

theremino
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theremino **System**



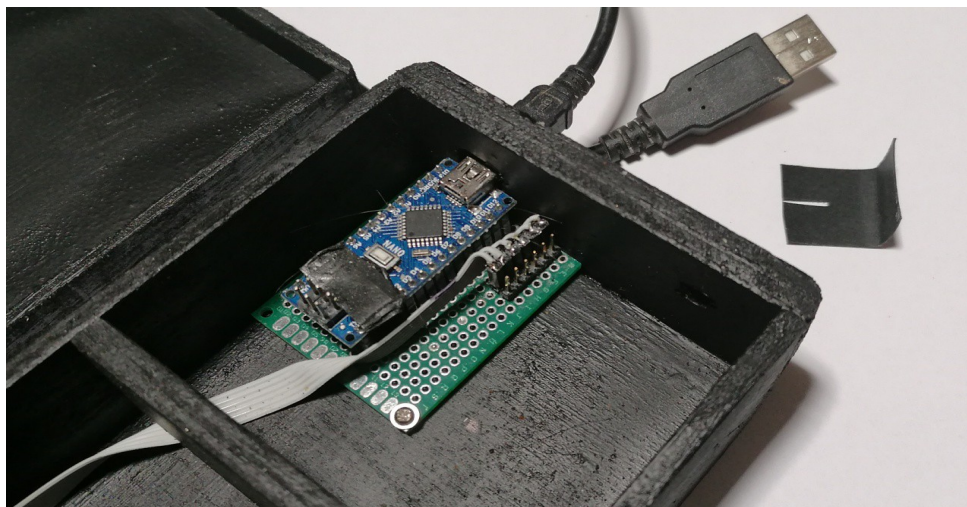
Theremino Spectrometer Construction with Linear Sensor

An example of wooden construction

This document shows a simple but effective realization. With a dozen pieces you get a container with a lid.



The lid is more or less shaped like a shoebox lid.
Small vertical walls effectively eliminate light
which would otherwise fit through the slots if it were a flat lid.



We initially tried with flat lids
adding rubber to seal them and screws to tighten them.

But over time the rubber gets squashed and even the smallest crack is enough to let light in.

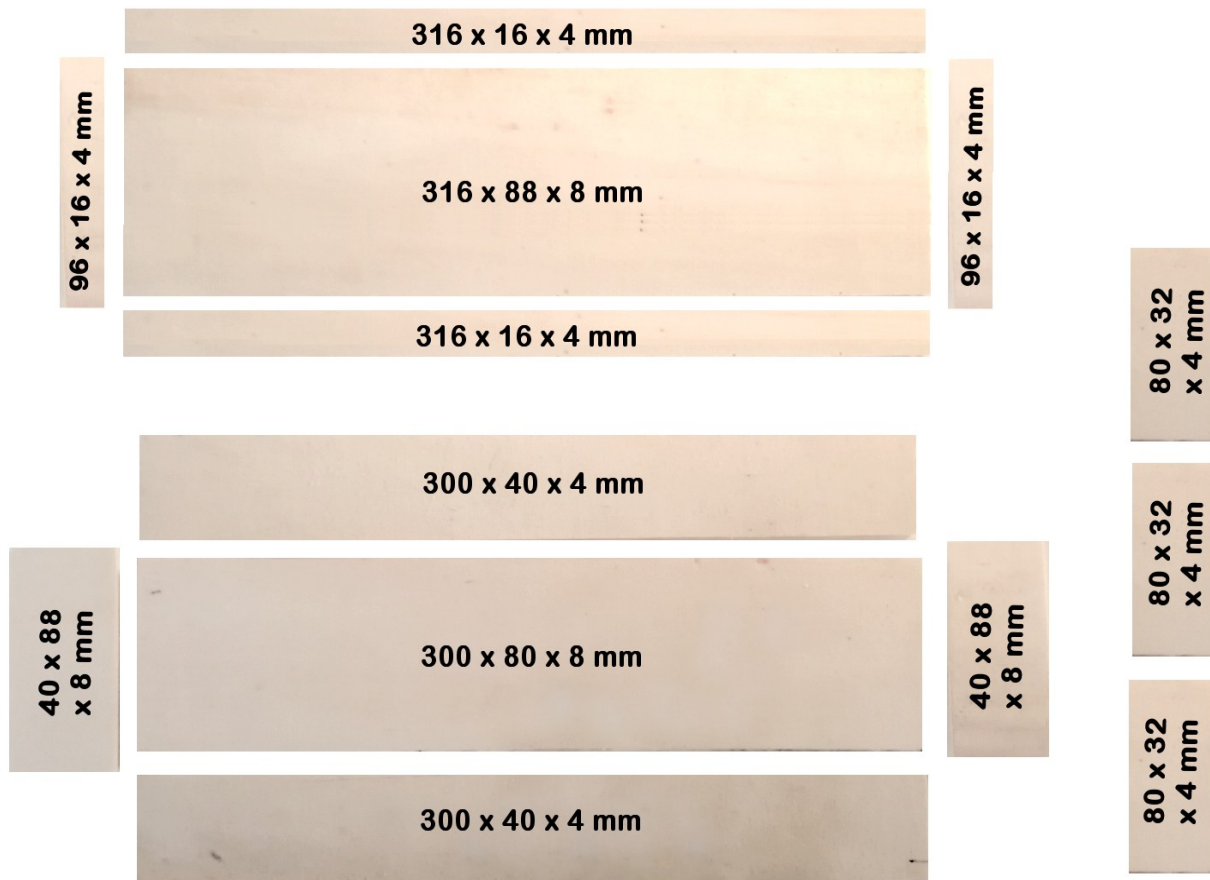
This example is about thirty centimeters long.
but even just 20 or 15 centimetres could be enough.

