DUO
INSTRUCTIONS FOR FABRICATION

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1. Basic Info

Duo is an add-on device for blinds' cane designed to allow the blind and visually impaired to locate people around them and maintain the security distance of 1,5m.

Thanks to the use of ultrasonic and infrared sensors, Duo is able to locate people around the blinds and send haptic feedback to the cellphone to allow them to move around avoiding people. The device allows users to hack a simple cane, permitting visually impaired people to keep their distance even in a health emergency situation like the current one.

Duo is easily removable from the cane and it also permits the blind person to use it on the guide-dog simply changing the case.

BILL OF MATERIALS

The table below contains all the materials necessary for the reproduction of the product.

BUY

Name and typology	Link	Qty	Cost
PIR infrared sensor	http://bit.ly/pirinfrared	1	12,56€
Micro lipo charger	https://www.adafruit.com/product/1904	1	4,99€
Microlipo battery	http://bit.ly/microlipobattery	1	12,99€
Ultrasonic sensor	https://www.digikey.com/en/products/detail/parallax-inc/28015/1774419	1	29,99€
SPST switch Ø 16 mm	https://it.rs-online.com/web/p/interruttori-a-bilanciere/3144995/	1	2,11€
Arduino Lolin32	https://www.amazon.it/ILS-LOLIN32-V1-0-0-Bluetooth-ESP-32/dp/B07687C66W	1	21,20€
Screw M3x8	socket head screw	12	

MAKE

Name	Material and Technology	Qty
clip.stl	PLA 3D printing	1
internal_support.stl	PLA 3D printing	1
lower_part_case.stl	PLA 3D printing	1
upper_part_case.stl	PLA 3D printing	1
silicon_cover_stick.stl	Flexible resin SLA printing	1
silicon_cover_dog.stl	Flexible resin SLA printing	1

TECHNOLOGY AND TOOLS USED

- Form 2 by FormLabs (SLA 3D printer) to print the flexible covers..

- Wasp 2040 (FDM printer) to print all the other components.

- Soldering station.

- A personal computer running Arduino IDE.

SECURITY TOOLS AND DEVICES

Safety goggles are suggested for soldering, in addition, also gloves and face mask to manage the resin for the SLA printing.

2. Step By Step Explanation

Duo has been designed to be adapted to any kind of blind's cane and guide-dog simply adjusting the band and changing the case. So the 3D files are perfect to be downloaded and used by everyone.

STRUCTURE (SLA/FDM 3D PRINTING)

The flexible covers are printed in SLA while all other parts could be printed on a regular FDM printer. If your printer has a direct drive extruder, you can also print the cases in TPU (we raccomanded a 80 shore polymer).
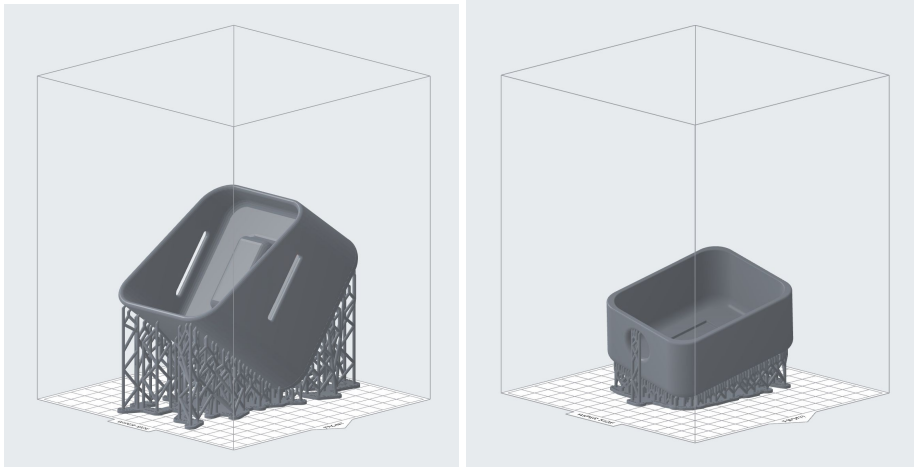
Fig. 1-2. The two covers are placed in the SLA slicer.

