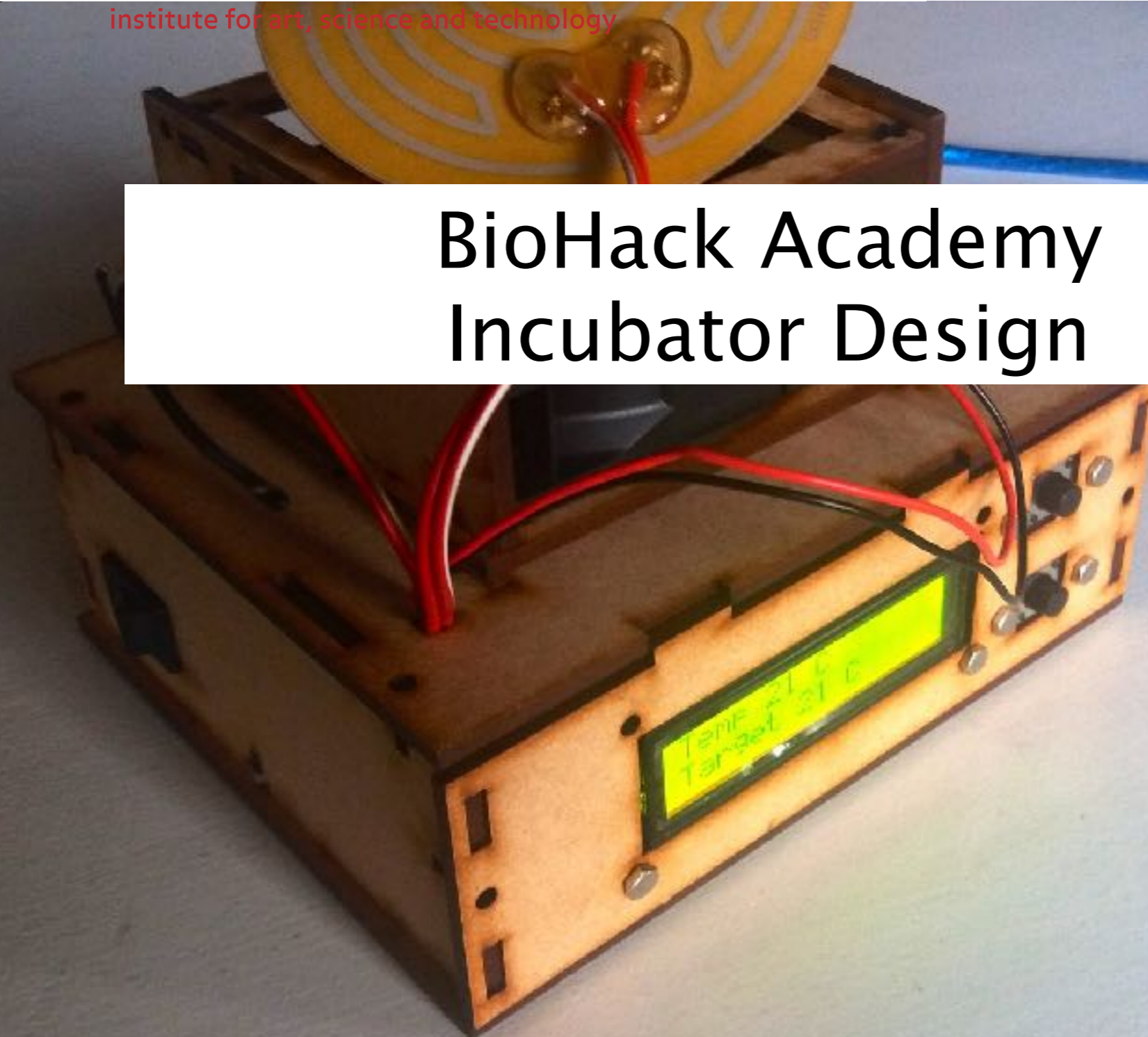




waag
wetlab amsterdam

institute for art, science and technology

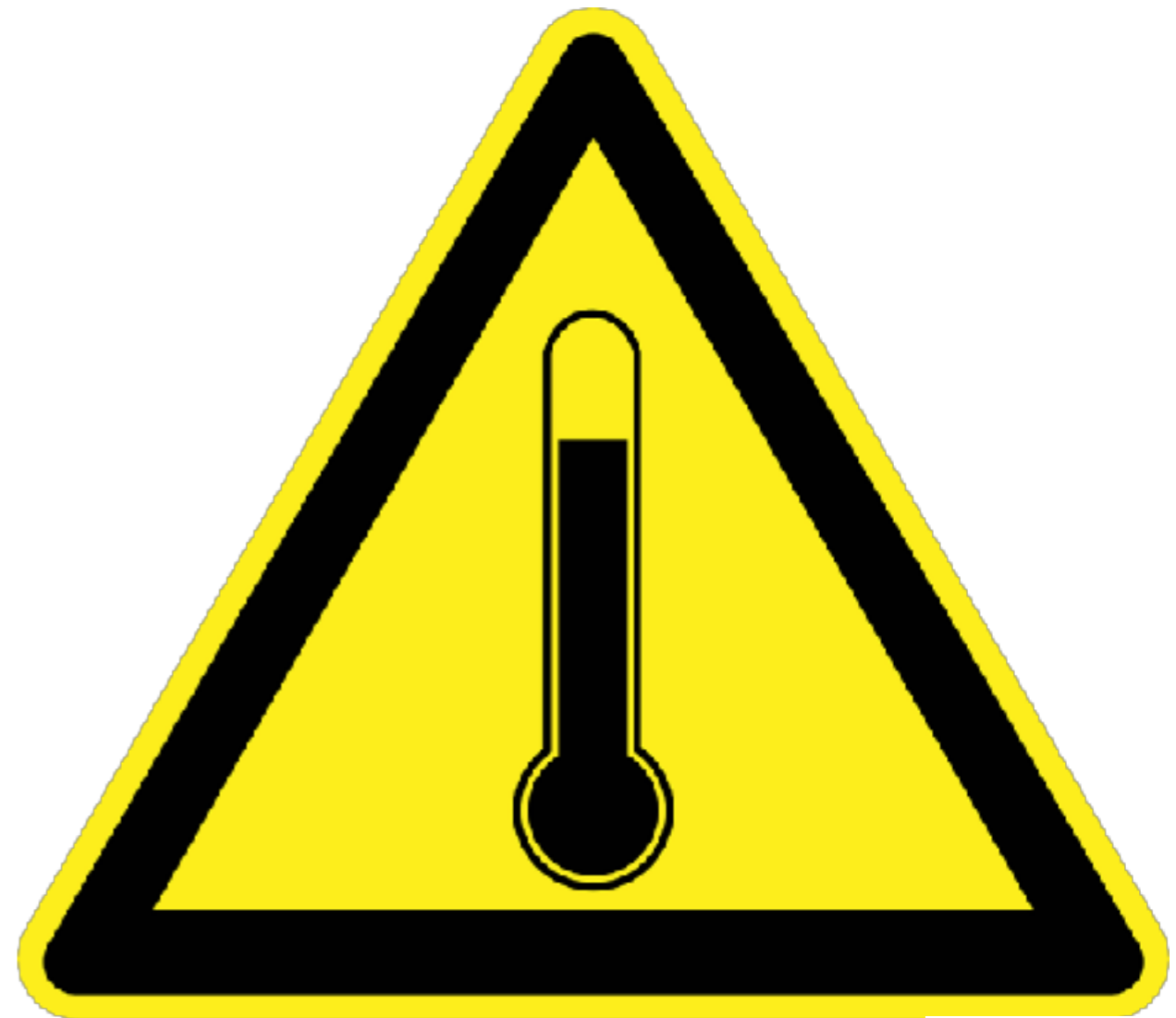
BioHack Academy Incubator Design





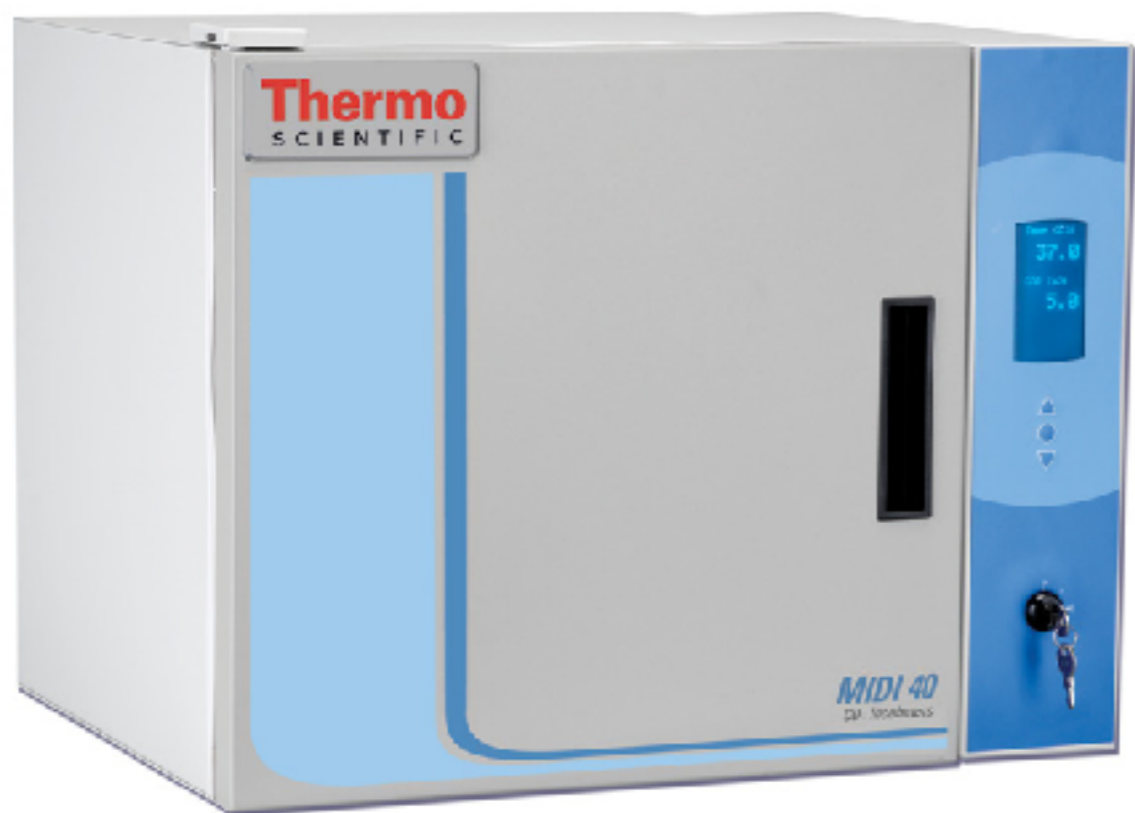
Why we need an incubator

- The behaviour of microbes is temperature dependent
- Temperature dependent:
 - Enzyme reactions
 - DNA interactions
 - Cell state





Industry standard





Function

- Heat isolated enclosed cabinet, often with see-through window
- Heat source
- Temperature controller
- Temperature indicator
- User interface to set temperature



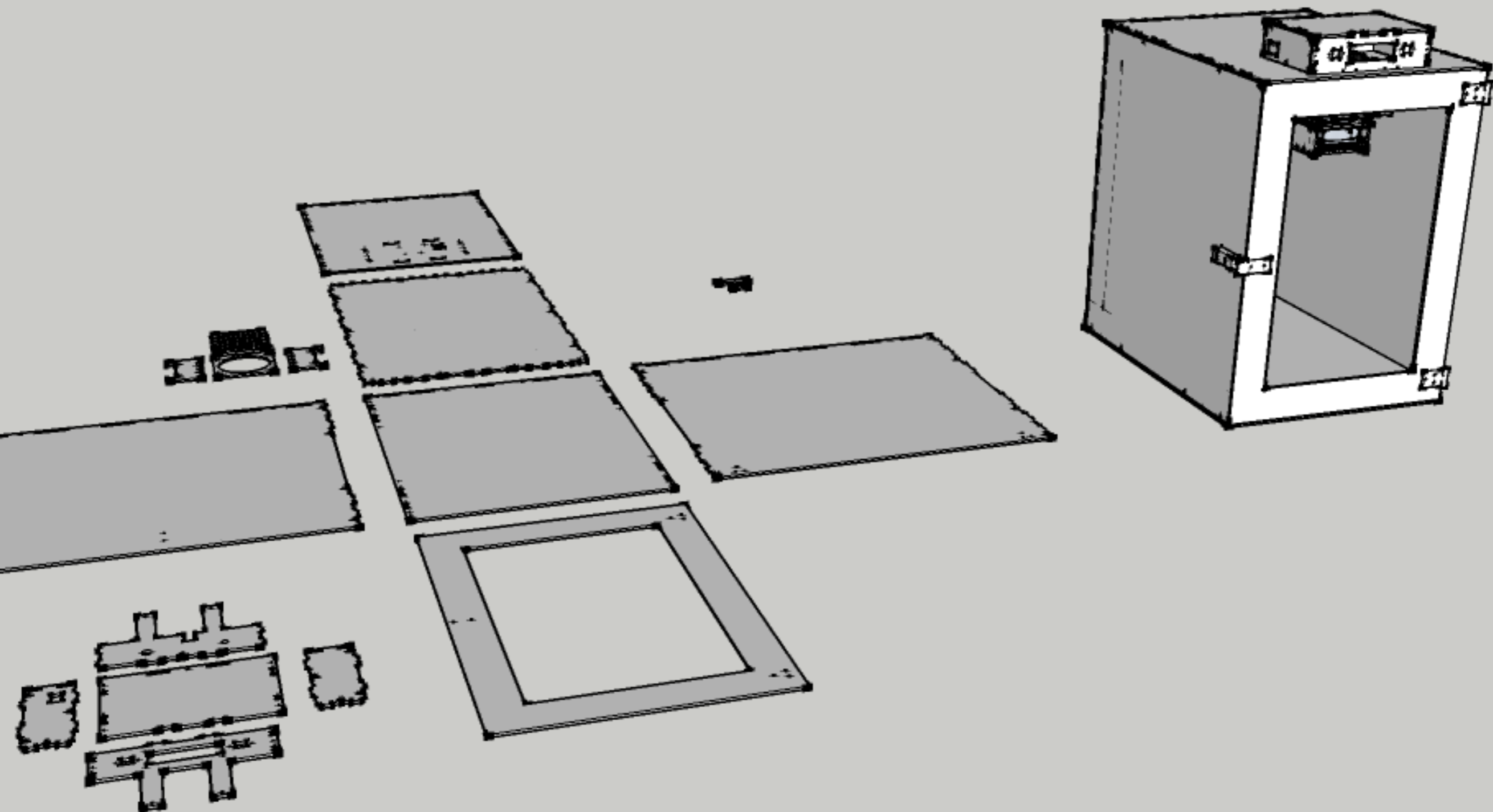
Design constraints:

- 9 cm petri dishes



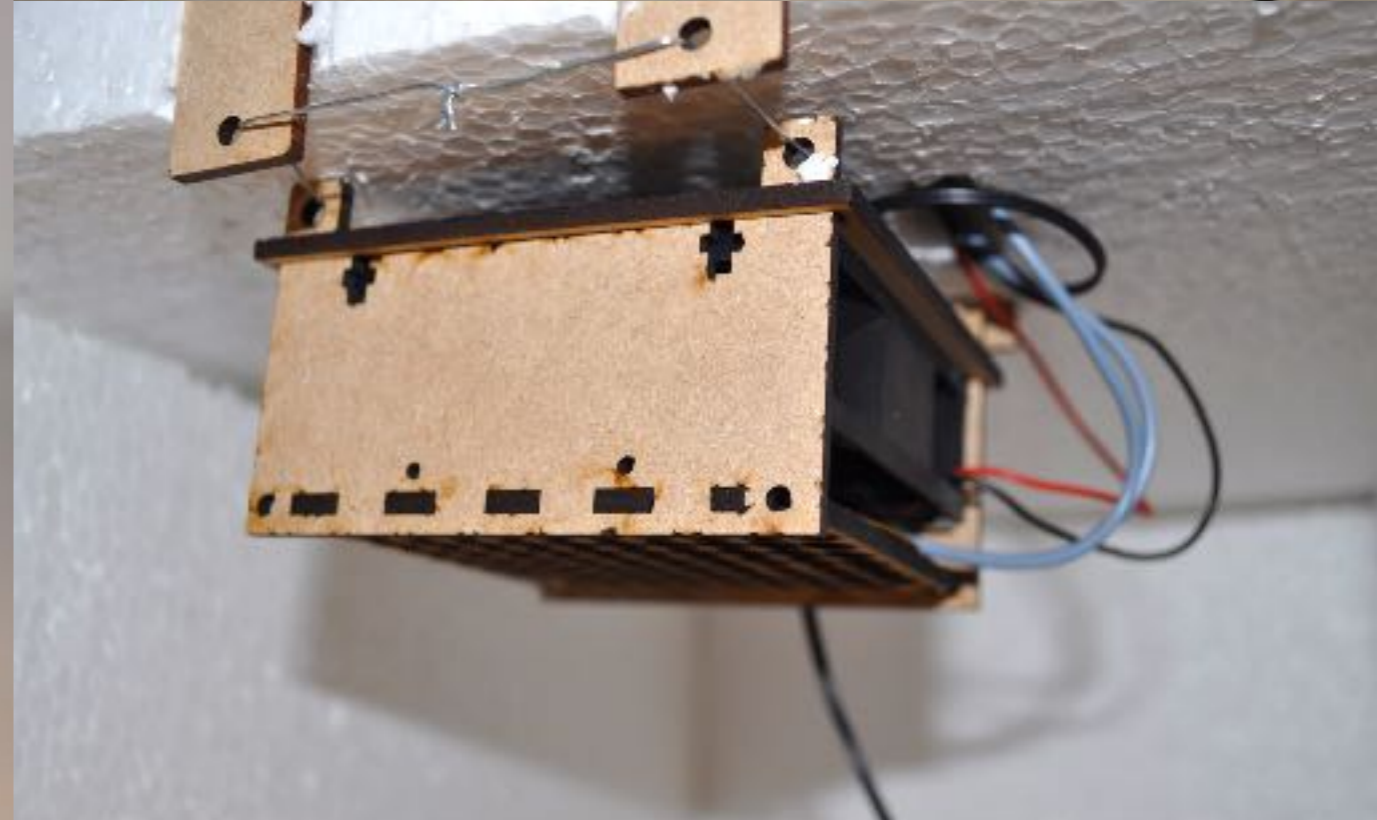
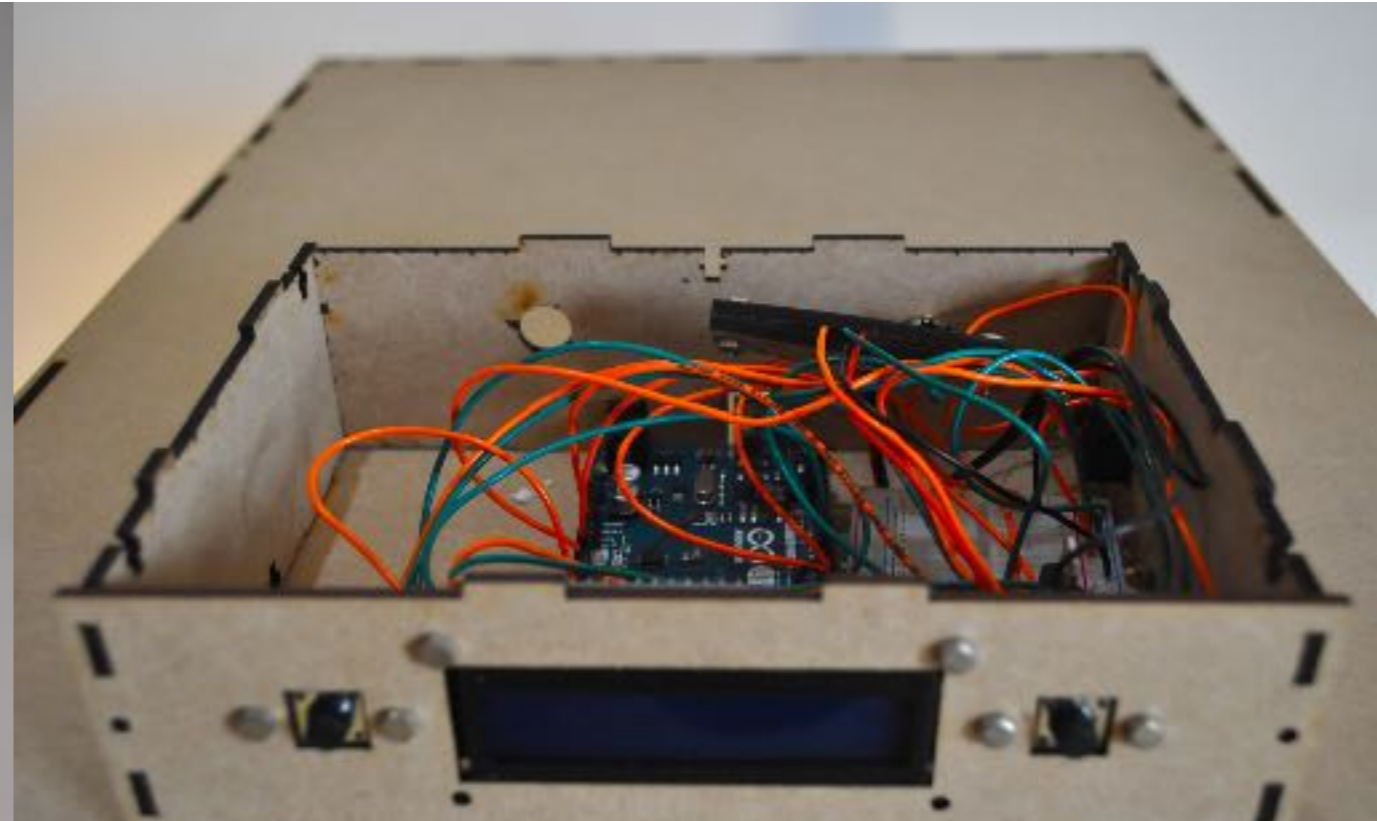
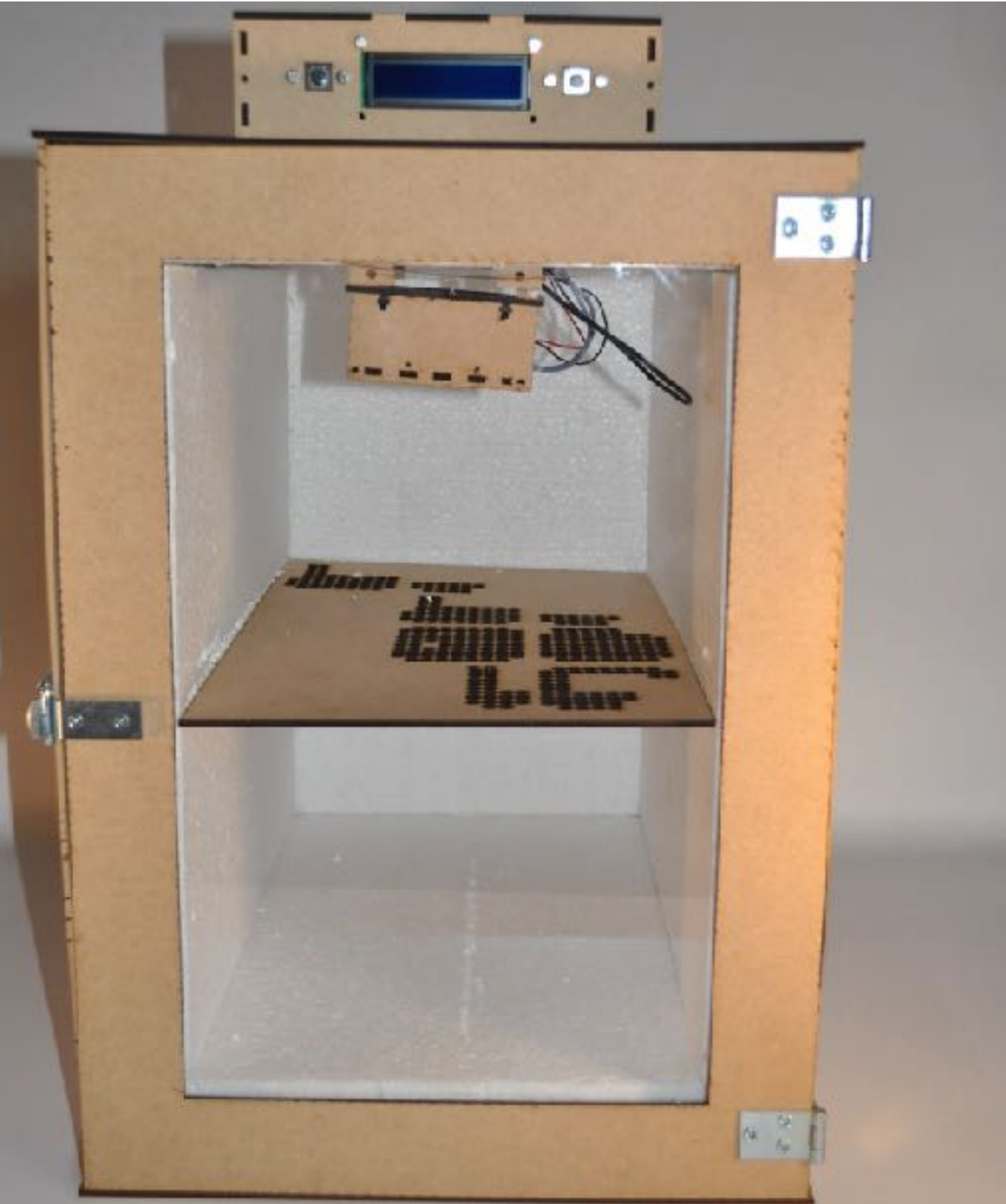


