

# DermAware

## INSTRUCTIONS FOR FABRICATION

AUTHORS:

**Nicolò Bisi, Nur Eral, Mattia Fantoni**

CO-AUTHORS:

**Polifactory** (Polifactory - Politecnico di Milano);

**Angelo Geraci, Nicola Corna, Fabio Garzetti, Nicola Lusardi**  
(Department DEIB, Politecnico di Milano).

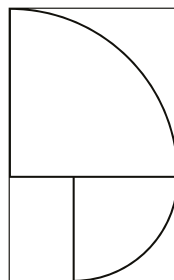
CONTACT:

Mattia Fantoni (mail to: [mattiafantoni@gmail.com](mailto:mattiafantoni@gmail.com))

DERMAWARE is a project developed with the collaboration of Polifactory within the Distributed Design Market Platform 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**

POLITECNICO MILANO 1863



**Distributed  
Design  
Market  
Platform**



Co-funded by the  
Creative Europe Programme  
of the European Union

# 1. Basic info

**DERMAWARE is a digital bracelet to educate people on the burden associated with *atopic dermatitis*<sup>1</sup>.**



Fig. 1. DERMAWARE: the final object (photo credits: Gabriele Renna)

DermAware is an educational digital device conceived to make people aware of the effects generated by the co-existence with atopic dermatitis. It simulates the annoyance generated by pruritus, typical of this pathology, at variable intervals and with different levels of intensity. In this way, DermAware can be used by patient associations or in schools to organize public and educational events.

---

<sup>1</sup> Definition of *Atopic Dermatitis* from Enciclopedia Britannica: Atopic dermatitis, the most common type of dermatitis, typically begins in infancy and can last into adulthood. It is characterized by redness, thickening, and scaling of the skin in patches, typically on the face, neck, hands, feet, in the crook of the elbow, or behind the knee. The skin becomes extremely dry, and this leads to itching. In adulthood the severity of skin symptoms tends to decrease; however, about three-quarters of affected individuals eventually develop hay fever or asthma. Scientists have identified abnormal levels of immune substances in people affected by atopic dermatitis, indicating that immune dysfunction plays an important role, likely triggering allergic reactions to normally innocuous substances. For example, in some affected people, chemical compounds associated with certain foods, plants, and animals may stimulate an inappropriate immune reaction that gives rise not only to skin symptoms but also to congestion, wheezing, and gastrointestinal upset. Irritants in tobacco smoke, detergents, industrial chemicals, and certain fabrics can also aggravate skin symptoms. The underlying cause of atopic dermatitis is not known, but it tends to run in families whose members have hay fever and asthma. (see: [www.britannica.com/science/dermatitis#ref240131](http://www.britannica.com/science/dermatitis#ref240131))

## BILL OF MATERIALS

The table below contains all the materials necessary for the reproduction of the product (consumables, electronics, components).

### CONSUMABLES

Name and tipology	Link	Quantity	Price
Resin Invicta 907	<a href="https://www.google.it/search?q=xfab+invicta907&amp;oq=xfab+invicta907&amp;aqs=chrome..69i57.4960j0j7&amp;sourceid=chrome&amp;ie=UTF-8">https://www.google.it/search?q=xfab+invicta907&amp;oq=xfab+invicta907&amp;aqs=chrome..69i57.4960j0j7&amp;sourceid=chrome&amp;ie=UTF-8</a>	1 cartridge	75,00 €
Textile for wristband	n.a	300x100 mm	2,00 €
Screws for the shell	n.a.	3 (M2x20)	0,30 €