Step 01 – Select and extract lower_part_case.stl, internal_support.stl and upper_part_case.stl file from DUO_digitalfiles.zip

These files include the geometry that can be opened through a slicing software for 3D printing (choose the best slicing software that fits your printing needs).
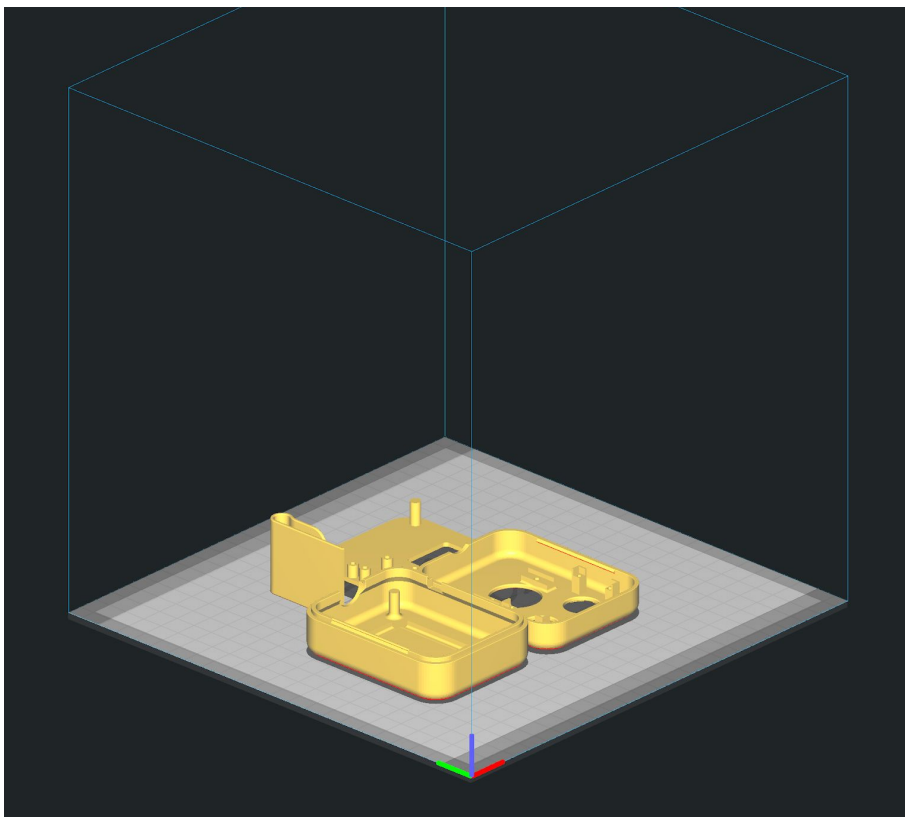Verify the printing settings, according to the printer used (SLA and/or FDM).

Fig. 3. The correct positioning of the components on the plate..

Step 02 - Proceed with the 3D printing operations

Proceed with the setting of the printer. For this project is recommended a flexible resin. We have opted for [this one](#).

Fig. 4. The end result of the SLA printing.
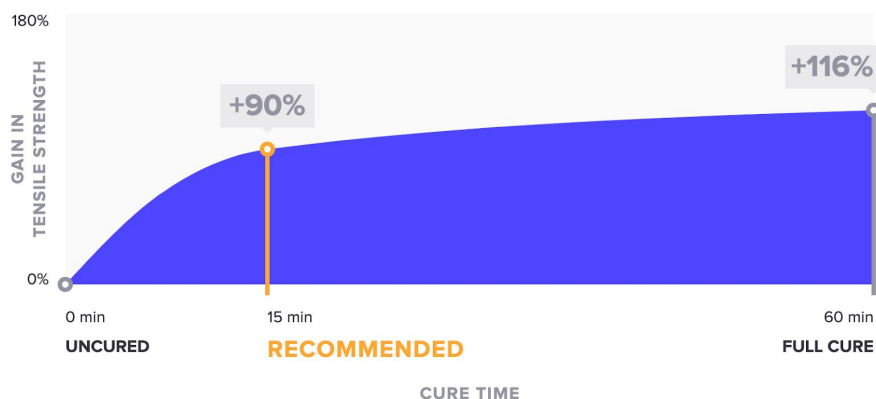
Step 03 - Wash and cure the parts

Fig. 5. Settings from the FormLabs support to cure the resin.

