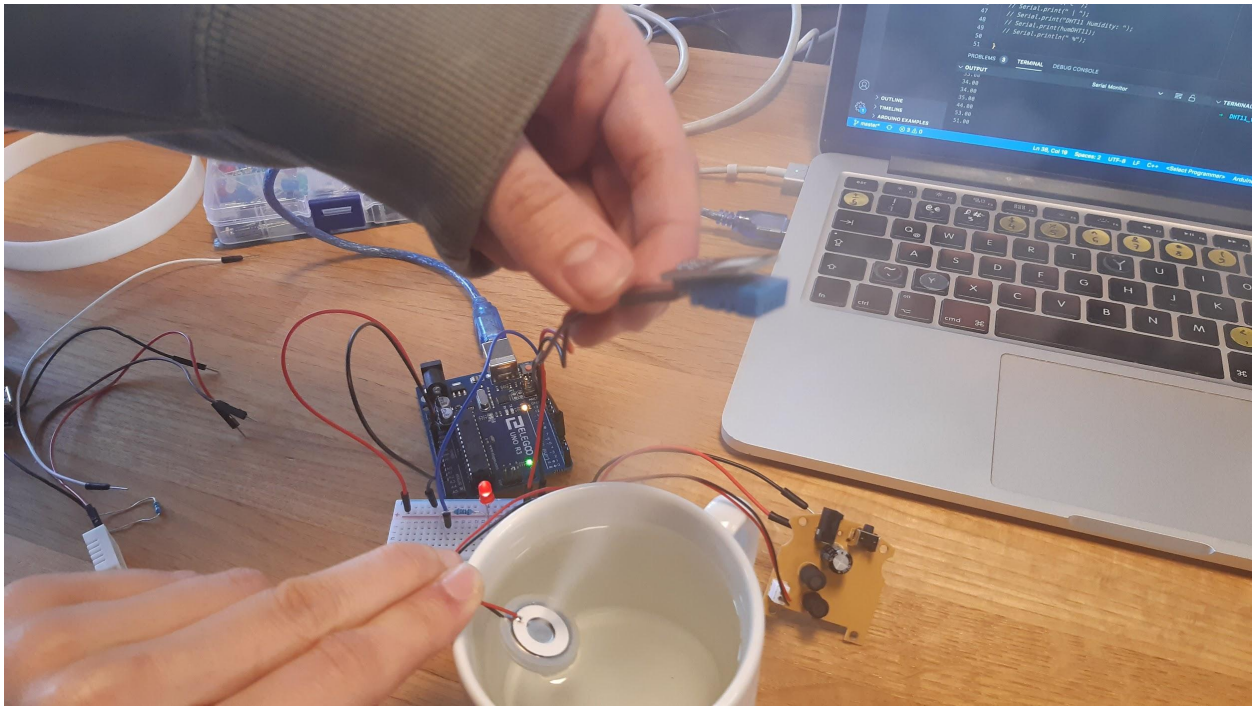


The very first element I was able to try out was the DHT11 Temperature/Humidity Sensor. Hooking it up with a LCD screen was easy enough, following a tutorial, and gave instant feedback. Being an SE student I went a few steps further, creating a node app for logging purposes - which I then deleted. I also compared the accuracy of the DHT11 vs DHT22, but I decided to use the former, as I made a rookie mistake of buying the latter without a PCB, which simplifies wiring. They read similar enough:



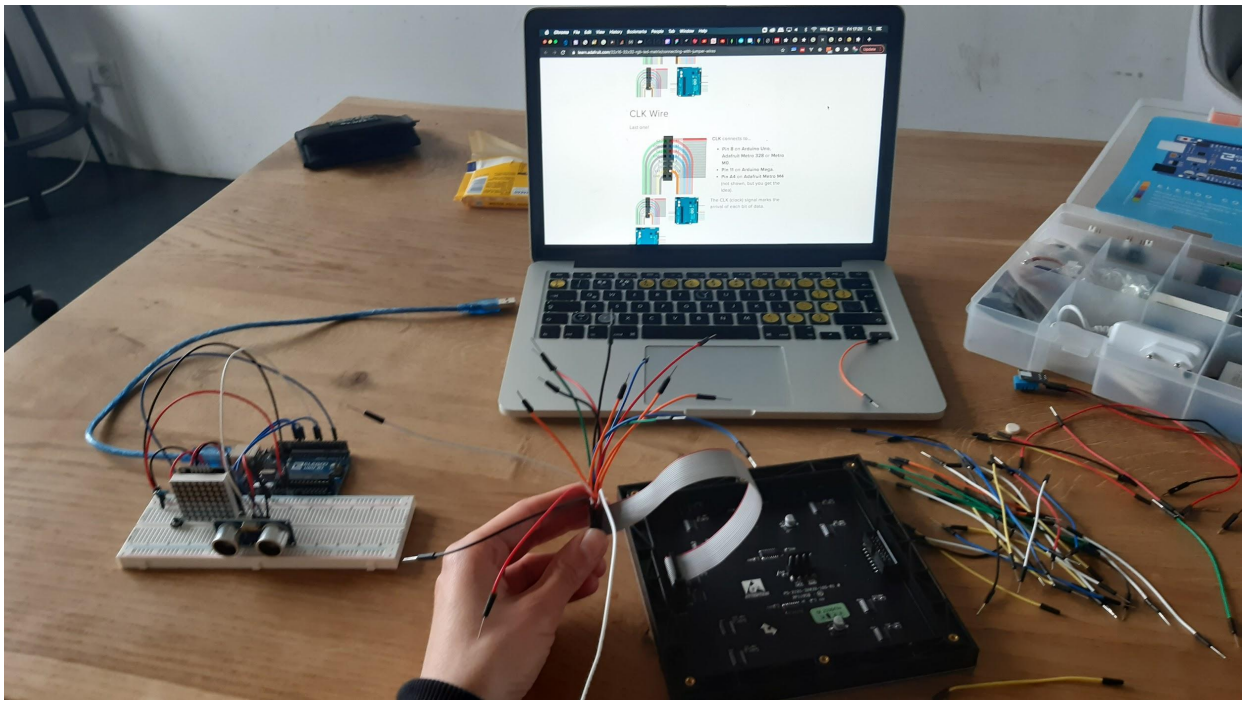
113 KHz Ultrasonic Atomizer + PCB Module

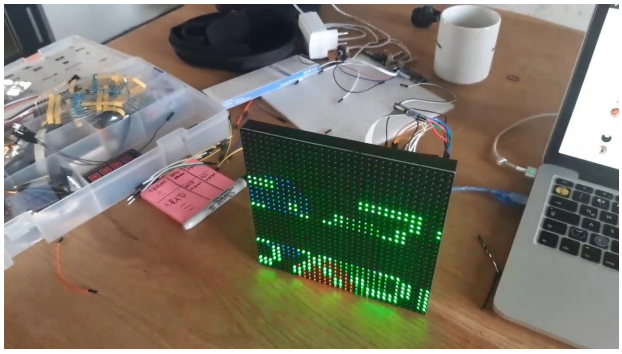
One of the scariest parts of the build was finding, buying, receiving and making the atomizer work. My initial inspirational video was using a commercial humidifier element, slightly disassembled, but I wanted to go the more “granular” way. It worked miraculously! At first, but more about this later…