Materials to use

With wood, glue, nails and small screws, you can build light containers that are easy to open and easy to store.

The best wood for these constructions is beech. It is easily found in "Brico", it is light and does not break even if you make holes for the screws very close to the edges.

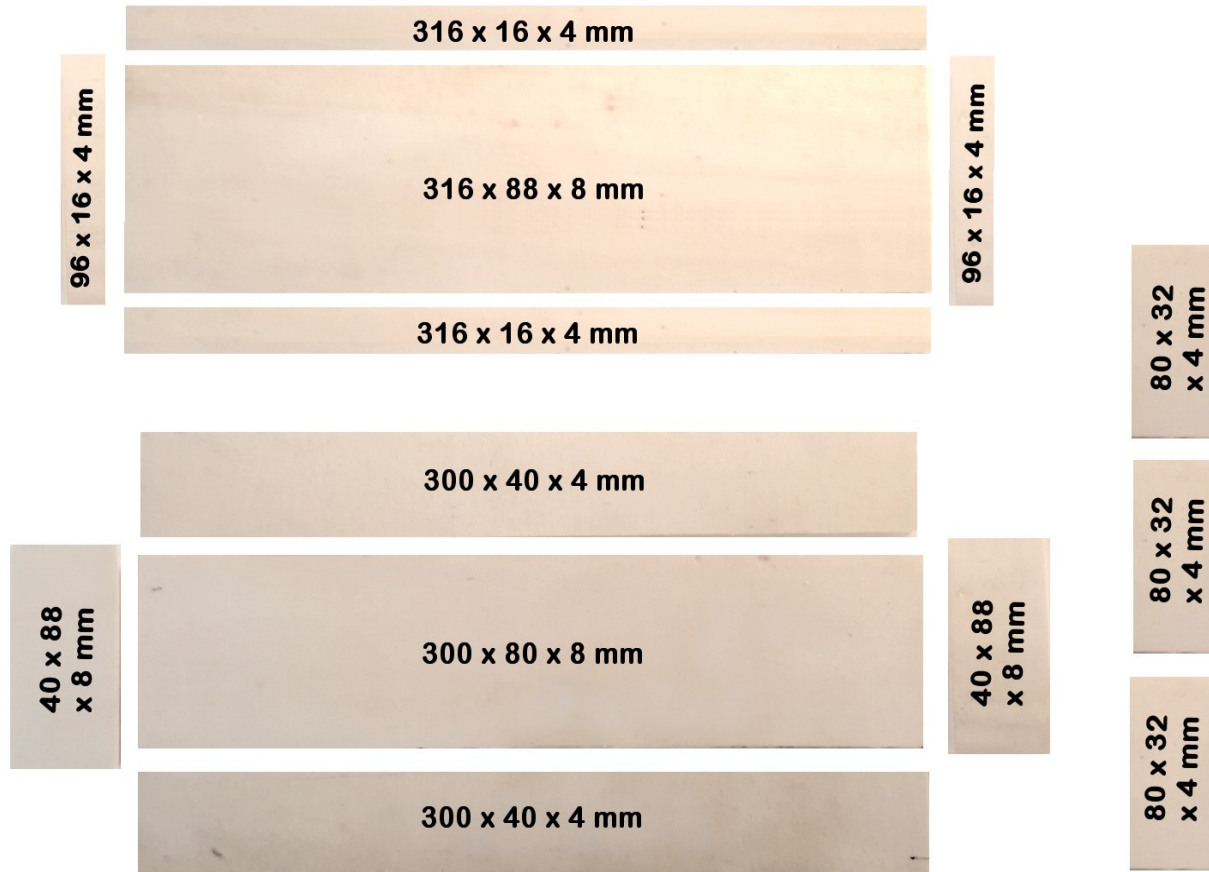
First, the holes are drilled and the box is assembled as a test. Once everything is in place, give it a splash of matte black paint and you have beautiful looking, easy to assemble pieces.