Step 04 – Remove the supports

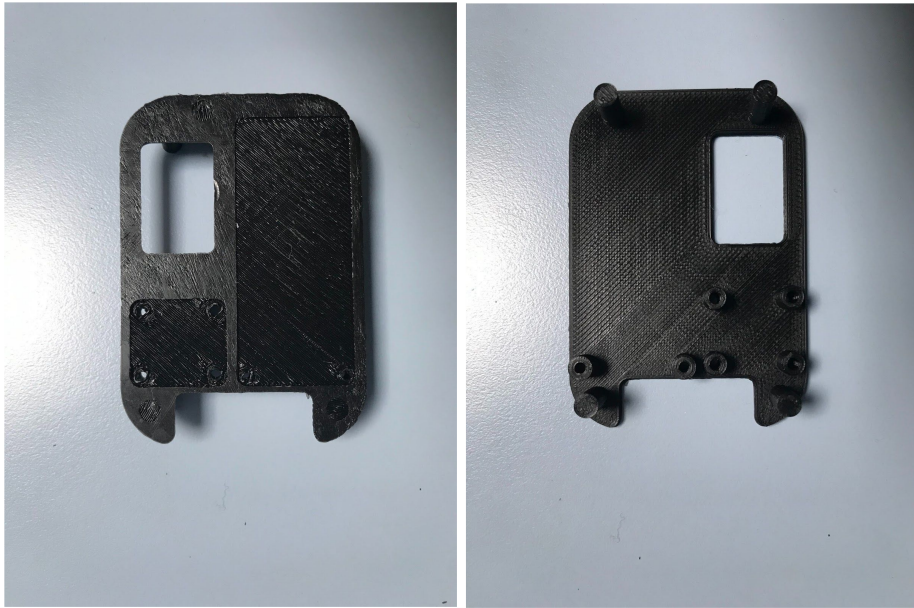Use a pair of small cutters to remove the supports. They will come off easily.

Fig. 6-7. The board support
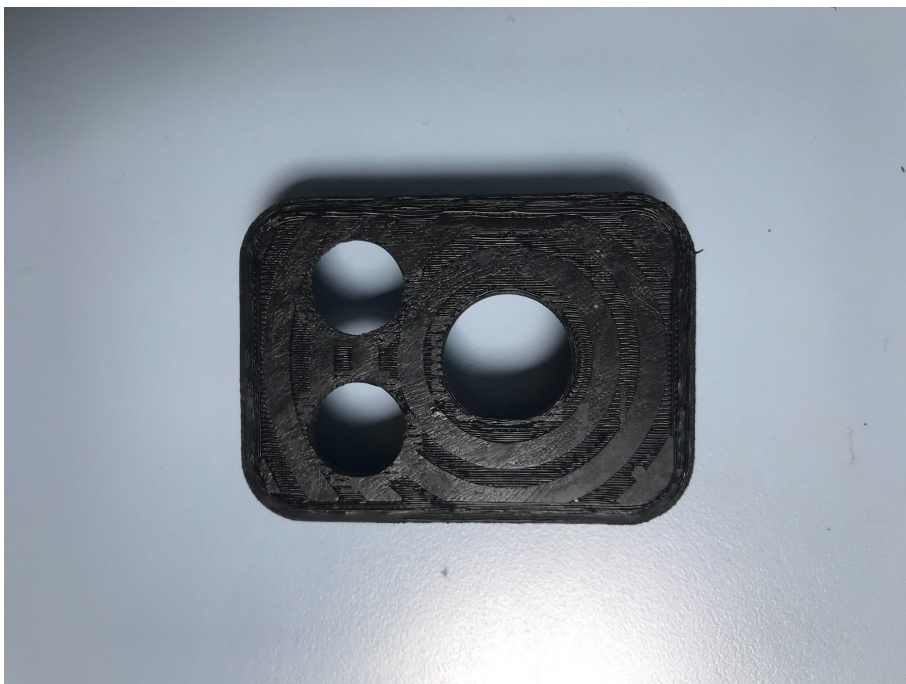

Fig. 8. The superior shell.

