– SUNO –

The Self-Oriented Solar Mirror

USER MANUAL

isep Instituto Superior de Engenharia do Porto

EUROPEAN PROJECT SEMESTER

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1 GENERAL INFORMATION

Thank you for purchasing SUNO's Self-Oriented Solar Mirror (SOSM). This device tracks the Sun and reflects sunlight to your desired area. Some functions for which the device can be used are:

- Light up a dark room.
- Alleviate the symptoms of seasonal affective disorder.
- Desalinate Water.
- Increase the efficiency of a solar thermal water heater.

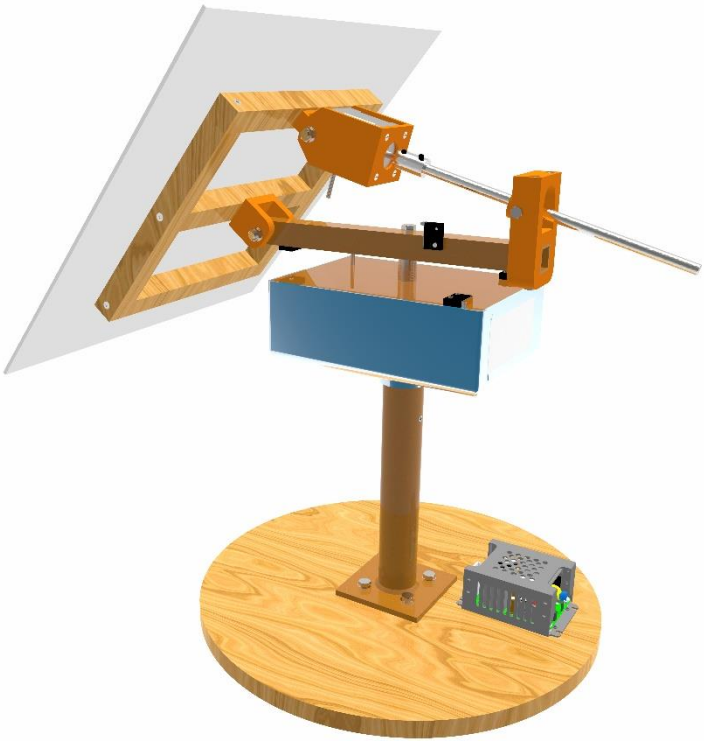


Figure 1: SUNO - Product view

2 THE PRODUCT

2.1 LIST OF COMPONENTS

To assemble the SOSM, all necessary items are shipped together. Below is the list of components that are inside the packaging.

Table 1: List of components 1

N. º	Description	Qty.
001	Circular base	1
002	Central post	1
003	Hexagonal head screw DIN 933 M6 x 16	5
004	Flat washer DIN 125a M6	9
005	Grub screw DIN 916 M6 x 6	2
006	Box	1
007	Box cover	1
008	Box door	1
009	Azimuth shaft	1
010	Shaft spacer	1
011	Shaft holder	1
012	Hexagonal head screw DIN 933 M5 x 12	1
013	Flat washer DIN 125a M5	1
014	Radial bearing 6001-2Z	4
015	Philips oval countersunk machine screw DIN 963 M3 x 10	8
016	Socket head cap screw DIN 912 M4 x 10	5
017	Flat washer DIN 125a M4	5
018	Stepper motor NEMA 17	2
019	Azimuth motor bracket	1
020	Worm wheel	1
021	Worm gear	1
022	Grub screw DIN 916 M4 x 6	5
023	Control system	1
024	Lateral square profile	2
025	Frontal square profile	2

Due to the considerable number of components, it is recommended to thoroughly check that there are none missing.

Table 2: List of components 2

N. º	Description	Qty.
026	Central square profile	1
027	Mirror joint	1
028	Cross connector square profile	1
029	Mirror's surface	1
030	Mirror joint's articulating shaft	1
031	Leadscrew joint	1
032	Hexagonal nut DIN 934 M6	4
033	Cross recessed countersunk head tapping screw DIN 7982 Ø3.5 x 35	6
034	Cross recessed countersunk head tapping screw DIN 7982 Ø3.5 x 25	2
035	Cross recessed countersunk head tapping screw DIN 7982 Ø3.5 x 19	4
036	Leadscrew motor bracket	1
037	Motor coupling	1
038	Hexagonal nut DIN 934 M8	1
039	Threaded rod M8	1
040	M8 nut housing	1
041	Hexagonal head screw DIN 933 M5 x 20	2
042	M8 housing lower support	1
043	M8 housing upper support	1
044	Socket head cap screw DIN 912 M4 x 25	2
045	Socket head cap screw DIN 912 M4 x 40	1
046	Hexagonal nut DIN 934 M4	1
047	Motor joint's articulating shaft	1
048	End range sensor	4
049	Slotted cheese head machine screw DIN 84 M2 x 12	6
050	Power supply	1

