

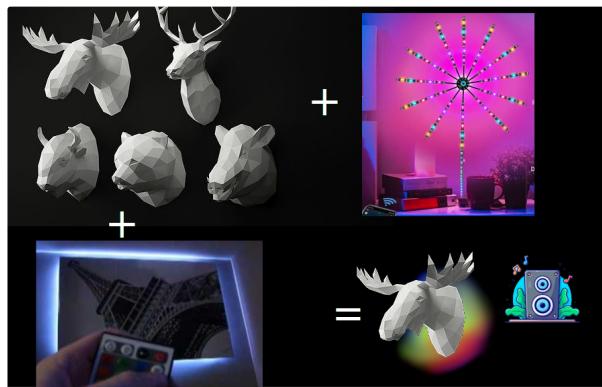
04.PROJECTS OUTCOMES (2023-2024-S016)



Low-poly Music Ambient Visualiser

While enjoying music, we usually focus on the sounds. But imagine adding a visual twist to the beats, especially during parties or family gatherings.

This device doubles as a cool party decoration and a stylish room accessory. It brings a lively visual element to your music experience, making it a versatile addition to any setting.



Concept Design

Description

The system comprises a primary docking base featuring a backlight control mechanism, a bezel equipped with LEDs, and a swappable low-poly head component. Additionally, it offers a versatile and user-friendly design, seamlessly integrating these elements for enhanced functionality and ease of use.

Analysis

There's no need to reinvent the wheel; practical visualisation solutions, including those compatible with the Arduino platform, are already available. Utilising these existing solutions can not only streamline the development process but also help in minimising unnecessary financial expenditures and saving valuable time.

As for the heads, drawing inspiration from the world of Papercraft, which inherently involves low-poly 3D models, opens up a treasure trove of possibilities. The internet hosts a vast database of freely available 3D models, ready to be employed for various purposes. Leveraging this extensive collection not only ensures a cost-effective approach but also provides a rich resource for diverse and creative head designs, enhancing the overall appeal of your project without breaking the bank.

Decision

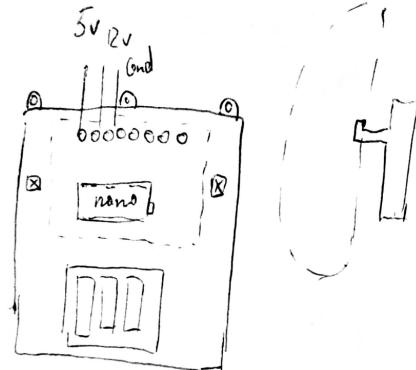
For the main controller will be used already fine documented solution based on Arduino ([Link](#)).

For the swappable heads, we will need a custom design and probably 3D printer.

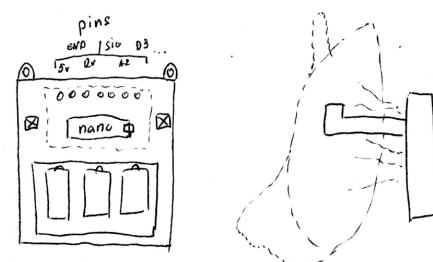
Design

Beyond being a mere toy, the device is designed with practical utility in mind. Recognising that switchable heads may accumulate dust during daily use, a solution has been implemented to make them easily detachable and washable, ensuring a hygienic and user-friendly experience.

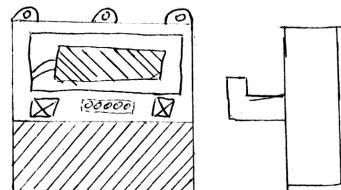
Furthermore, the universal connector is a key element, intended to not only support current functionalities but also accommodate future improvements seamlessly. In the initial design phase, a magnetic connector was conceived for its convenience. However, after encountering various complications during development, a decision was made to transition to the more conventional pin-based connector, prioritising reliability and ease of use in the final design.