BHA3 Incubator



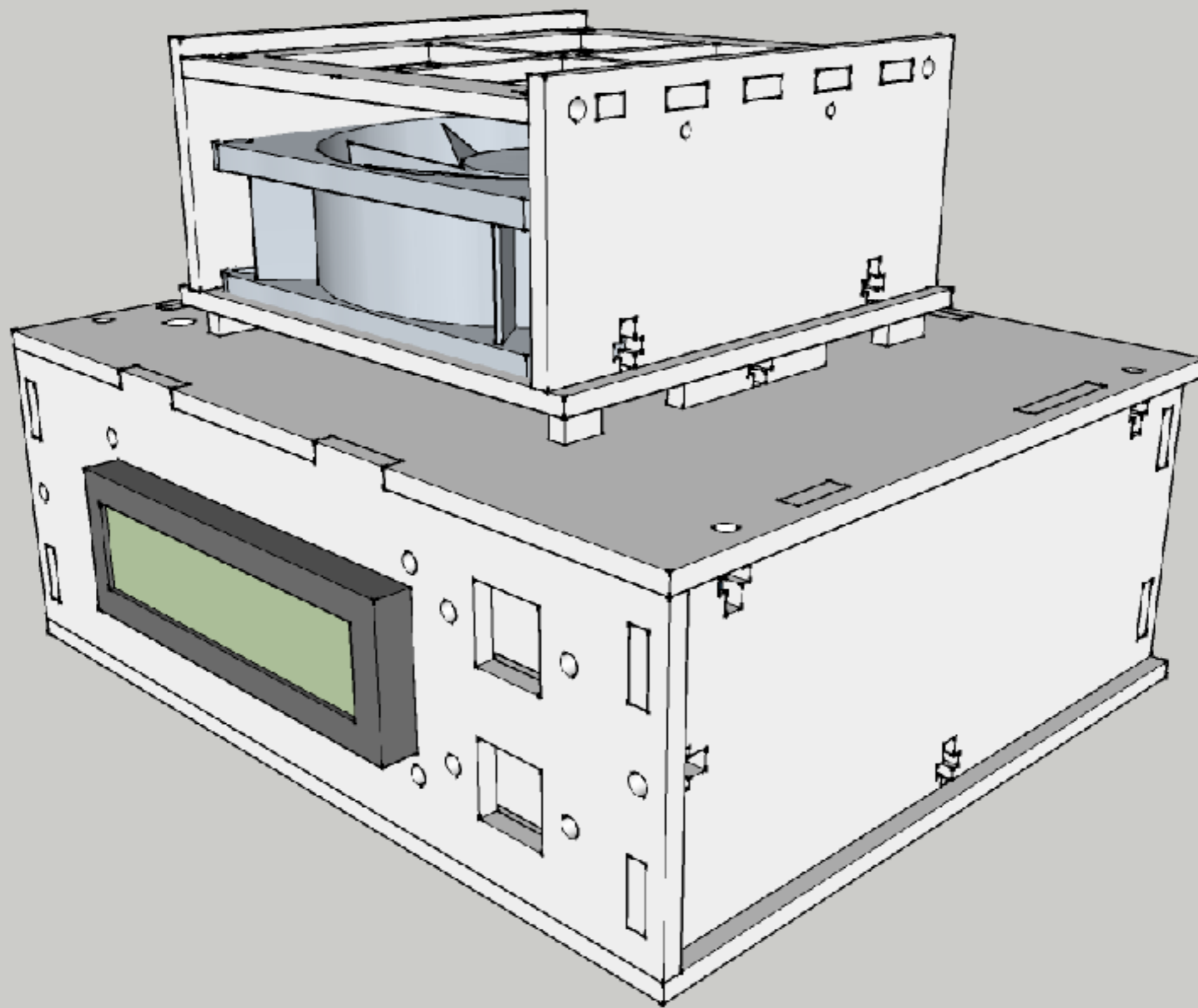


BHA3 Incubator



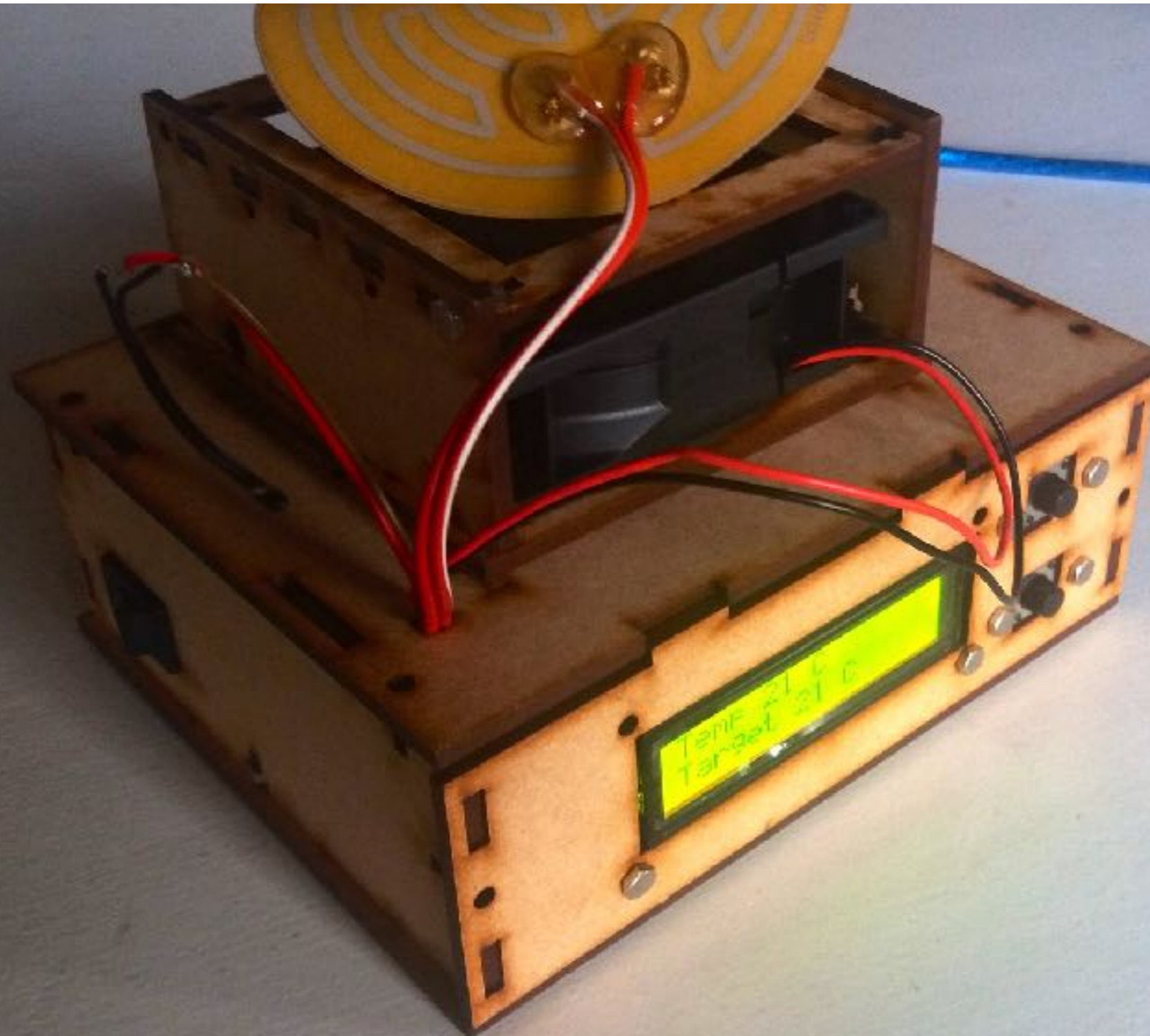


BHA4 incubator





BHA4-6 incubator





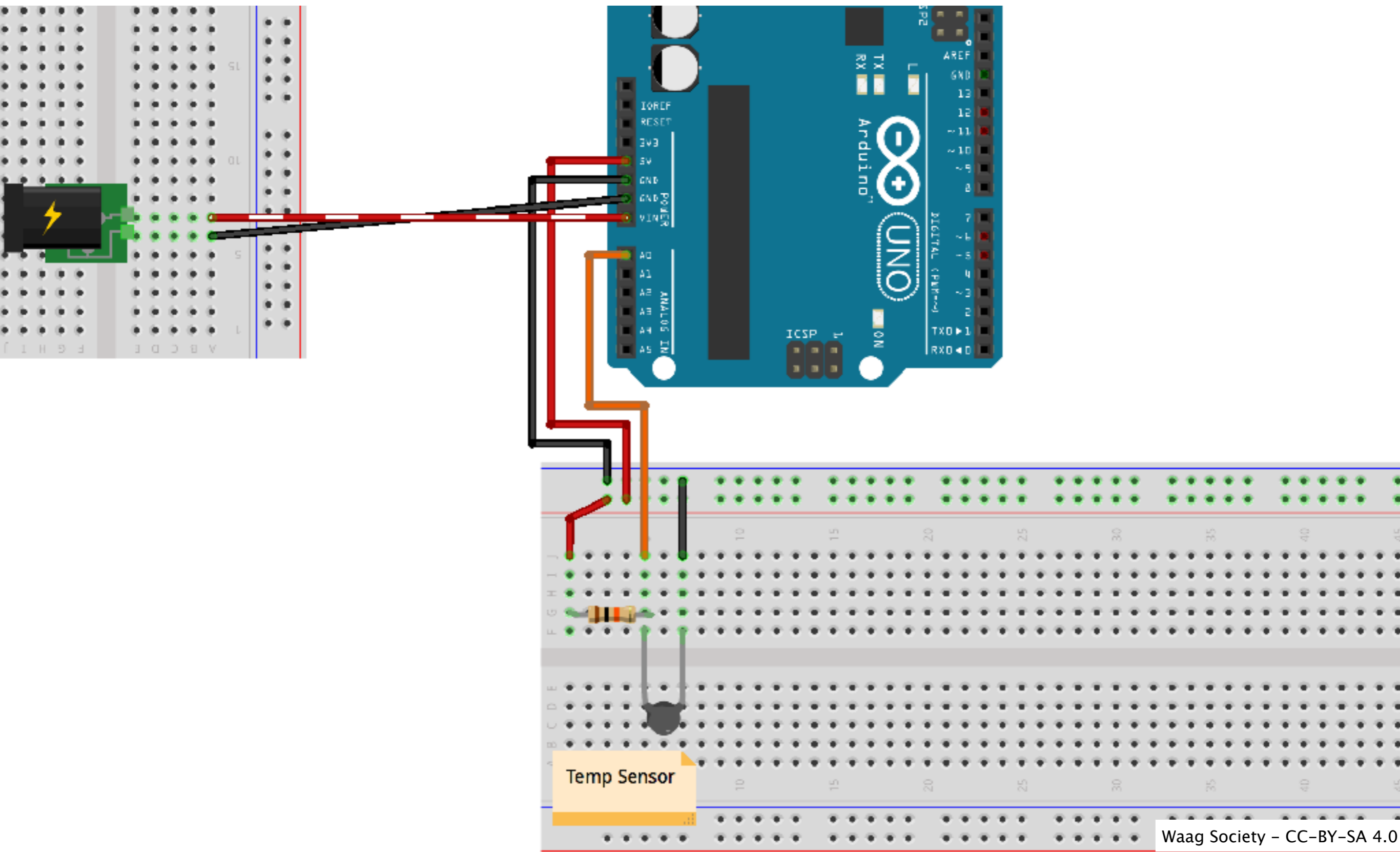