BOARD PROGRAMMING

Step 01 – Select and extract from DUO_digitalfiles.zip the file Duo_ArduinoCode.ino

These files include the code to be loaded on the electronic board. Use a programmer and an integrated development environment to load the code. Then, verify the proper functioning of the board opening the serial monitor.
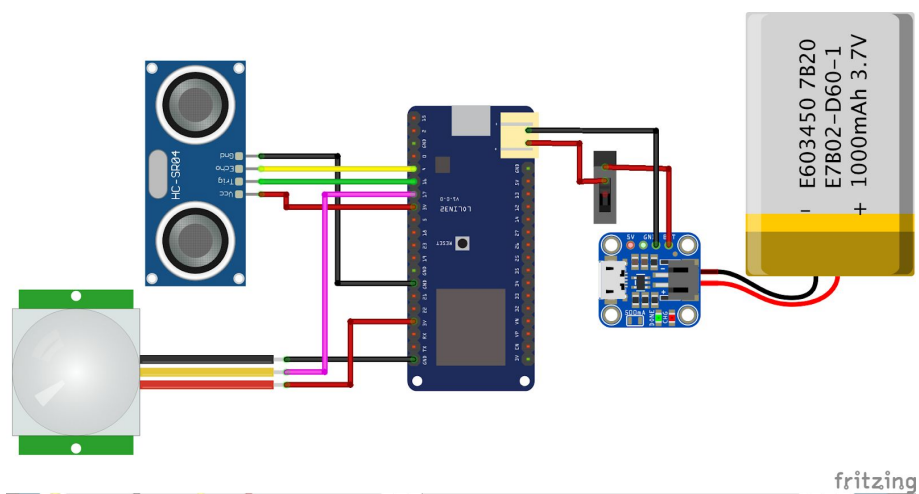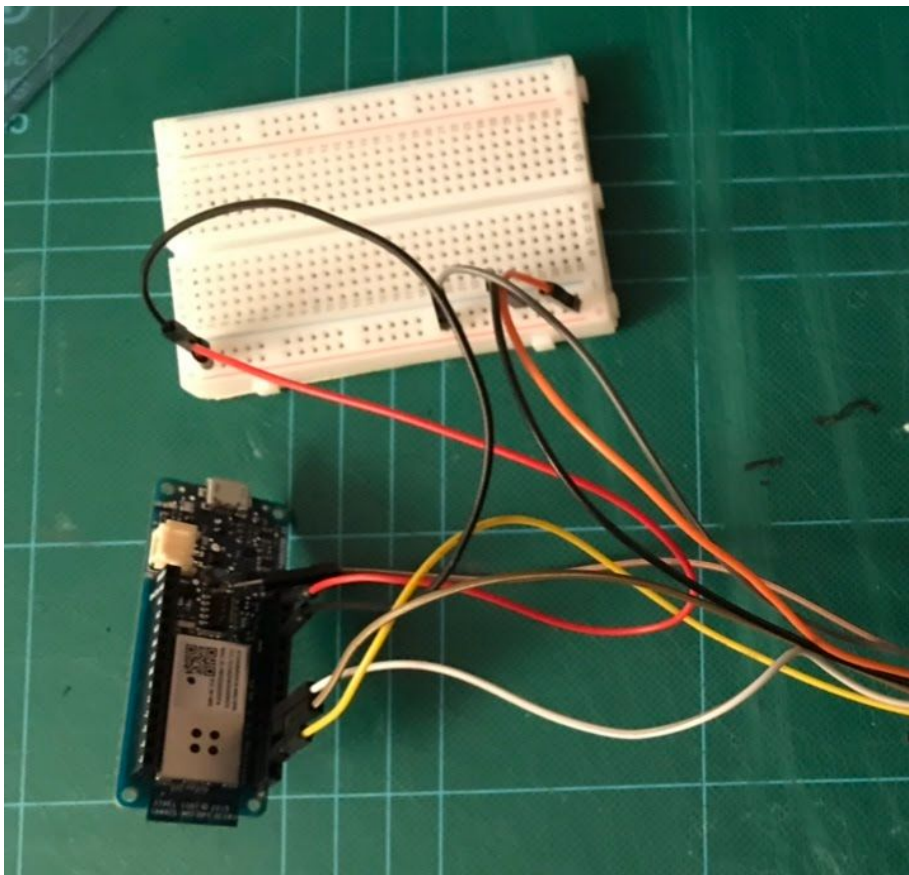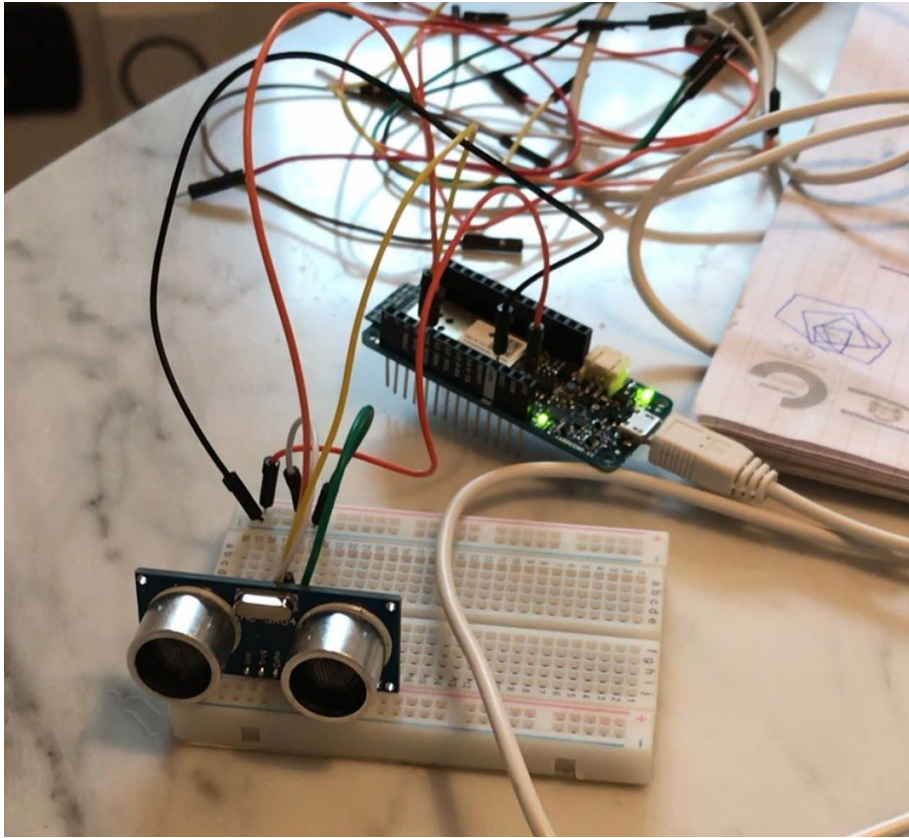
Fig. 9. Wiring of the electronic components.