The first concept was drawn by hand on a piece of paper

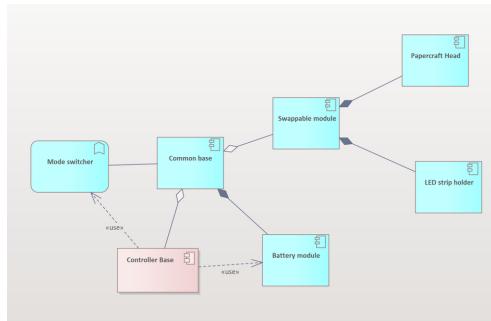
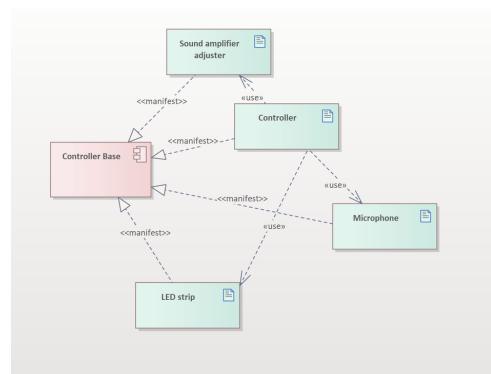
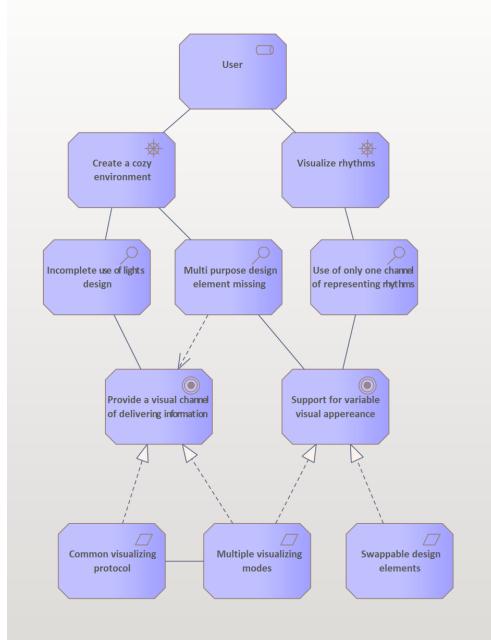


More detailed view

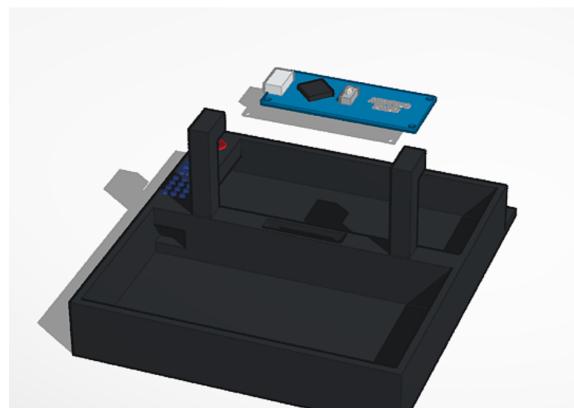


Improved placement of pins

Now it is time to document the design. First of all, business diagram tells us about the design from the business view. Then component diagram will show what components will be used in the solution to achieve defined goals. The last one will provide information about physical components will be used in the solution.

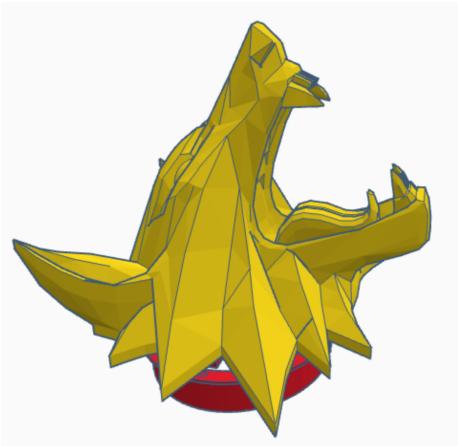


After creating a documented sketch and finalising list of features to be implemented, design was digitalised in the [Tinkercad | From mind to design in minutes](#).