Sensing the temperature

- 10K thermistor





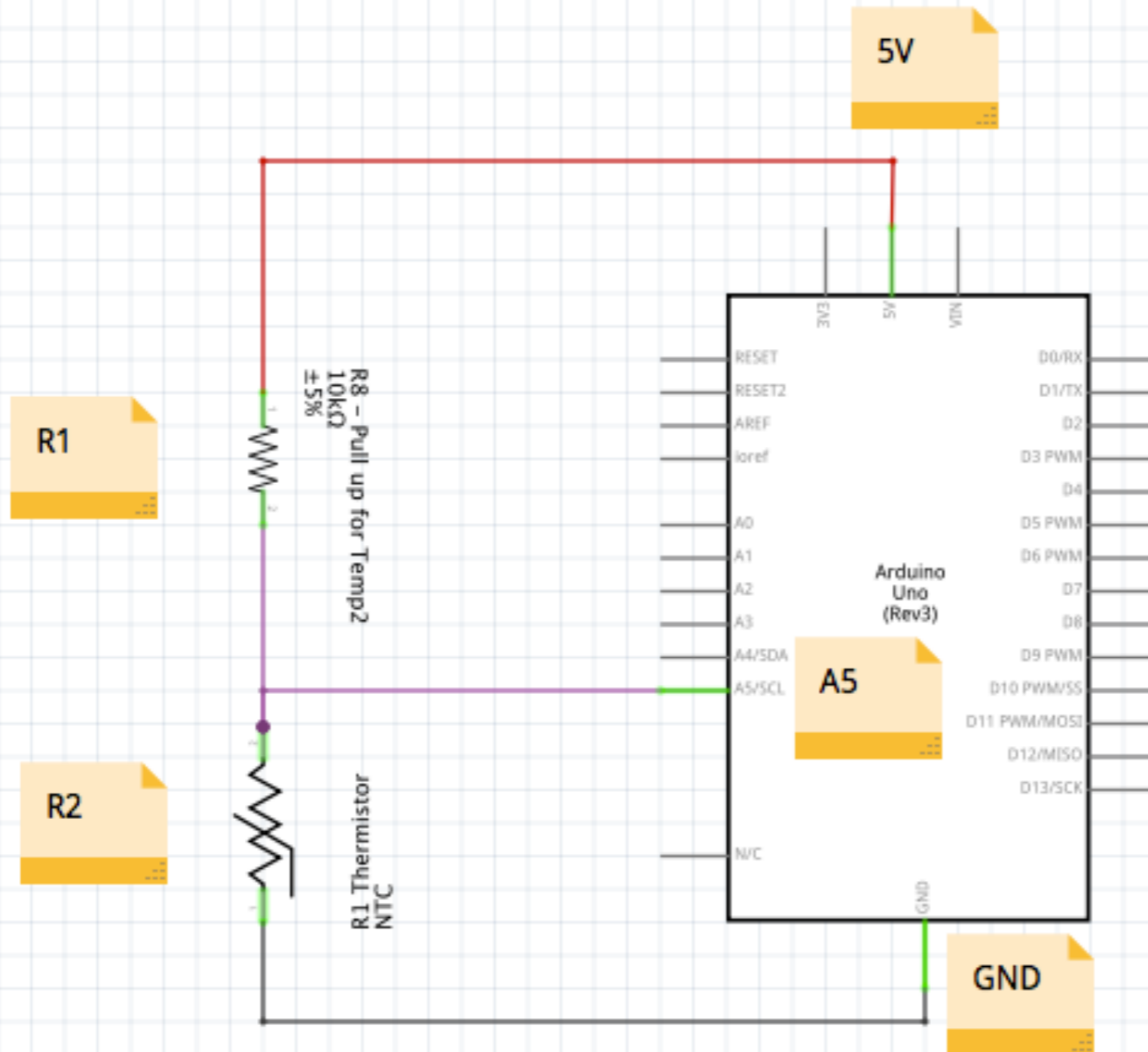
Sensing the temperature



Temp Sensor



Schematic

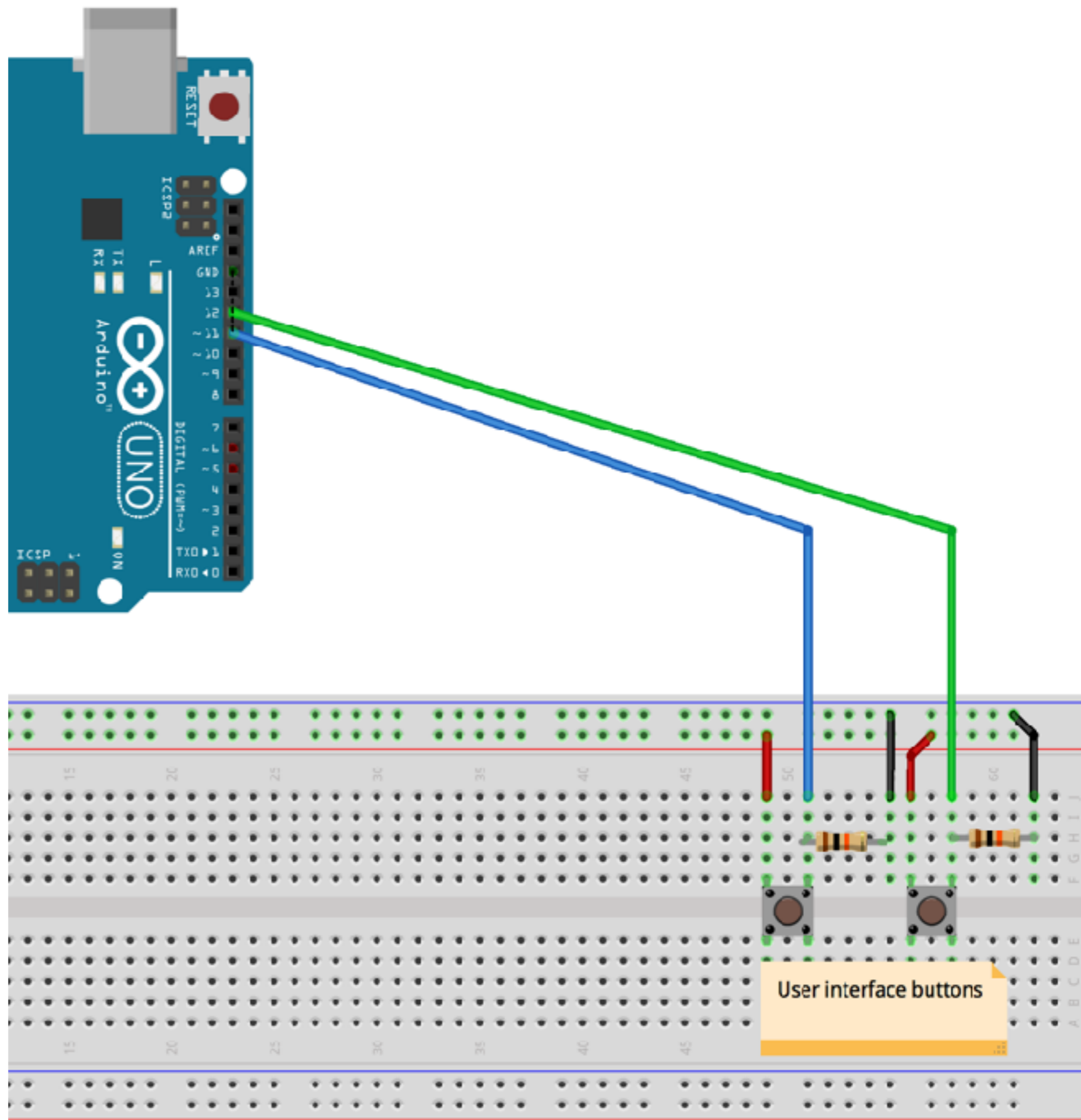




Push buttons

Pull down resistors