List of materials for the container

With a long structure, it is easier to focus and adjust the position of the components.

But the length could be reduced to 20 cm, or even up to 15 cm if you prefer.



The container is made up of two 8 mm thick strips while all the other pieces are 4 mm.

Get 252.5 x 8mm bronze screws and 4 and 8 mm wooden sheets

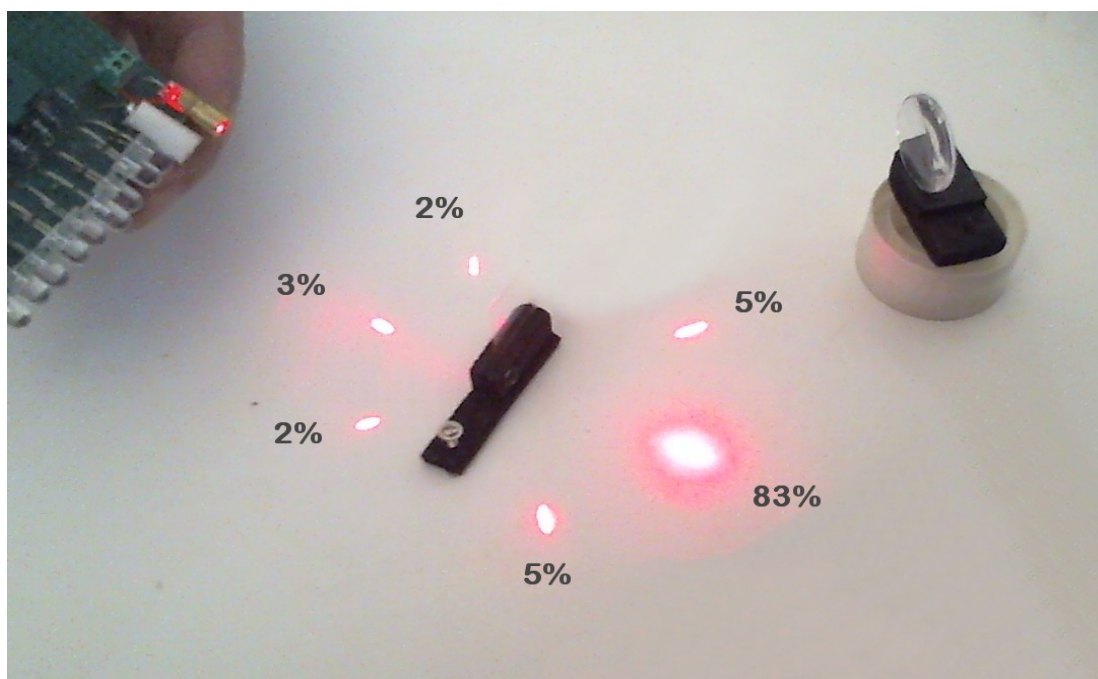
If they are made of evaporated beech they are more resistant but other woods can also work well.

The pieces they must be cut as shown in the image.

When you buy the sheets of wood you can also ask to cut them, usually the Brico-Centers do this service for free.