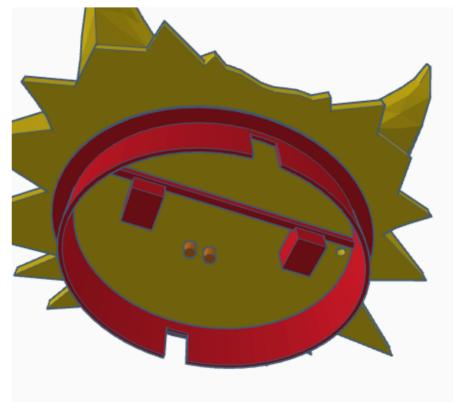


3D Preview

After some design iterations, a need of the **LED holder** was confirmed - switchable head, containing a lot of plastic, should be washable (as mentioned before), so it must not contain any electronics.

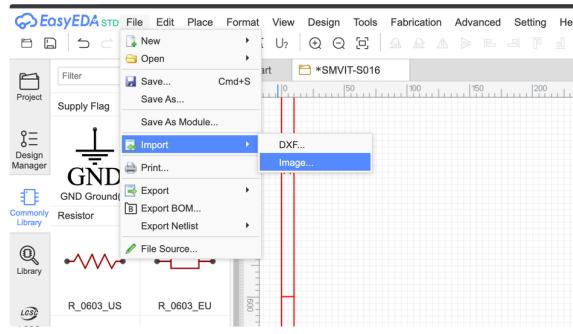


Side view

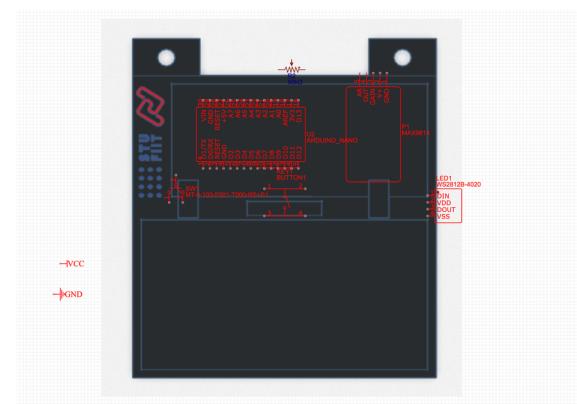


Bottom view

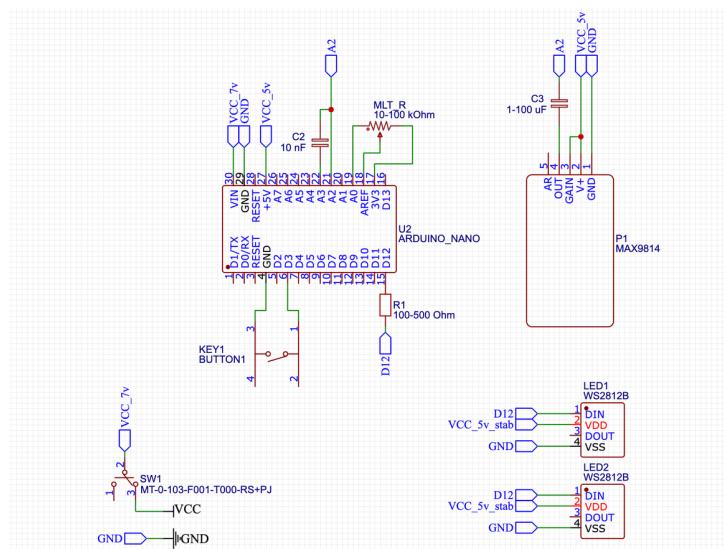
After designing a base model and some heads, there is also a need to design an electronical part. It was done with help of the EasyEDA tool ([EasyEDA - Online PCB design & circuit simulator](#)).