2.2 LIST OF TOOLS

To assemble the SOSM, some tools are needed. These are mentioned below.

Table 3: List of tools

Description	Image
Allen Key 2mm	
Allen Key 3mm	
Open-ended Spanner 8x9 mm	
Open-ended Spanner 10x11 mm	
Slotted Screwdriver	
Phillips Screwdriver	

An electric screwdriver and an adjustable spanner can be used as a substitute for the tools mentioned above.

2.3 ASSEMBLY INSTRUCTIONS

To facilitate the assembly of the SOSM, the assembly is performed in separate stages. The assembly instructions are detailed in the next pages. It is important to note the following:

- The product has been designed using a 3D program. Some of the components have been obtained from different CAD libraries. Therefore, some of the components shipped may look different to the images shown in this manual.

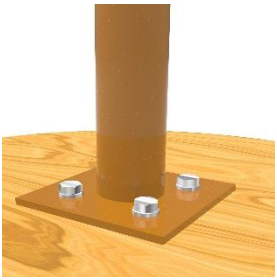
2.3.1 STAGE 1: CENTRAL STRUCTURE

1. Position parts nº. 001 and 002, so that the bores in the base match with the holes in the post.

Parts:

- 001 x 1
- 002 x 1

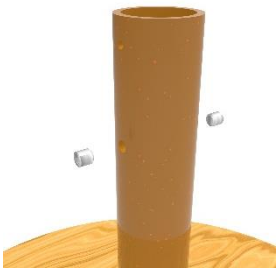
2. Position the flat washers and the screws, and screw them with the help of an open-ended spanner.



Parts:

- 003 x 4
- 004 x 4

3. Place the grub screws in the lower bores, and screw them with the help of an Allen key.



Parts:

- 005 x 2

2.3.2 STAGE 2: CENTRAL STRUCTURE + CENTRAL BOX

1. Insert the four bearings (nº. 014), with the spacer (nº. 010) between them, in the shaft (nº. 009). Lock the relative movement with elements nº. 011, 012 and 013.

Parts:

- 009 x 1
- 010 x 1
- 011 x 1
- 012 x 1
- 013 x 1
- 014 x 4

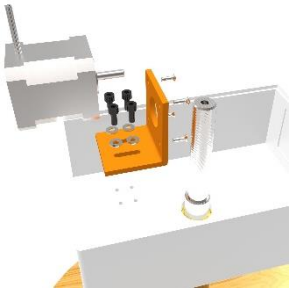
2. Put the shaft inside the central structure.

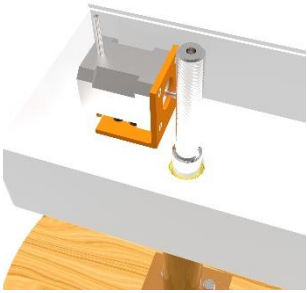
3. Put the door in the box (nº.006 and nº.008). Place both and make it fit with the central structure and the threaded bores. Then, attach them with the grub screws (nº. 022).

Parts:

- 006 x 1
- 008 x 1
- 022 x 2

4. Place component nº. 019 and attach it to the box using the flat washers and the screws (nº. 016 and 017). Then, attach the motor with the screws (nº. 018 and 015, respectively).

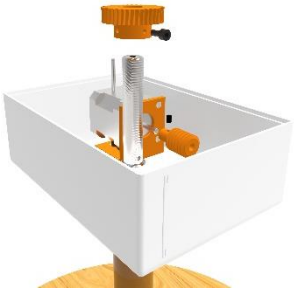


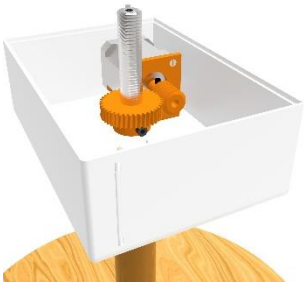


Parts:

- 015 x 4
- 016 x 4
- 017 x 4
- 018 x 1
- 019 x 1

5. Insert the worm gear (nº. 021) in the motor, and lock it with the grub screw (nº. 022). Then, do the same with the worm wheel (nº. 020), in the shaft. Lock it with the Allen screw (nº. 016).