- 10 K Ohm





Selecting a heat source

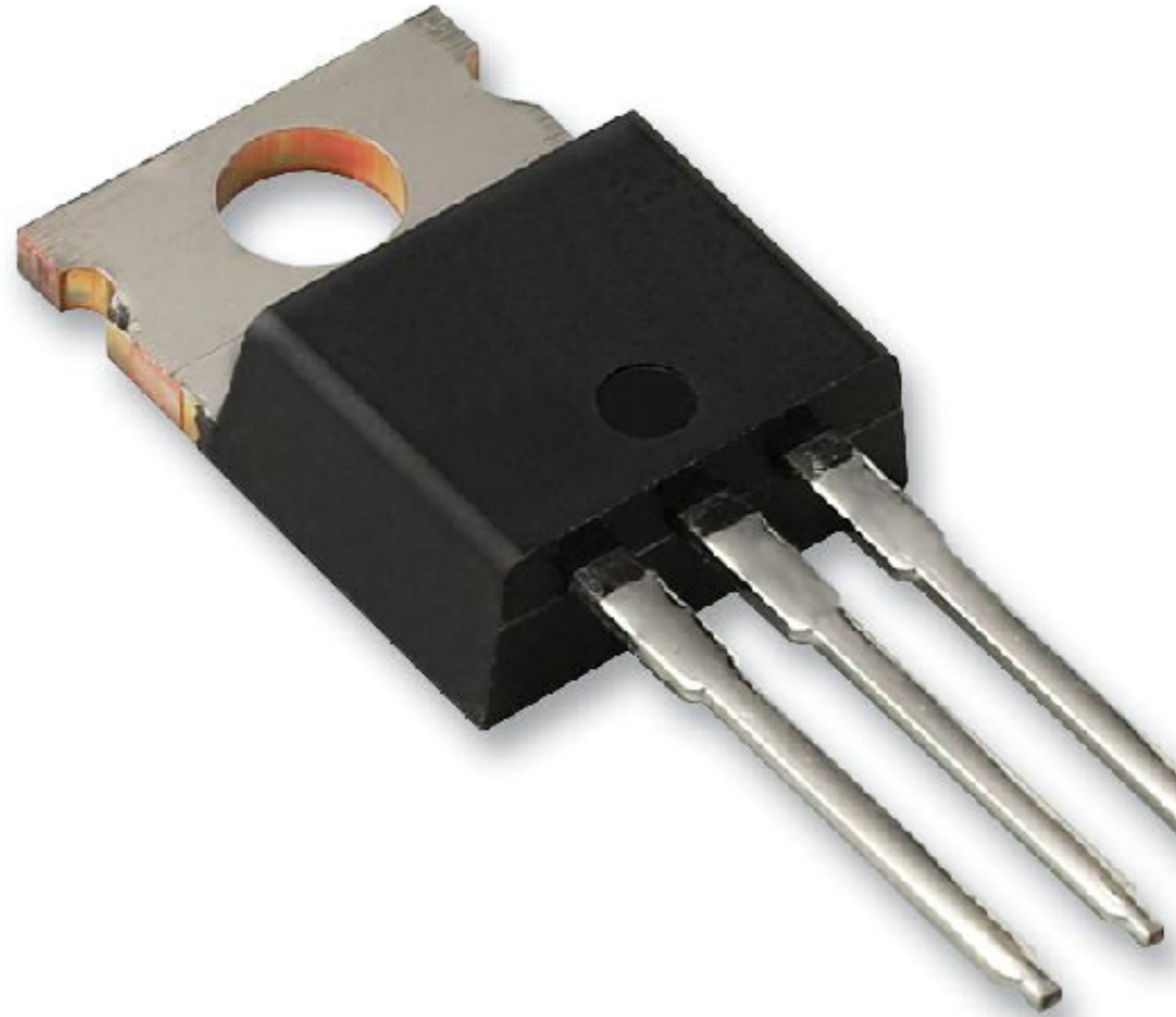
- Lamp
 - Heat as a by product
- Microwave
 - Needs liquid to heat
- Infrared
 - 100W infrared
- Power resistor