Adding a base image, to prototype components positioning

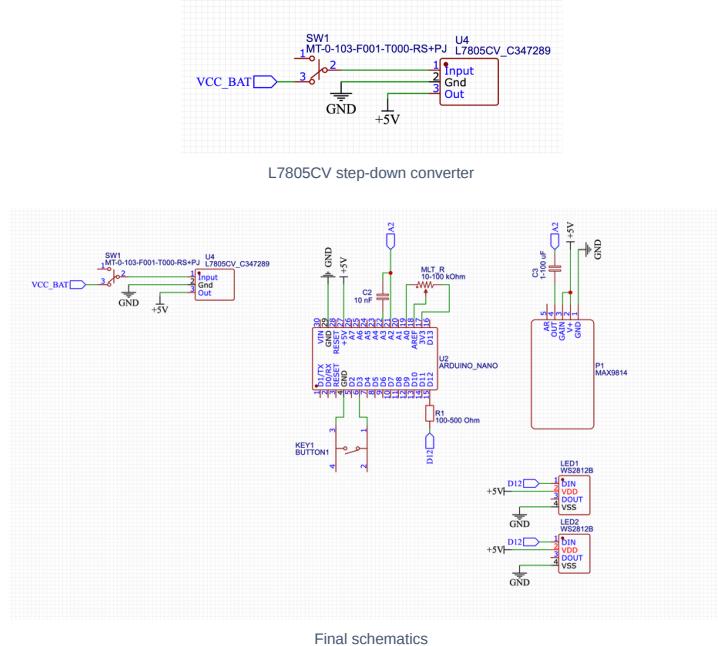


Now placement of the components is more clear

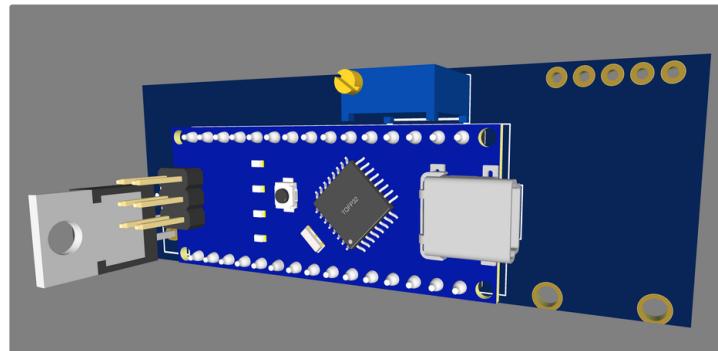


Initial schematics

After the first round of schematics, when we assumed, that 7V power is enough (2x 18650 batteries), we found that our LED strip need a stable 5V input with at least 600 mA power. Arduino can hold up to 500 mA of output power, so we needed a better solution for converting voltage - adding a step-down converter is a common solution.



Final schematics



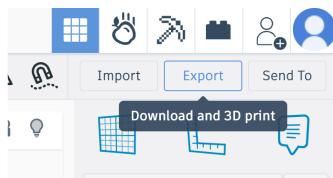
3D View

Implementation

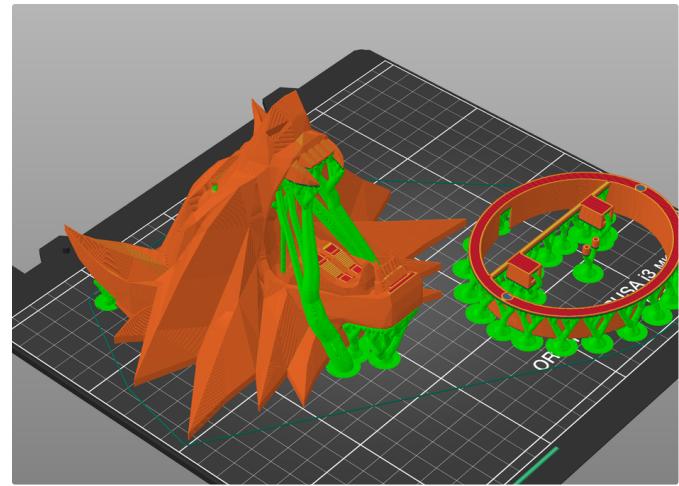
Now its time to 3D print heads, buy and solder an electronical part.