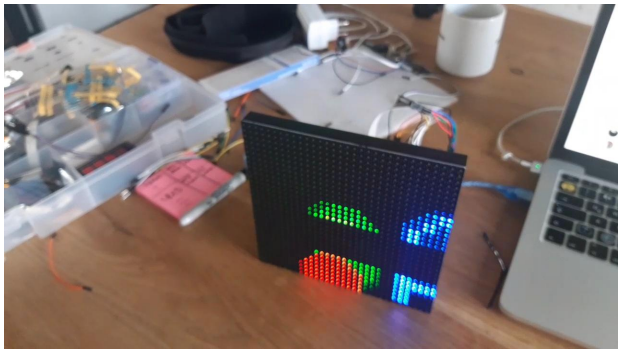


Symbolic waterfall

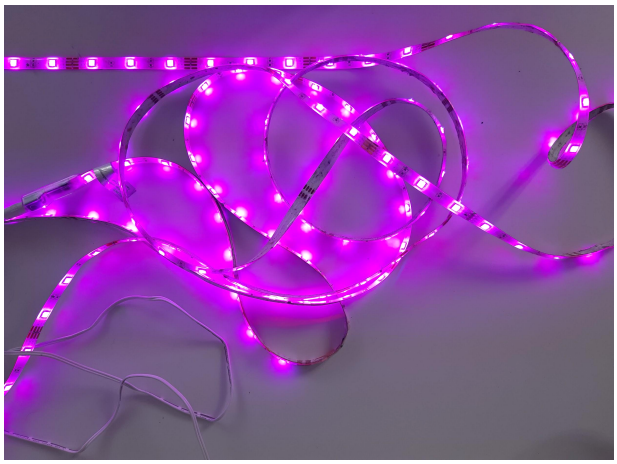
Adafruit 32x32 RGB LED Matrix Panel

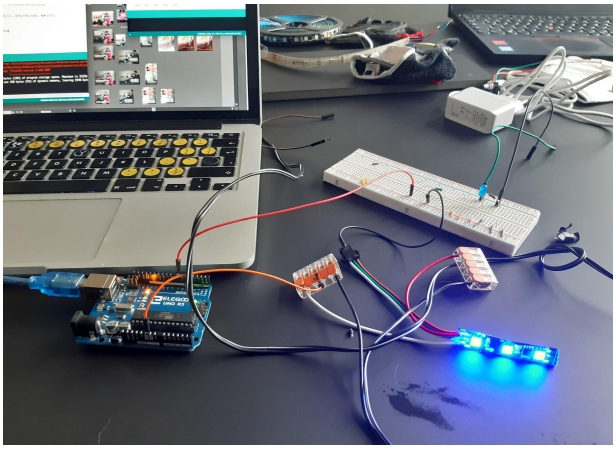






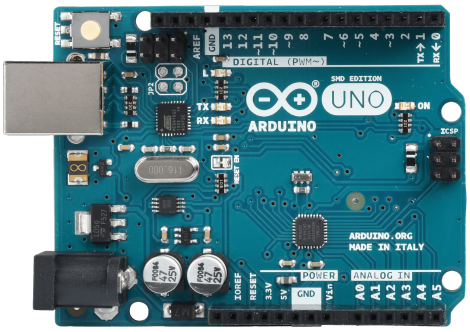
I had two ideas, either I use some LED Stripes, or a full-on LED Matrix. Of course, the Matrix could have been much more impressive, but since I accidentally ordered a matrix that can't be connected to a microcontroller with such low memory as the UNO, I did try to chop up some stripes and make that work for my waterfall imitation needs. If nothing else, I did learn a lot about electricity - and short circuits...