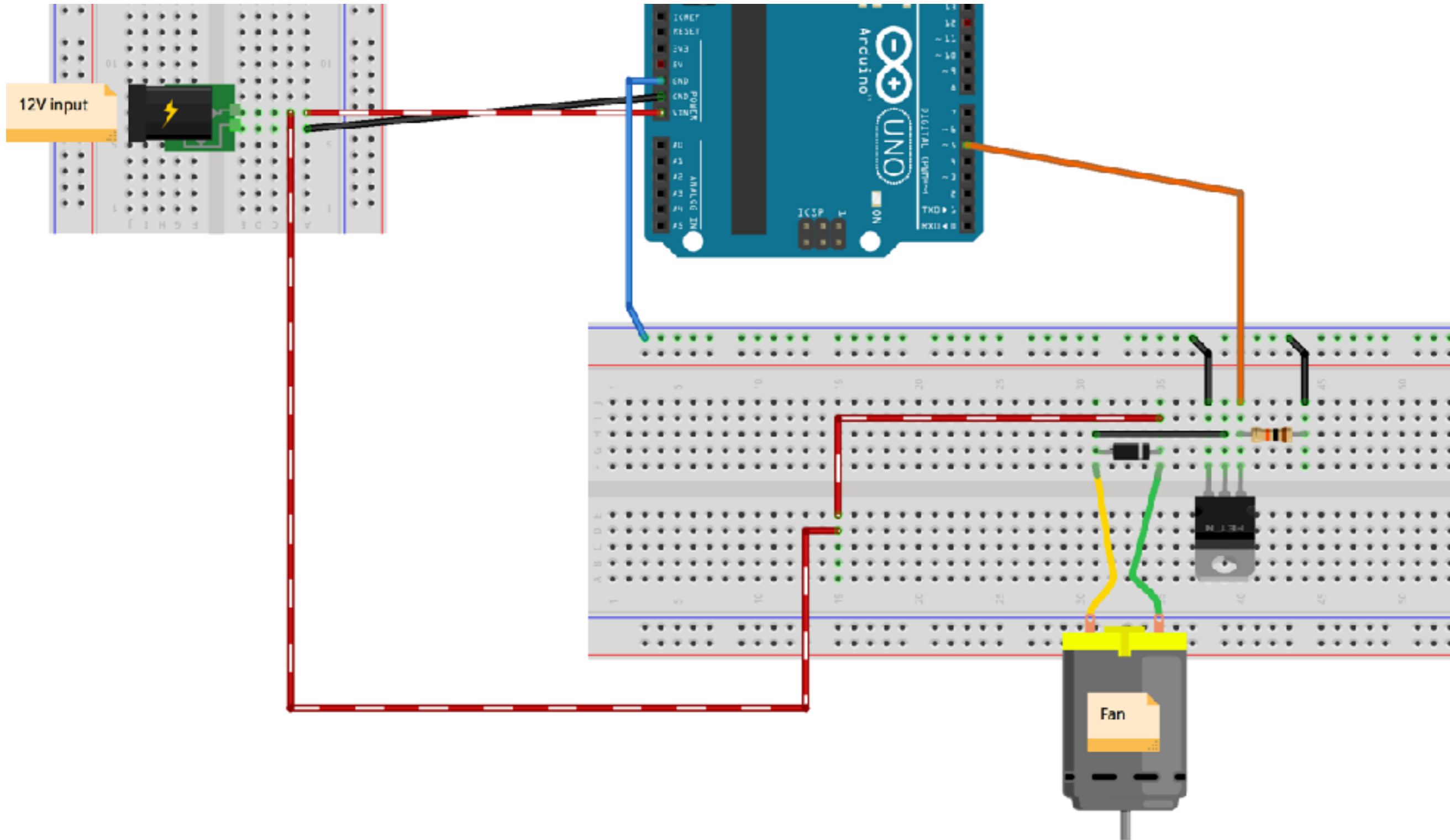
Fan speed controller

- MOSFET
 - Semiconductor
- N-channel
- 60V
- 30A



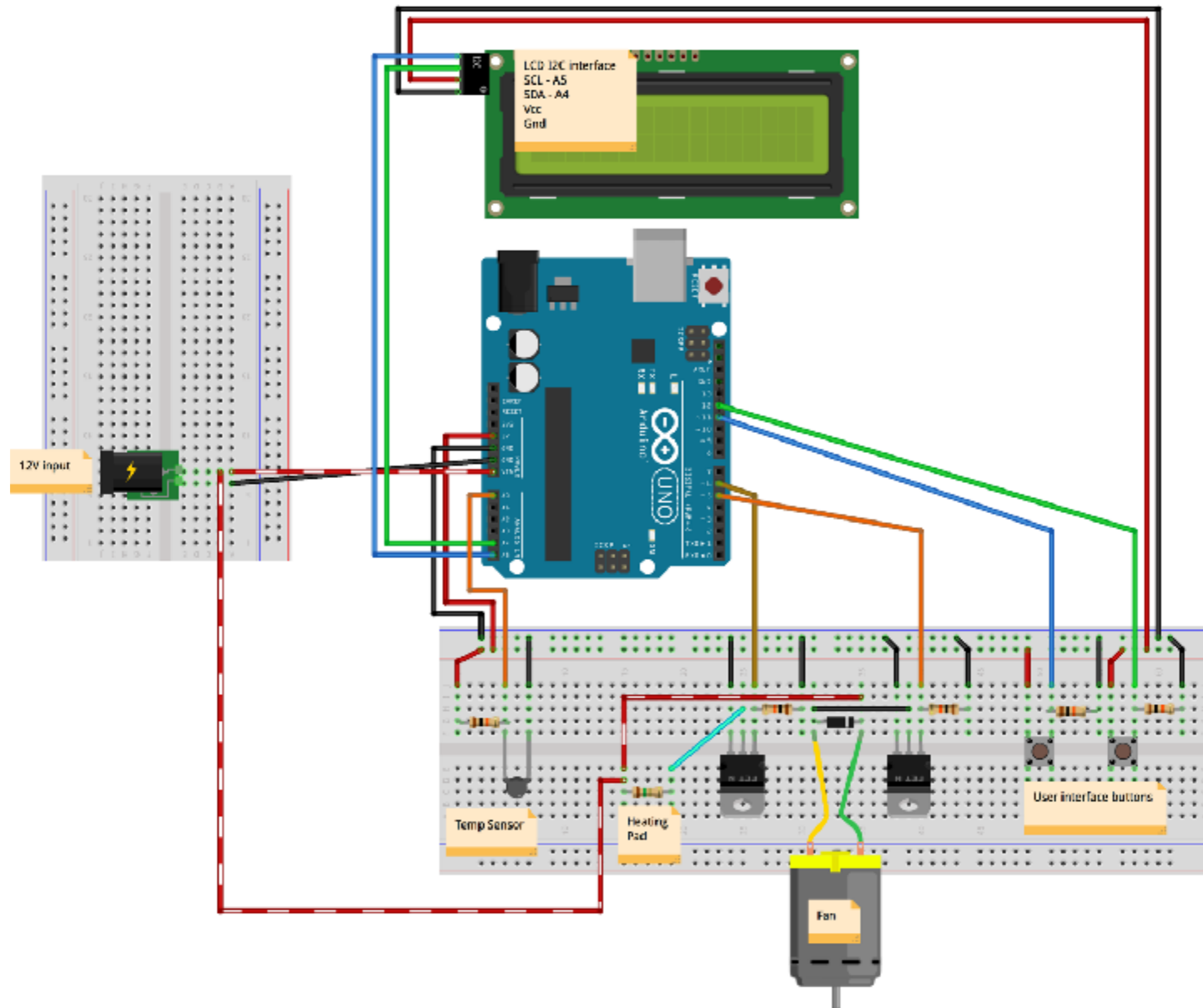


Controlling the fan



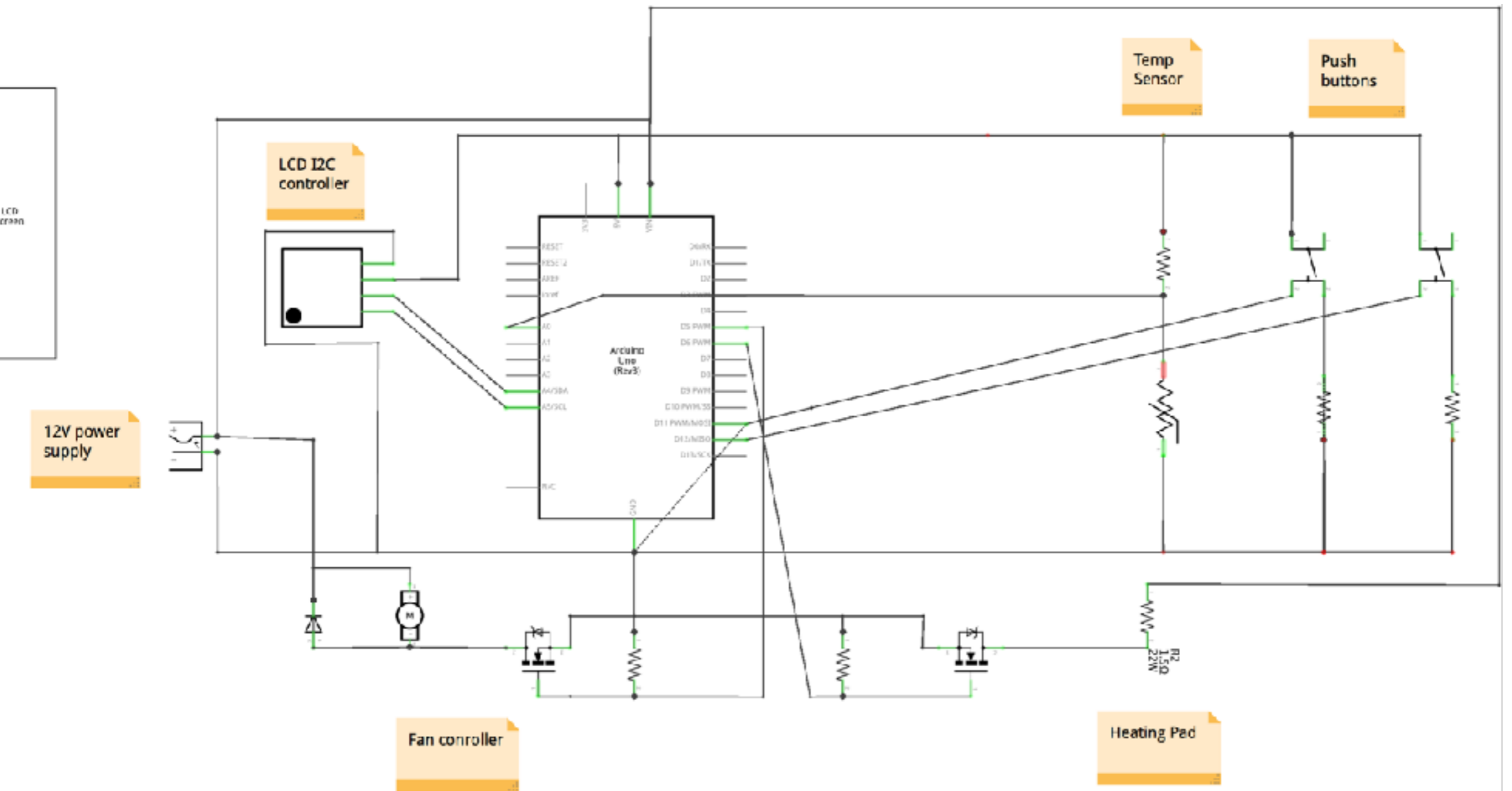


All of the electronics together





Schematic



fritzing



Power Supply

$$P = A \times I$$

Power = Current \times Potential

Watt = Ampere \times Volt

- 1 x 250 mA Arduino
- 1 x 400 mA Fan
- 1 x 30 mA display
- 1 x 430 mA heating pad

- Total: 1130 mA
- So a 1.5 Amp power supply should be enough





Arduino tutorial codes

- MOSFET code:
 - <http://bildr.org/2012/03/rfp30n06le-arduino/>
- Button code:
 - <http://arduino.cc/en/tutorial/button>
- Thermistor code:
 - <http://computers.tutsplus.com/tutorials/how-to-read-temperatures-with-arduino--mac-53714>



Code



This repository Search

Pull requests Issues Gist



BioHackAcademy / BHA_Incubator