Podrobnosti objednávky	
Produkt	Cena spolu
LED RGB pásek IP30 30/90/144 LED 1/2/5 metrov × 1 Hustota LED: 144 LED na meter Dĺžka: 1 meter Farba: Čierny	12.70€
Držák pre dve 18650 Li-Ion batérie × 1	0.90€
Mikrofón modul MAX9814 s adaptívnym zosilňovačom × 1	5.50€
Nabíjačka pre 18650 batérie MS-2020 × 1	3.50€
SMD kondenzátor 0805 rôzne varianty 10 kusov - 10nF × 1 Hodnota: 10nF	0.25€
Elektrolytický kondenzátor 25V rôzne kapacity - 47uF balenie 10 kusov × 1 Typ: 47uF balenie 10 kusov	0.90€
Kovový trojpolohový prepínač MT8-103 × 1	0.45€
Trimmer typu 3296 rôzne varianty (C) - 3296-503: 50K × 1	0.30€
18650 batéria LI-ION rôzne kapacity 10C s výstupom - 3000 mAh 10C × 2 Batéria: 3000 mAh 10C	11.90€
Elektrolytický kondenzátor 25V rôzne kapacity - 2200uF balenie 10 kusov × 1 Typ: 2200uF balenie 10 kusov	2.20€
Medzišúť:	38.60€
Doručenie:	Odborný odber Bratislava - okamžite 7:30-15:30
Spôsob platby:	Kreditná / Debetná karta
Cena spolu:	38.60€ (vrátane 6.43€ DPH)

First of all, some shopping

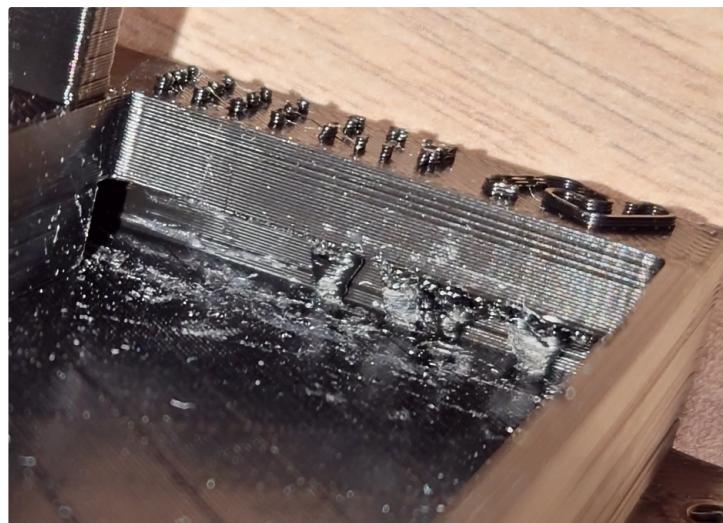


From Tinkercad we can easily export our 3D model in STL format, just clicking on Export button

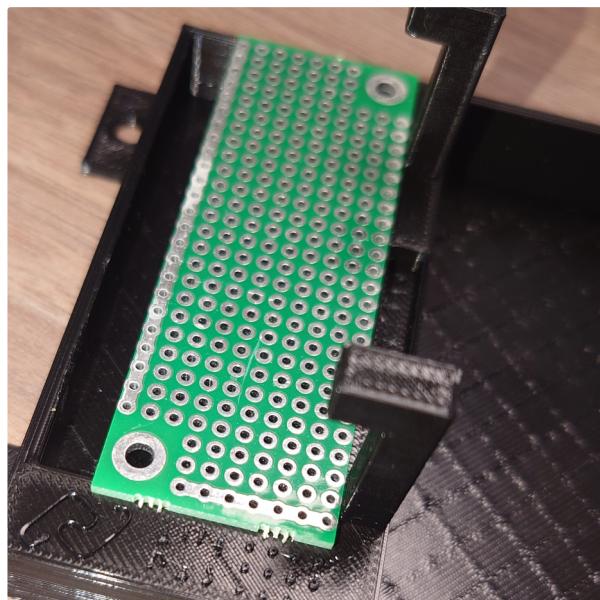


Then using PrusaSlicer, we can prepare our 3D model for printing and generate a G-Code.