Diffraction gratings

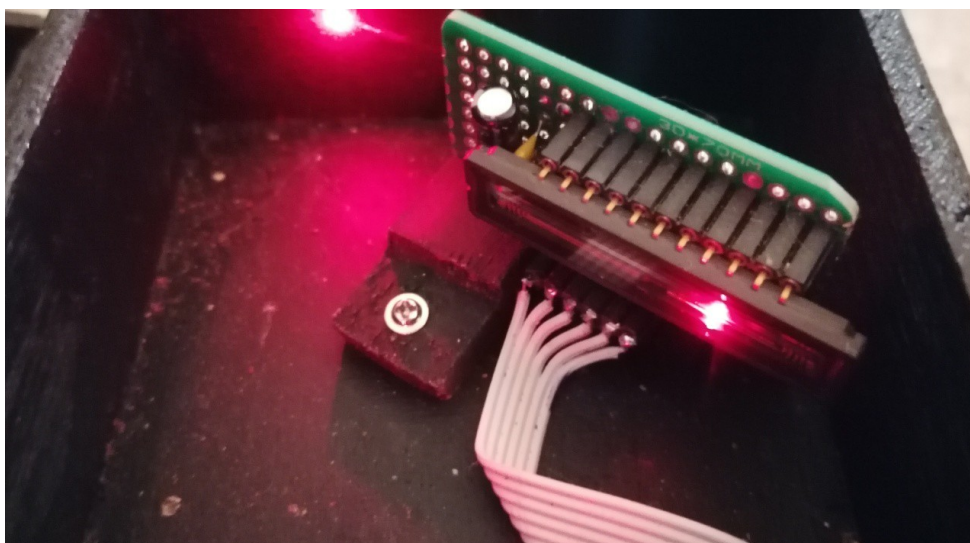
Read the document "Theremino_Spectrometer_Gratings"



Focus the lens

It's about moving the sensor closer or further away from the lens and aligning it well,

It is an important and very difficult operation.



Anti-reflection diaphragms

The inside walls of the spectrometer are hit by light very slantingly and therefore reflect light, even if well painted in matt black and even if covered with black paper. This diaphragm, if well constructed and of the right size, can completely eliminate reflections.

For best results, the hole should be countersunk (enlarged from the camera side) so that it has clean edges toward the incoming light. This way, the incoming light does not hit the inside walls of the rectangular hole and create reflections.

Even better would be to make the hole much larger than necessary (30 x 20 mm) and then close it with black cardboard, cut with a cutter and fixed above and below, with two drawing pins.



To achieve complete elimination of reflections, the hole should be as narrow and low as possible. Since the height of the lens above the entrance slit can vary from one construction to another, the best way to find its ideal size is to place a strong light behind the slit and test with black cardboard how tight the four walls of the hole can be tightened.

You can also place more than one diaphragm, experiment and try until you get the best results.

The light entry slit

When measuring a bright light source it is best to use a narrow slit. But to measure very dim light sources it is necessary to widen the slit and sacrifice some resolution.

It is recommended to start with a 3mm slit for a 30cm long spectrometer (1mm for every 10cm of spectrometer length).

The slit must not be micrometrically small otherwise, in addition to allowing little light to pass, it produces interference fringes.

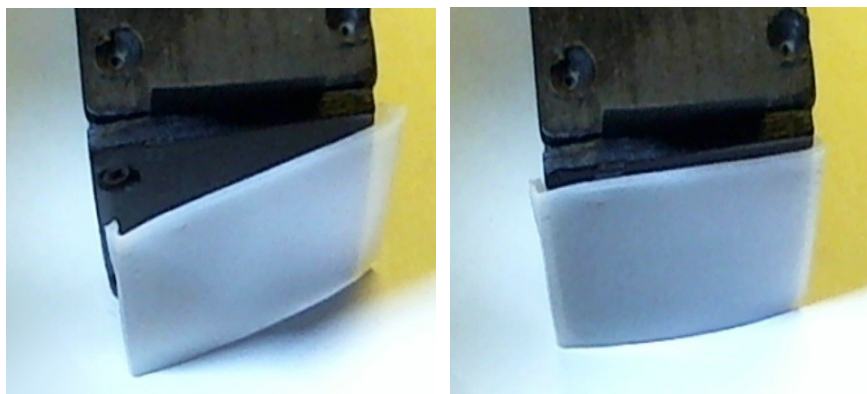
So there is no need to use razor blades (as some write) or even to make complex mechanisms to adjust the width of the slot. Just find a thin black plastic sheet and make two cuts with the cutter leaving a few mm of space.

Eventually you can make two or three of these sheets, with different thicknesses and it is not difficult to find a way to be able to remove them and change them. Everyone can do as they are best or even use adhesive tape to fix them.