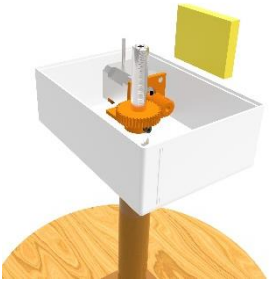




Parts:

- 016 x 1
- 020 x 1
- 021 x 1
- 022 x 1

6. Finally, put the electronics inside the box (nº. 023), and close the box with its cover (nº. 007).

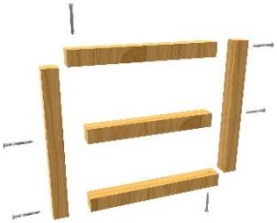


Parts:

- 007 x 1
- 023 x 1

2.3.3 STAGE 3: MIRROR

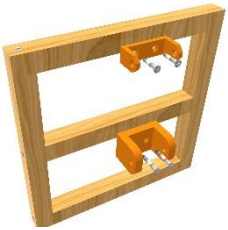
1. Place part nº. 024 on the laterals, nº. 025 up and down, and nº. 026 on the centre. Use a screwdriver to connect them with the screws nº. 033.

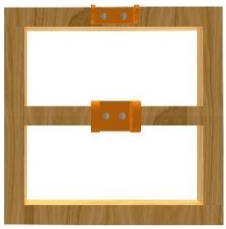


Parts:

- 024 x 2
- 025 x 2
- 026 x 1
- 033 x 6

2. Using the screws nº. 034, screw the part nº. 027 to the central profile. Next, using the screws nº. 035, screw the part nº. 31 to the upper profile.

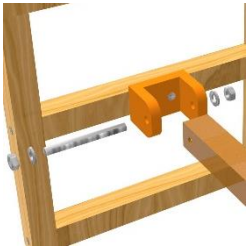




Parts:

- 027 x 1
- 031 x 1
- 034 x 2
- 035 x 2

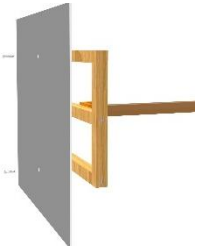
3. Position part nº. 028 and screw to it the part nº. 030. Then, close with the flat washer and the nut (nº. 004 and nº. 032).



Parts:

- 004 x 2
- 028 x 1
- 030 x 1
- 032 x 2

4. Glue the mirror (nº. 029) to the wood profiles. Then, use the screws nº. 035 to fix them.

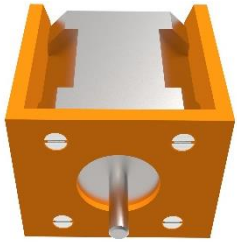


Parts:

- 029 x 1
- 035 x 2

2.3.4 STAGE 4: LEADSCREW

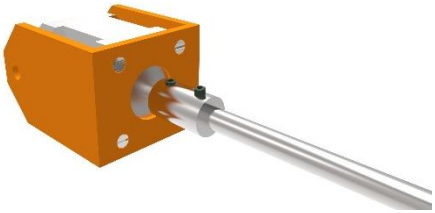
1. Place the motor (nº. 018) in the bracket (nº.36). Then, use a screwdriver to attach them with the screws (nº. 015).



Parts:

- 015 x 4
- 018 x 1
- 036 x 1

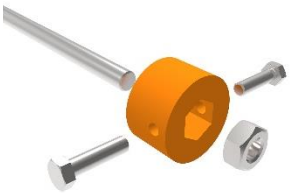
2. Attach the coupling (nº. 037) to the motor and the threaded rod (nº. 039). To do this, use the grub screws (nº, 022).