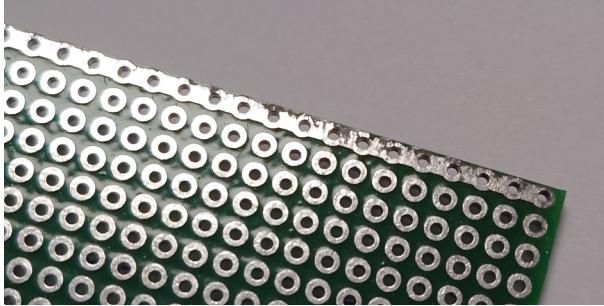
After 3D printing, we needed to remove supports, produced during slicing process in order to prepare 3D model to print. Some of them are easy removable, but sometimes it is hard to remove them clearly.



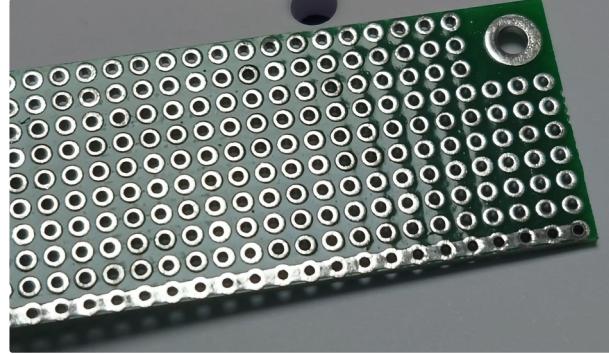
Indestructible supports



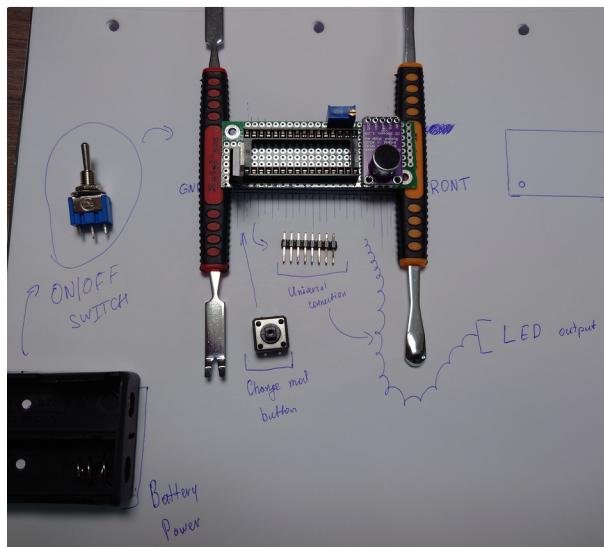
Also a new complication arrived: prototype board is not compact enough. Not a big deal - just cut it a bit!



Some of the prototyping PCBs are not in a good condition, so we need to solder such defects