The diffuser screen

This screen is used to prevent light rays from entering the chamber directly and causing reflections inside it. With some sources, such as LEDs and lasers, the screen is absolutely necessary but in other cases it is better to remove it.

Without a screen the spectrometer is very directive and this could be useful for measuring distant color areas. For example to see the color differences between different areas of the sky.



The screen is made from a shampoo or shower gel container.

Choose a large jar, with a wide, flat front and back and made of a good, thin, bright white opal plastic.

The right jars are made of opaline polypropylene, which diffuses the light very well and does not dim it. Possibly try different brands to find the best, with the thinnest and brightest plastic.

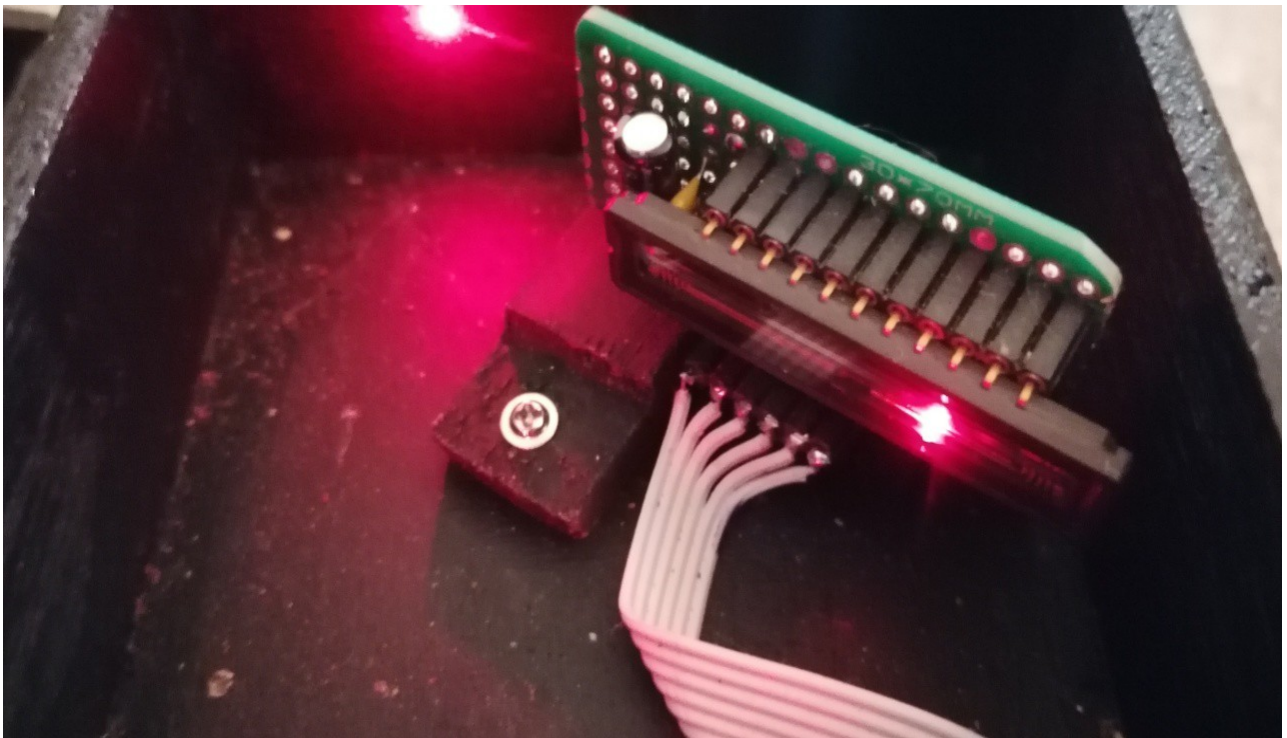
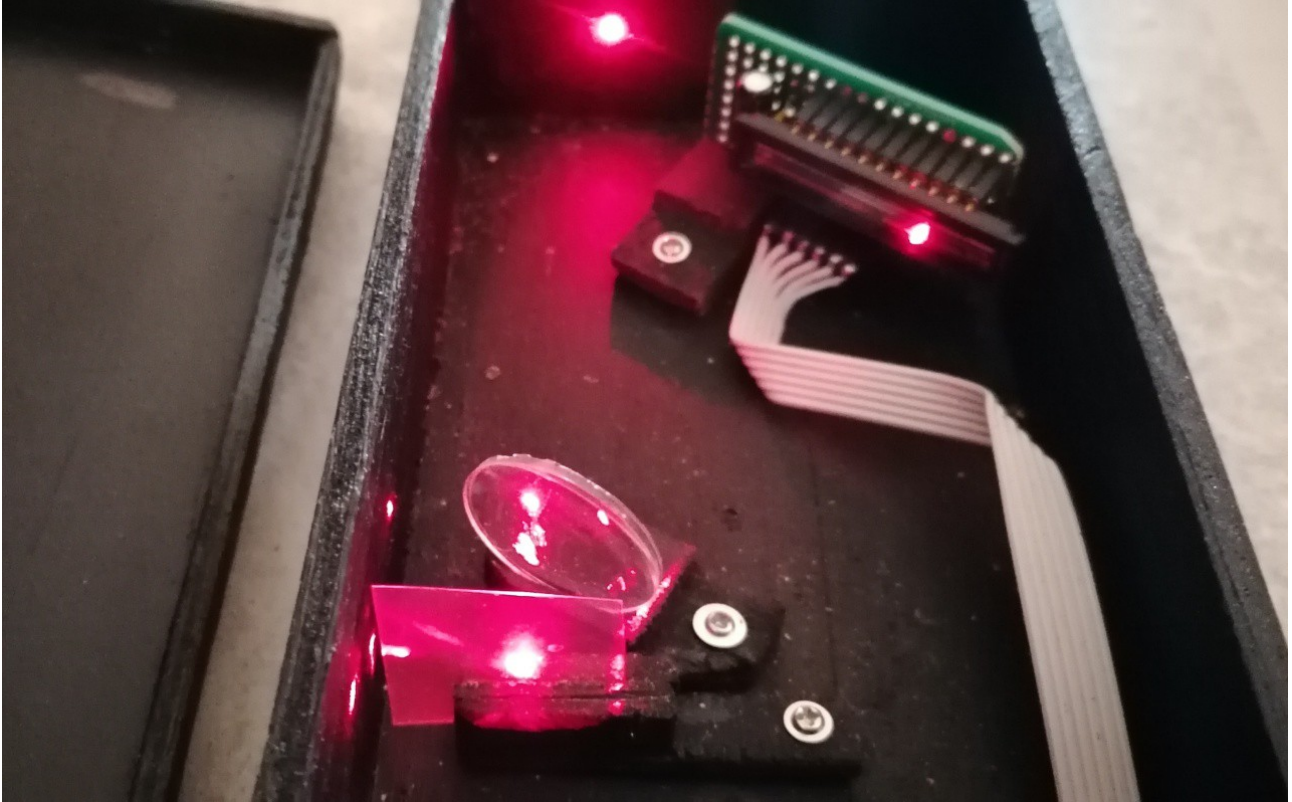
First you have to remove the labels. Fill the container with very hot water to soften the adhesive. Lift the plastic of the label on one side and pull it slowly so as not to leave glue. If this is not possible, change the jar and find one with labels that are easier to remove.