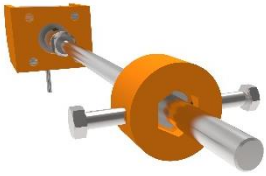


Parts:

- 022 x 2
- 037 x 1
- 039 x 1

3. Put inside part nº. 040 the M8 nut (nº. 038). Then, fix this last one with the screws (nº. 041).



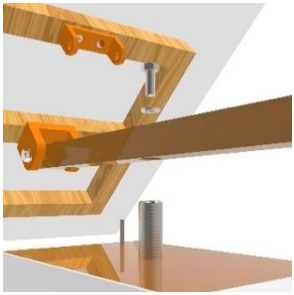


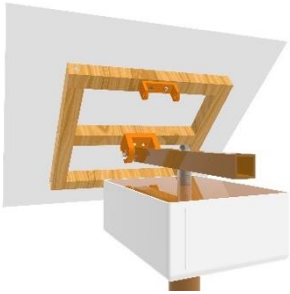
Parts:

- 038 x 1
- 040 x 1
- 041 x 2

2.3.5 STAGE 5: FINAL ASSEMBLY

1. Put together the assemblies obtained in stages 2 and 3. To do this, insert the shaft in the middle hole of the component nº. 028. Then, lock them using the flat washer and the screw nº. 004 and 003, respectively.

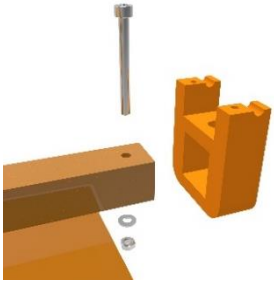




Parts:

- 003 x 1
- 004 x 1

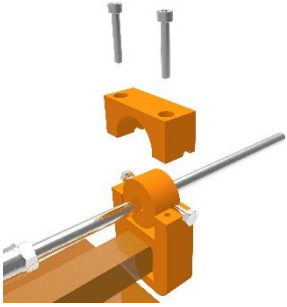
2. Place the component nº. 042 at the end of the component nº. 028. Then, attach it using components nº. 045, 017 and 046.

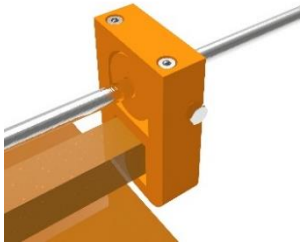


Parts:

- 017 x 1
- 042 x 1
- 045 x 1
- 046 x 1

3. Take the leadscrew assembly and place the screws of the M8 housing on component nº. 042. Add component nº. 043 and use the screws nº. 044 to fix it.

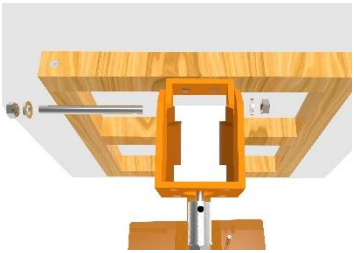


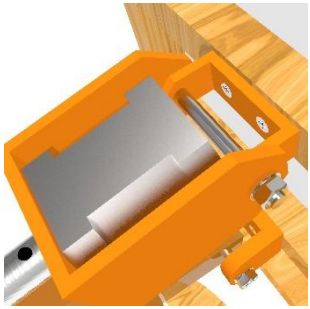


Parts:

- 043 x 1
- 044 x 2

4. Attach the leadscrew to the mirror. To do this, turn the rod until the holes of the joint and the bracket of the leadscrew match. Once done, position part nº. 047 and close with the flat washer and the nut (nº. 004 and nº. 032).

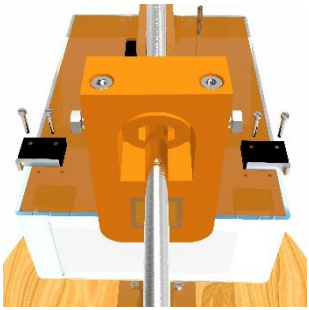


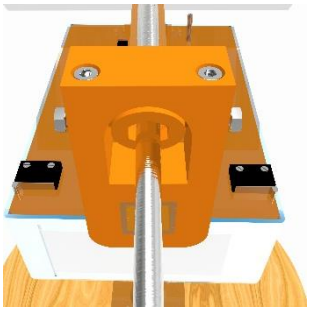


Parts:

- 004 x 2
- 032 x 2
- 047 x 1

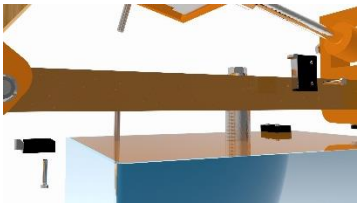
5. To affix the end of range sensors (nº. 048). Match the holes present in components nº. 007 and 028, and screw with component nº. 049.