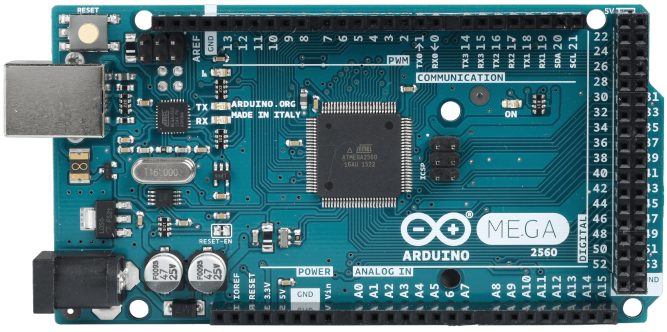




Swapping UNO to MEGA

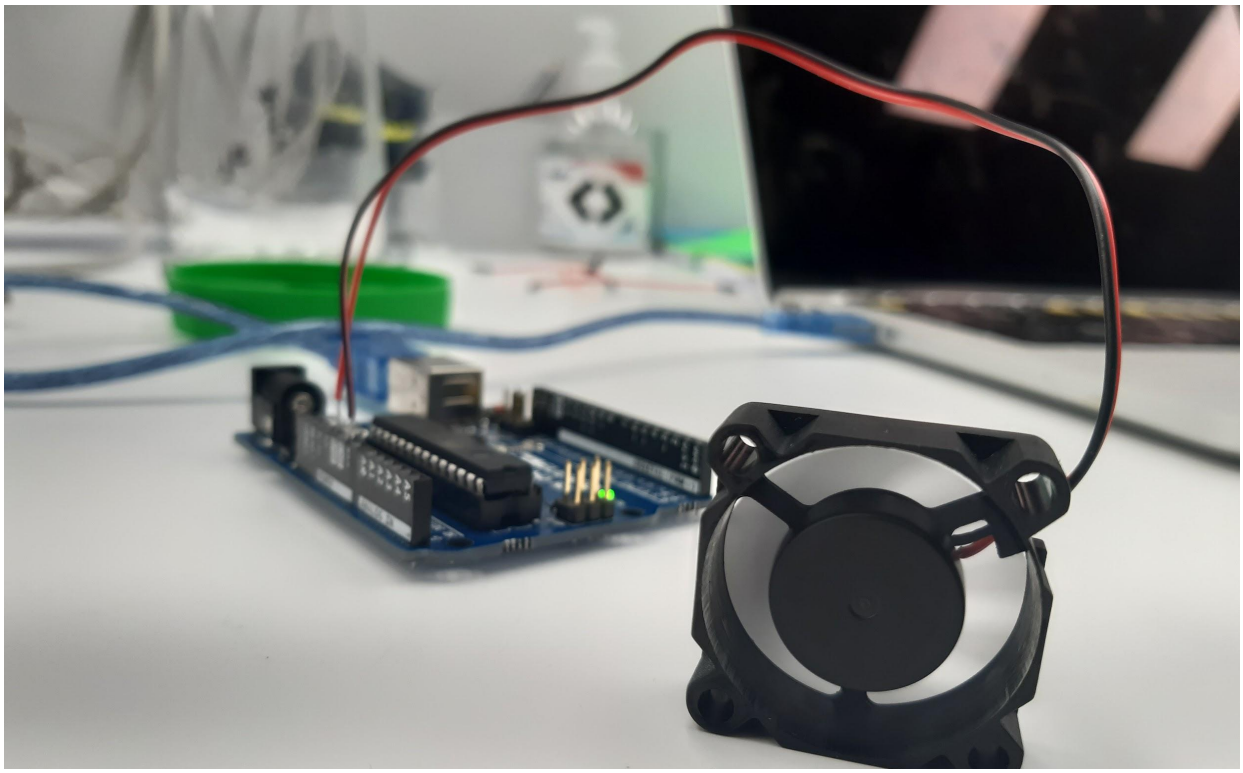
So, when I accidentally fried the whole UNO while programming the stripes, I concluded that it would be easier to order a new Arduino, a MEGA. As it is compatible with my so far useless Matrix, so it sounded more appealing than ordering another UNO and continuing to struggle to code something half as impressive as what the Matrix's libraries could easily do. Plus, no need for a second LCD screen, all the information can be displayed nicely!





Thermoplastic 3010S / 4010S / 9025S 12 / 24V Brushless DC Fan Cooler

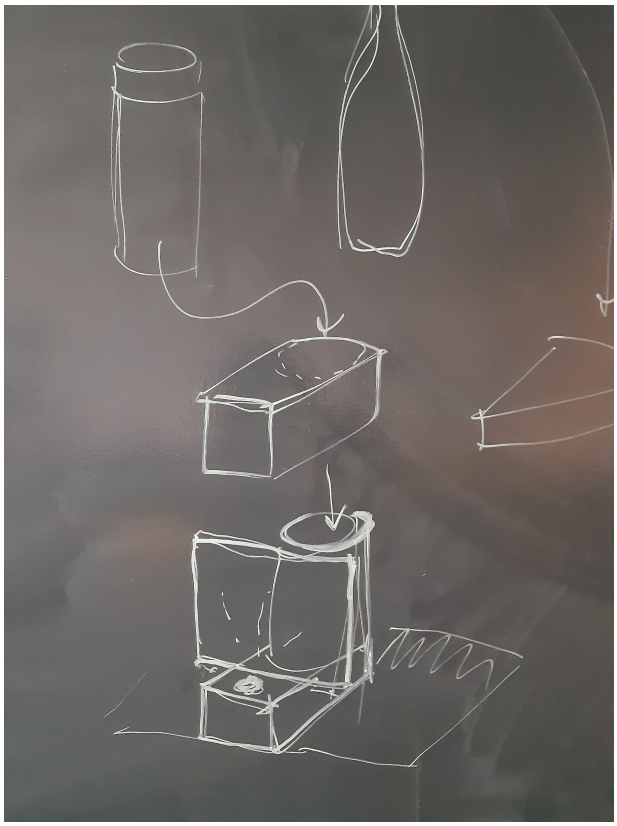
Deciding on the fan that drives the created mist away was easy, thanks to the tutorial I found. It arrived on time and was literally the easiest thing to test and wire.