Cut a large rectangle from the flat area of the jar. Then trim it progressively with scissors and fold it with pliers until you obtain a screen that fits well on both sides of the spectrometer.



Various images

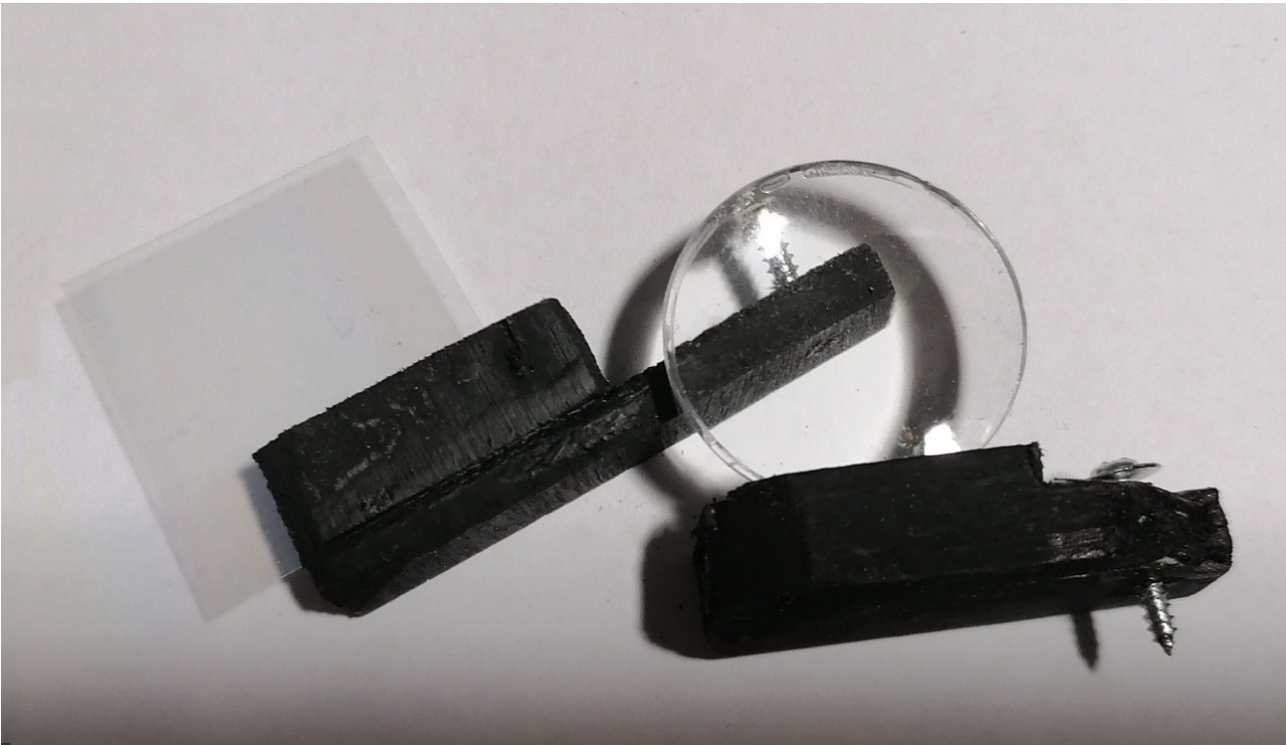
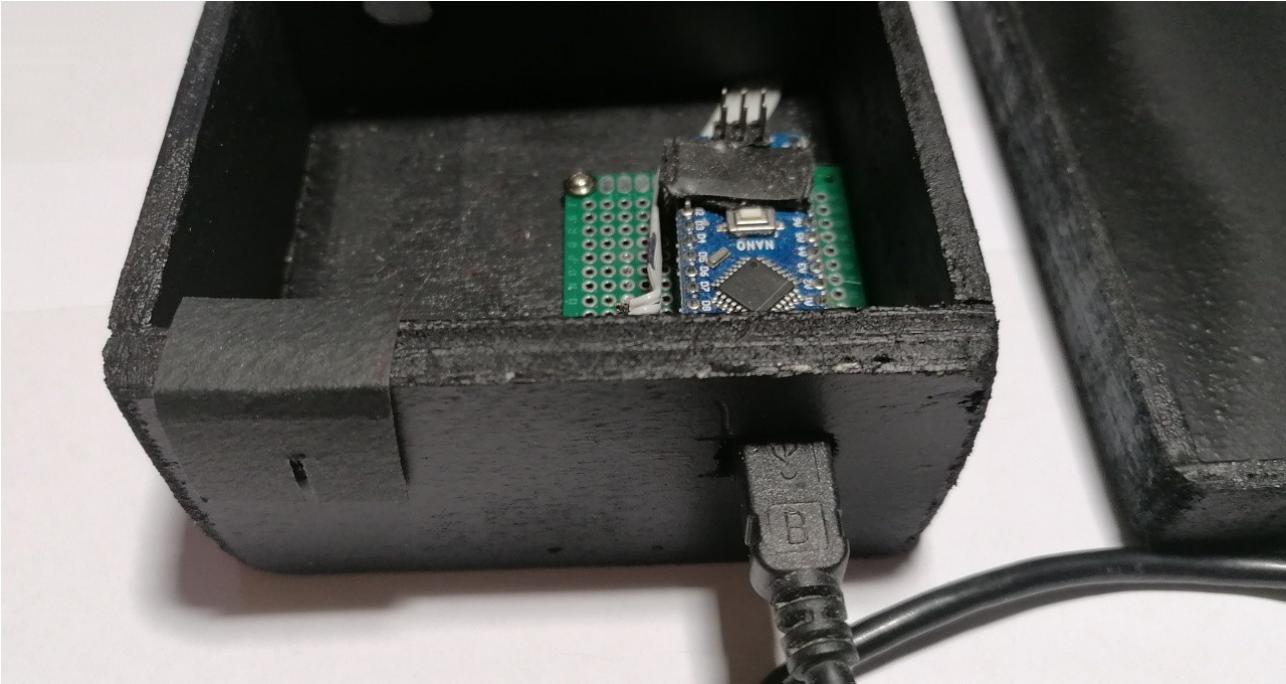
We don't have time to do better otherwise we will never publish!
Look at the pictures and try to find your own solutions.