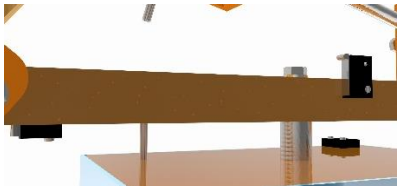




Parts:

- 048 x 4
- 049 x 6





The last step is to put the power supply (nº. 050) above the circular base. **Almost done**! To make the product work, it is necessary to follow the electrical instructions given in the next chapter.

3 ELECTRICAL CONNECTION

The electrical connection for the SUNO prototype is made via the 220-240V mains supply. Simply plug the device into an appropriate mains outlet.

3.1 SYSTEM SCHEMATICS

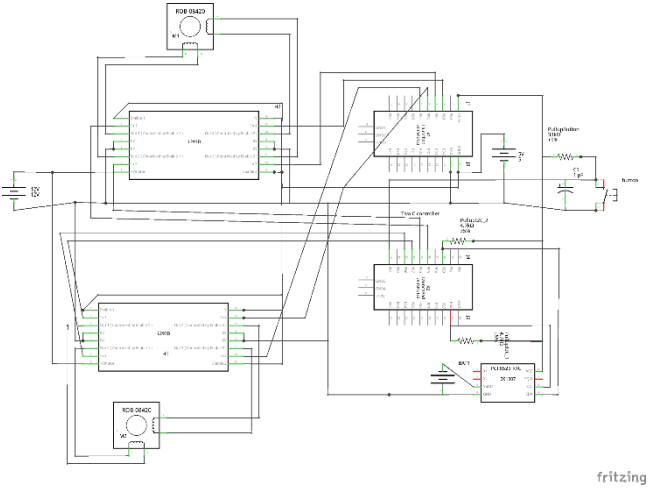


Figure 2: System schematics

3.2 MOTORS AND POWER CONNECTION

Connect the lower motor to the breadboard according to the following mapping of wire colour to pin:

- Red - a61
- Yellow - a58
- Grey - j61
- Green - j58

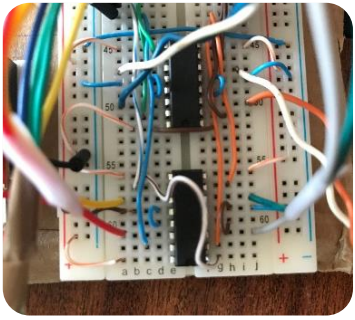


Figure 3: Lower motor connection

For the upper motor connect it to the orange/white and blue/white wires:

- Red, Yellow - Blue, White
- Grey, Green - Orange, White

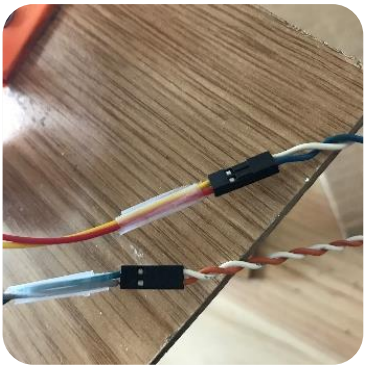


Figure 4: Upper motor connection

The power supply should be connected as follows:

- 12V - j-side +V bus
  Yellow jumper wire to Red wire
- 5V - a-side +V bus
  Red jumper wire to middle Grey wire
- Ground - ground bus
  Blue wire to outer Grey wire

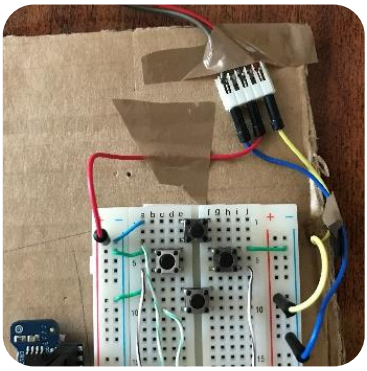


Figure 5: Power supply connection

4 START USING YOUR DEVICE

Setup Instructions

1. Place the solar mirror in a dry and sunny location such as a garden or balcony and face the mirror approximately south. You can use a compass to help you find south. As the mirror comes pre-programmed to your location you do not need to worry about entering any information!
2. Switch the solar mirror on using the switch on the device as shown in the picture.