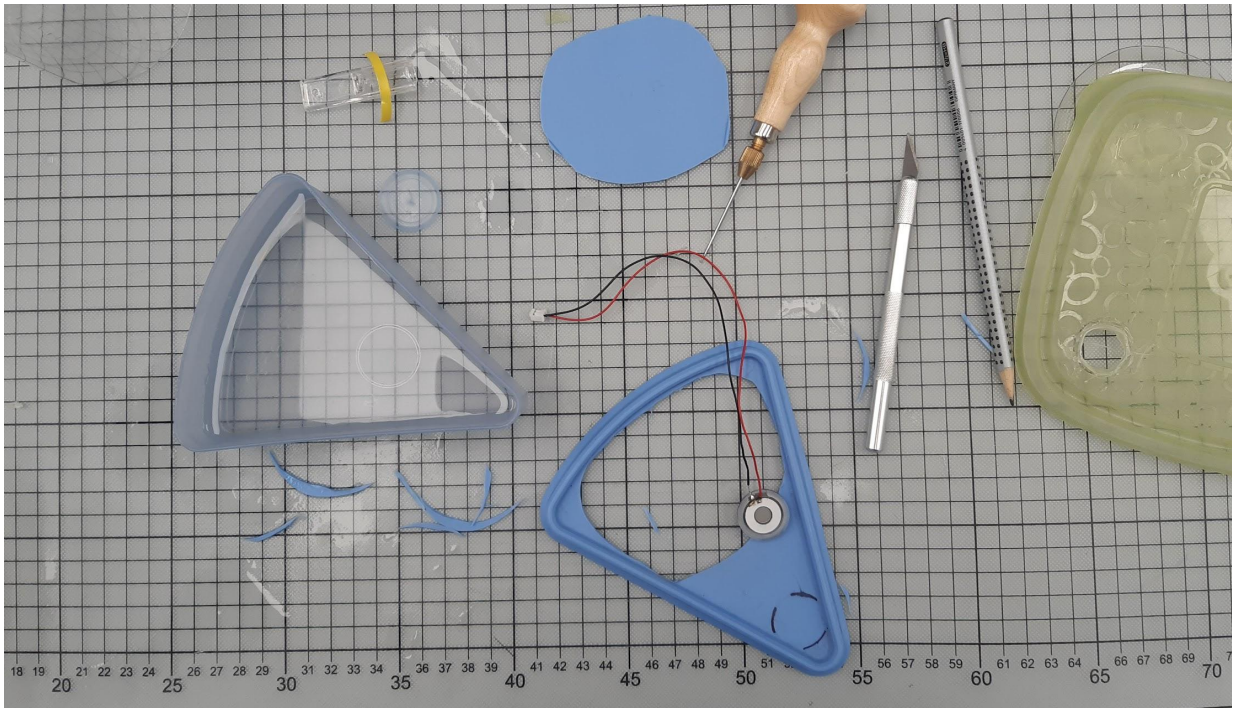


AC 110V 220V Converter DC 24V 1A Server Power Supply Adapter 828

The power supply was specified by the same tutorial, and it required some wire cutting, but was relatively easy to integrate into my slightly modified design.