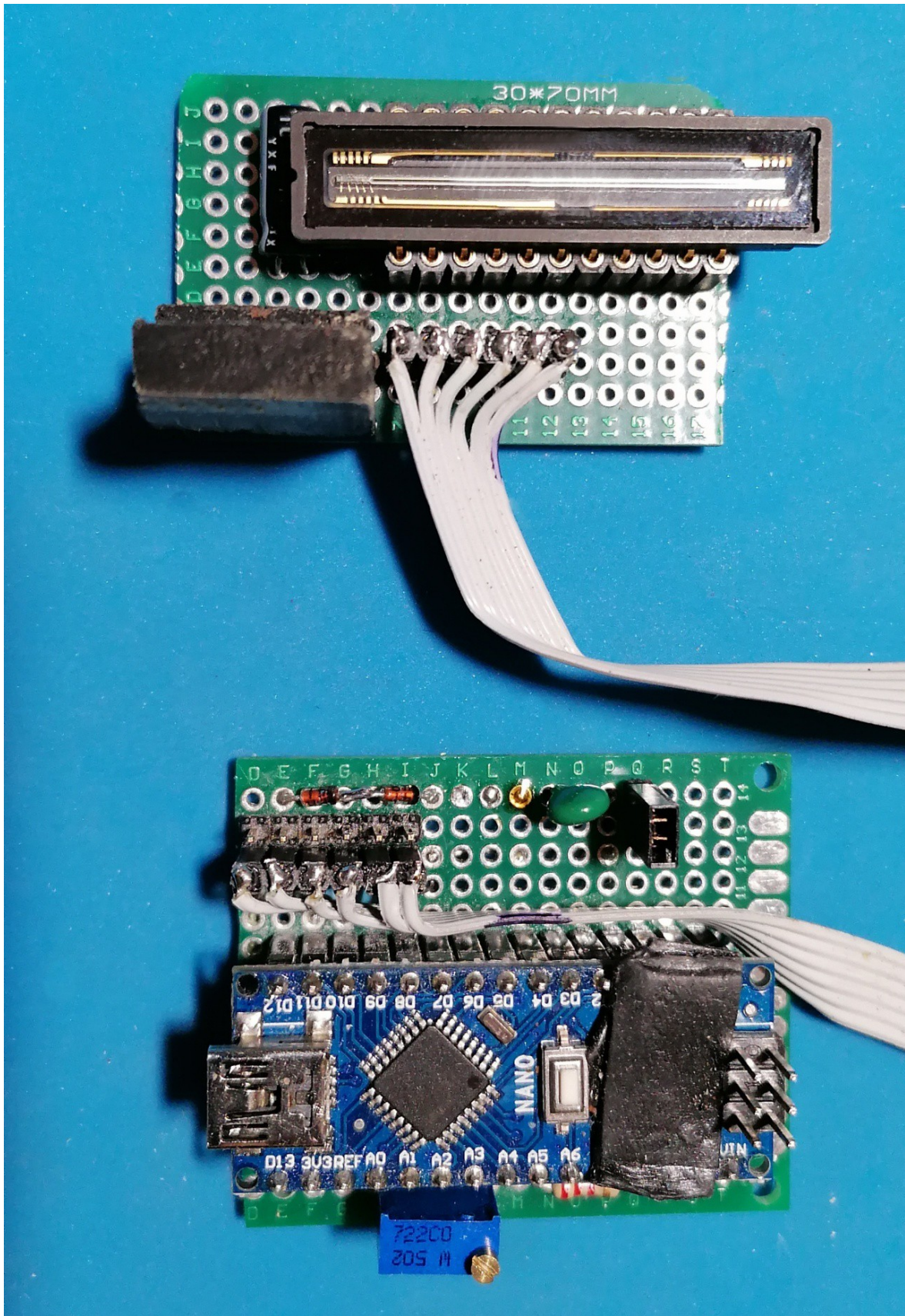
Various images - 2



Various images - 3



Various images - 4



Various images - 5



**Good
construction**

**and that the photons
be with you**