Figure 6: On-off switch

3. Wait while the solar mirror repositions itself. Do not press any buttons or switch off the device while it is moving.
4. Find the location of the light reflected by the solar mirror.
5. Set the desired position of the reflected light using the buttons on the breadboard as shown in the picture.

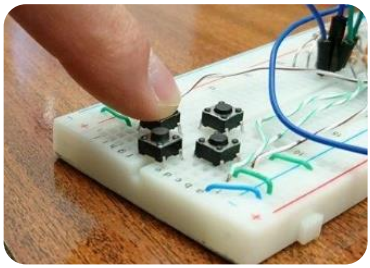


Figure 7: Setup buttons

6. Setup is complete. Switch the mirror off at the end of the day to conserve battery life (Not required for the prototype version). Should you want to change the position of the reflected light, switch the device off and follow the steps above again.

To get the most out of your SUNO solar mirror always keep the reflective surface clean by wiping with a damp cloth

5 FURTHER INFORMATION

5.1 MAINTENANCE

For the correct operation of the device, it is recommended to:

- Keep the reflective surface clean by wiping with a clamp cloth.
- Grease the leadscrew from time to time, for the mechanism to work smoothly.
- Check the correct operation of the end of range sensors.

5.2 SAFETY

To ensure your safety when using the device always follow these rules:

- Never look directly at the Sun or it's reflection in the mirror.
- Ensure that the sunlight is not reflected onto flammable liquids or materials.
- To avoid damage to your property, ensure that the sunlight is not reflected onto objects that are sensitive to or degraded by sunlight.
- Ensure that the power supply for SUNO does not come into contact with liquids and do not use in humid environments.
- Ensure that the mains voltage corresponds to the voltage indicated on the power supply rating label.
- If the power supply cable is damaged do not use the device and replace the power supply.

5.3 WARRANTY

- **Length of warranty:** Two-year limited warranty from the date of purchase.
- **SUNO will provide**: Hassle- free replacement of your SOSM or spare parts.
- **SUNO will not provide**:

1. Repairs when the SOSM is used for uses other than normal home use.
2. Damage resulting from accident, alteration, misuse or abuse or use with products not approved by SUNO.
3. Replacement parts or repair costs for the SOSM when operated outside the country of purchase.

5.4 RECYCLING

SUNO has been designed in such a way as to be user serviceable. If a part fails, contact us to be sent a replacement part. If for any reason you do not want the product anymore please send it back to us and we will recycle it. Alternatively, you can recycle SUNO's parts yourself using the following advice:

- All metal and wooden parts of SUNO are recyclable – take them to your local recycling centre. You may also repurpose these parts for your own projects to reduce environmental impact.
- Take all electronic parts to your local e-waste facility. Never throw electronics directly into the bin as they can contain substances which are harmful to the environment and should be recycled properly. It is possible to desolder some of the various electronic components for your own use – to do so is at your own risk.

5.5 TROUBLESHOOTING AND SUPPORT

I can't see any reflected light
Ensure that SUNO's reflective surface is clean.

Reflected light is in the incorrect area
Ensure that you are using SUNO in the location that you stated when you purchased it. Use the buttons to position the reflected light to your desired area.

I have placed the mirror but it has not repositioned itself
Ensure that SUNO is plugged in and switched on.

When I press the buttons, nothing happens
Wait a moment and try again
SUNO may still be repositioning itself after being turned on
Ensure SUNO is plugged in and switched on.

The reflected light position is unstable/repositioning does not happen frequently/SUNO operates outwith daylight hours
Contact us and we will help you to reconfigure the device - you will need access to a computer to reset SUNO's controller using the micro USB connection. There may be a problem with SUNO's real time clock in which case we will send you a replacement part.

5.6 CONTACT INFORMATION

- **Margot Gutscoven**: gutscoven.margot@gmail.com
- **Jan Latko**: jan.piotr.latko@gmail.com
- **Raymond Quinn**: rquinn200@caledonian.ac.uk
- **Anna Simons**: anna.simons.fi@gmail.com
- **José Hugo Valiente**: linkx95@gmail.com

Website: https://simons-anna.wixsite.com/suno