Unwatch 4 Star 4 Fork 5

Code Issues 0 Pull requests 0 Wiki Pulse Graphs Settings

Branch: master BHA_Incubator / Arduino Code / Incubator /

New file Upload files Find file History

PieterVanBoheemen updating pins Latest commit eaaeff4 22 days ago

..

Incubator.ino	updating pins	22 days ago
LiquidCrystal_I2C.cpp	bha3	a month ago
LiquidCrystal_I2C.h	bha3	a month ago



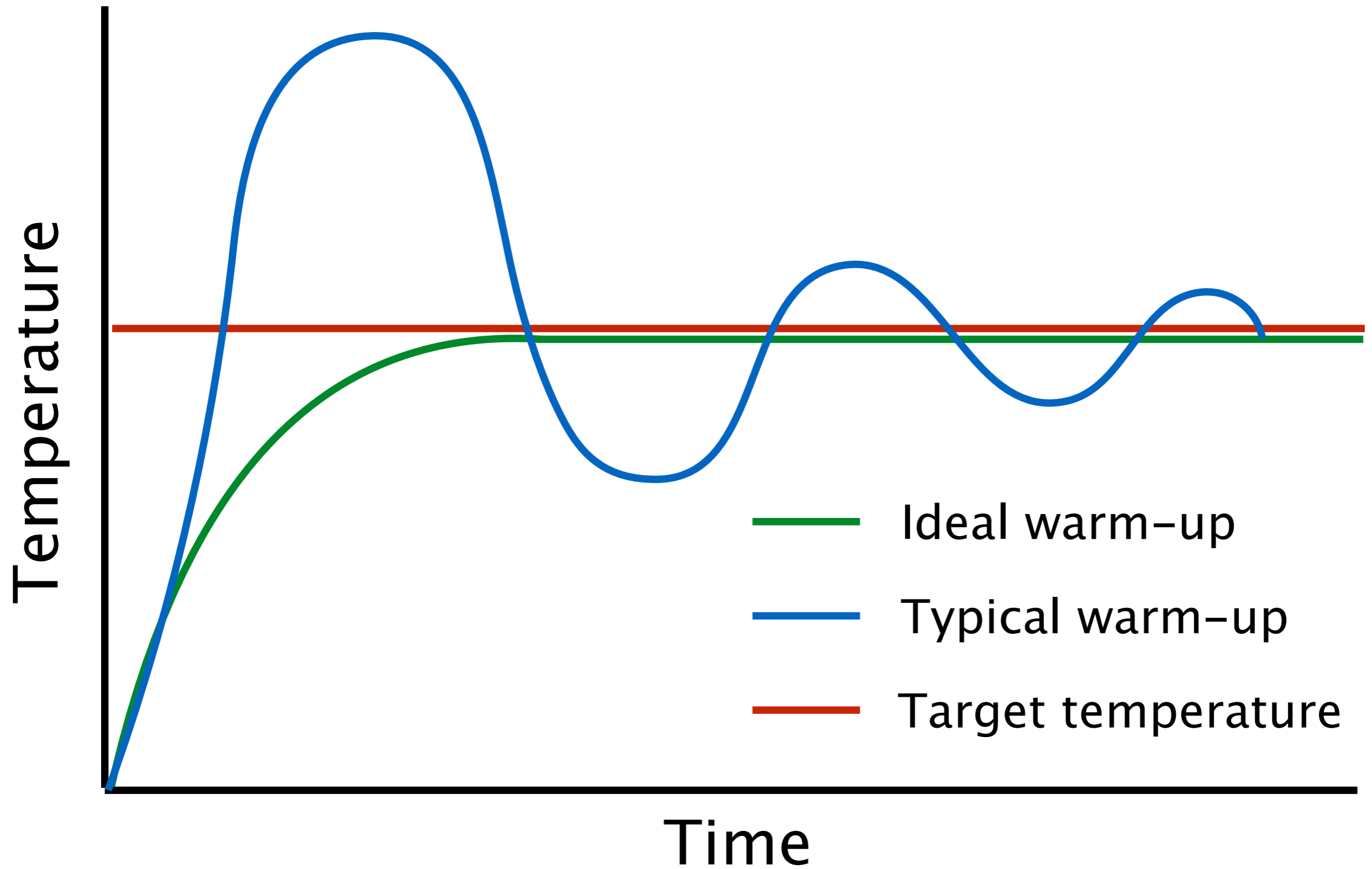


Code logic

- Measure temperature
 - Turn heating pad on when temperature is lower than target
 - Turn heating pad off when temperature is higher than target
- Check whether a button is pushed
 - If left button is pushed increase target temperature
 - If right button is pushed decrease target temperature
- Display current temperature
 - In case left or right button is pushed, display target temperature for 5 seconds



PID control





**some
rights
reserved**