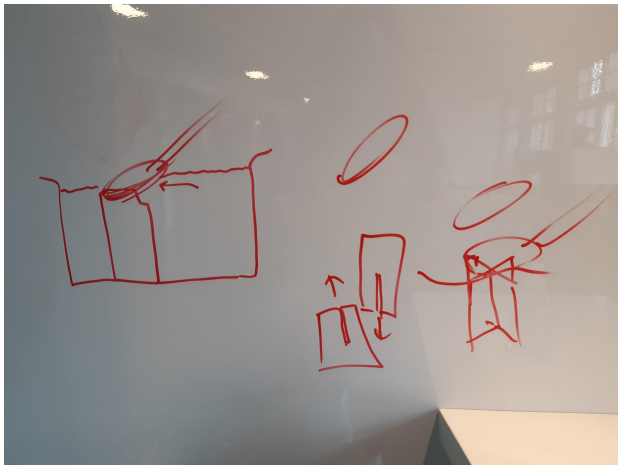
The actual build

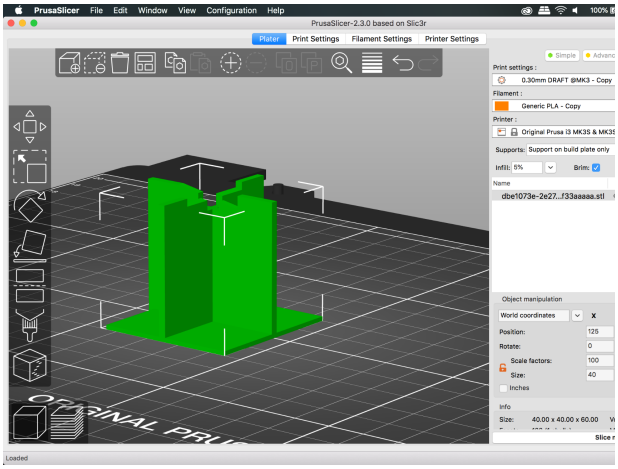


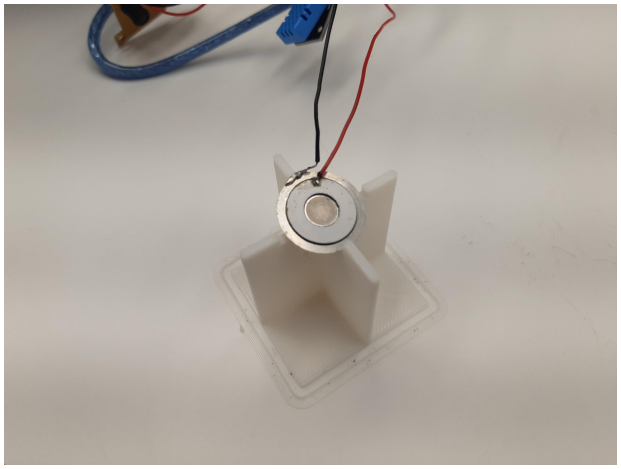


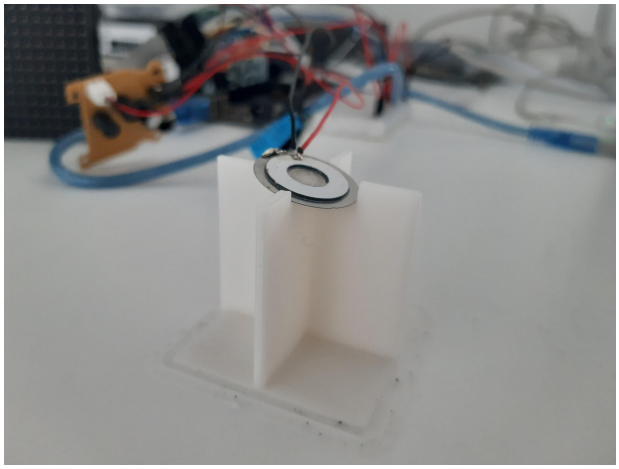
For the water tank that would host the water atomiser and the fan, too, I was trying to get some unused plastic containers, but the different types of plastic broke and bent differently. The multiple fit test and gluing unfortunately also damaged the wiring on the fogger... I had to think of something else instead of gluing it in place and hope for the best.

How to keep this afloat?









But the repeatedly re-soldered wiring of the disc became weaker and weaker so I needed to give up on it after a few painful hours, since soldering them back properly was close to impossible. Defeated but happy to have the backup that was initially recommended in the tutorial.

Continued at Part 2...