Fig. 10-111. The board connected to the sensors.

FINAL ASSEMBLY

Assemble the device starting from the inferior shell: arrange the battery inside the inferior shell, then connect it with the board and make the cable pass through the hole of the board support. Then connect the battery and the board. Place the board and the charger on their place and fasten them. Fasten the board support to the inferior shell. Then connect the board with the sonar and the pir sensor, then fasten them to the superior shell. Inset the switch button at the centre of the shells and connect it. Close the two shells thanks to the snap fit. Finally put the shells into the case and make the bend pass through the splits. Duo is ready to be used.

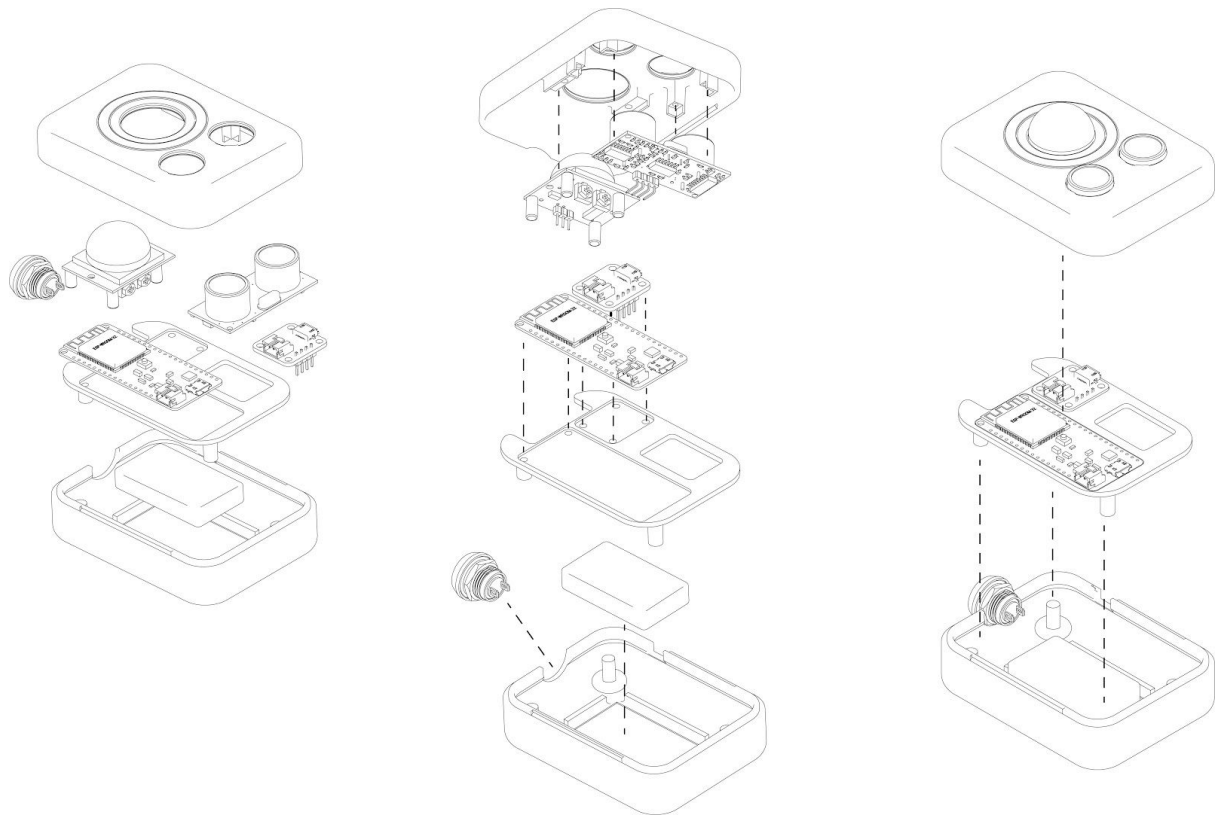

Fig. 12-13. The assembly of the sensors.

Fig. 14. Final Assembly

3. Credits

DUO is a project publicly released and made available in open source mode according to the **Creative Common License (CC-BY)** and promoted by Distributed Design with the related documentation.

The authors of DUO are Alice Carrera, Xiaojue Chang, Christian Kondic, Andrea Giovanni Ruggeri and Bianca Sordini. DUO is a project developed with the collaboration of Polifactory within the Distributed Design project co-funded by the Creative Europe Programme of the European Union. This publication reflects the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

* POLIFACTORY and DD logos have to be inserted (a .svg file with the two logos is included in the .zip folder named DUO_digitalfiles.zip)

4. Downloadable Files

DUO files can be download at:

***www.polifactory.polimi.it/en/polifactory/delice

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