Or find a better one

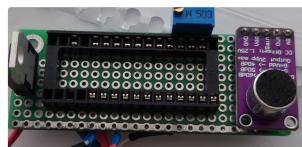


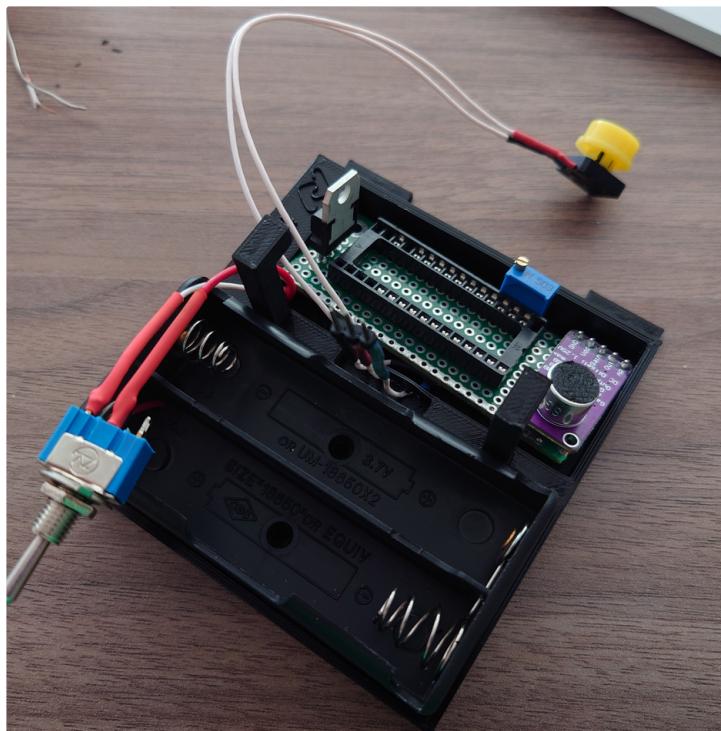
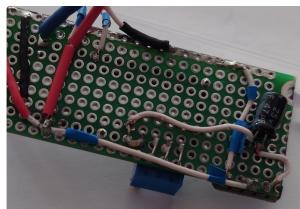
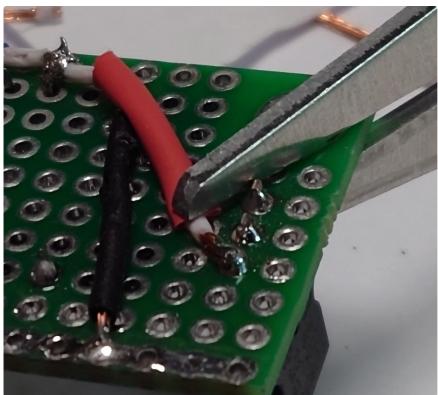
Some proto-fitting for component placing



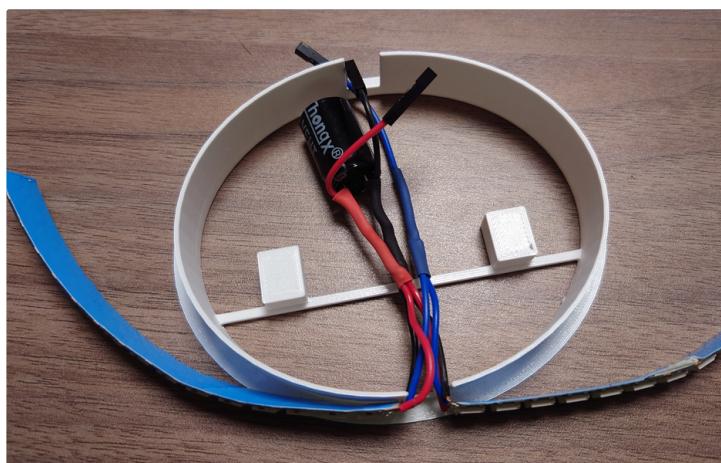
Soldering time! We will solder our components with 0.75mm wide copper wires with plastic coverage (MGTF 0,2)

Soldering process:





First fitting



Soldering a LED strip holder

Now prototype is ready, we can test it.

Validation, Verification



Lessons Learned

- Some 3D printed models can have artefacts
- Generated supports sometimes hard to remove
- Soldering can be complicated, then it is useful to fabricate a PCB
- Schematics and simulation is very helpful when dealing with electronics
- Do not reinvent a wheel
- Good documentation = Good project
- Device design some times need to go through cycles to be good enough