### ELECTRONICS COMPONENTS

Name and tipology	Link	Quantity	Price
ESP32-WROOM	<a href="https://www.digikey.it/products/it?keywords=1904-1025-1-ND">https://www.digikey.it/products/it?keywords=1904-1025-1-ND</a>	1	6,67€
Led RGB 516-3908-1-ND	<a href="https://www.digikey.it/products/it?keywords=516-3908-1-ND">https://www.digikey.it/products/it?keywords=516-3908-1-ND</a>	1	0,40 €
Micro USB B	<a href="https://www.digikey.it/products/it?keywords=609-4050-1-ND">https://www.digikey.it/products/it?keywords=609-4050-1-ND</a>	1	0,66€
Vibration motor	<a href="https://www.digikey.it/products/it?keywords=1670-1011-1-ND%20">https://www.digikey.it/products/it?keywords=1670-1011-1-ND%20</a>	1	2,98€
Switch	<a href="https://www.digikey.it/products/it?keywords=P16765CT-ND">https://www.digikey.it/products/it?keywords=P16765CT-ND</a>	1	0,27€
Capacitor 1uF 0805	<a href="https://www.digikey.it/products/it?keywords=1276-1246-1-ND">https://www.digikey.it/products/it?keywords=1276-1246-1-ND</a>	1	0,10€
Capacitor 10uF 080	<a href="https://www.digikey.it/products/it?keywords=1276-1052-1-ND">https://www.digikey.it/products/it?keywords=1276-1052-1-ND</a>	2	0,14€
Capacitor 0805	<a href="https://www.digikey.it/products/it?keywords=1276-1007-1-ND">https://www.digikey.it/products/it?keywords=1276-1007-1-ND</a>	1	0,09€
Capacitor 0805	<a href="https://www.digikey.it/products/it?keywords=1276-6460-1-ND">https://www.digikey.it/products/it?keywords=1276-6460-1-ND</a>	1	0,15€
Capacitor 0805	<a href="https://www.digikey.it/products/it?keywords=1276-1065-1-ND">https://www.digikey.it/products/it?keywords=1276-1065-1-ND</a>	2	0,12€
Diode Schottky SOD-123F 30V 2A	<a href="https://www.digikey.it/products/it?keywords=MBR230LSFTIGOSCT-ND">https://www.digikey.it/products/it?keywords=MBR230LSFTIGOSCT-ND</a>	1	0,34€
Diode Schottky 20V 1A	<a href="https://www.digikey.it/products/it?keywords=478-7800-1-ND">https://www.digikey.it/products/it?keywords=478-7800-1-ND</a>	2	0,36€
Inductor 22uH	<a href="https://www.digikey.it/products/it?keywords=587-2046-1-ND">https://www.digikey.it/products/it?keywords=587-2046-1-ND</a>	1	0,09€
MOSFET n-channel	<a href="https://www.digikey.it/products/it?keywords=T2N7002BKLMCT-ND">https://www.digikey.it/products/it?keywords=T2N7002BKLMCT-ND</a>	2	0,17€
MOSFET p-channel	<a href="https://www.digikey.it/products/it?keywords=NTR3A052PZTIGOSCT-ND">https://www.digikey.it/products/it?keywords=NTR3A052PZTIGOSCT-ND</a>	2	0,46€
Resistor 100k 0805	<a href="https://www.digikey.it/products/it?keywords=541-3978-1-ND">https://www.digikey.it/products/it?keywords=541-3978-1-ND</a>	1	0,09€
Resistor 330k 0805	<a href="https://www.digikey.it/products/it?keywords=1276-5426-1-ND">https://www.digikey.it/products/it?keywords=1276-5426-1-ND</a>	1	0,09€

Resistor 22k 0805	<a href="https://www.digikey.it/products/it?keywords=1276-5356-1-ND">https://www.digikey.it/products/it?keywords=1276-5356-1-ND</a>	1	0,09€
Resistor 33k 0805	<a href="https://www.digikey.it/products/it?keywords=1276-5370-1-ND%20">https://www.digikey.it/products/it?keywords=1276-5370-1-ND%20</a>	1	0,09€
Resistor 10k 0805	<a href="https://www.digikey.it/products/it?keywords=RMCF0805FT10K0CT-ND%20">https://www.digikey.it/products/it?keywords=RMCF0805FT10K0CT-ND%20</a>	5	0,09€
Resistor 330 0805	<a href="https://www.digikey.it/products/it?keywords=1276-5246-1-ND">https://www.digikey.it/products/it?keywords=1276-5246-1-ND</a>	3	0,09€
Resistor 2k 0805	<a href="https://www.digikey.it/products/it?keywords=1276-5287-1-ND">https://www.digikey.it/products/it?keywords=1276-5287-1-ND</a>	1	0,09€
Resistor 100 0805	<a href="https://www.digikey.it/products/it?keywords=1276-5224-1-ND%20">https://www.digikey.it/products/it?keywords=1276-5224-1-ND%20</a>	1	0,09€
Resistor 3,3k 0805	<a href="https://www.digikey.it/products/it?keywords=1276-5298-1-ND">https://www.digikey.it/products/it?keywords=1276-5298-1-ND</a>	1	0,09€
Loader IC	<a href="https://www.digikey.it/products/it?keywords=296-47315-1-ND%20">https://www.digikey.it/products/it?keywords=296-47315-1-ND%20</a>	1	0,97€
Voltage monitor	<a href="https://www.digikey.it/products/it?keywords=296-35470-1-ND">https://www.digikey.it/products/it?keywords=296-35470-1-ND</a>	1	0,60€
Voltage regulator	<a href="https://www.digikey.it/products/it?keywords=296-19643-1-ND">https://www.digikey.it/products/it?keywords=296-19643-1-ND</a>	1	1,92€
LED driver	<a href="https://www.digikey.it/products/it?keywords=296-41920-5-ND">https://www.digikey.it/products/it?keywords=296-41920-5-ND</a>	1	3,08€
Linear voltage regulator	<a href="https://www.digikey.it/products/it?keywords=296-40964-1-ND">https://www.digikey.it/products/it?keywords=296-40964-1-ND</a>	1	0,70€
Resistor 10k 0805	<a href="https://www.digikey.it/products/it?keywords=RMCF0805FT10K0CT-ND%20">https://www.digikey.it/products/it?keywords=RMCF0805FT10K0CT-ND%20</a>	4	0,08€
MOSFET n-channel	<a href="https://www.digikey.it/products/it?keywords=2N7002NCT-ND">https://www.digikey.it/products/it?keywords=2N7002NCT-ND</a>	2	0,28€
Capacitor 1uF 0805	<a href="https://www.digikey.it/products/it?keywords=1276-1246-1-ND">https://www.digikey.it/products/it?keywords=1276-1246-1-ND</a>	1	0,10€
Capacitor 2.2uF 0805	<a href="https://www.digikey.it/products/it?keywords=1276-2902-1-ND">https://www.digikey.it/products/it?keywords=1276-2902-1-ND</a>	1	0,16€
3.7V 500mAh Li-Po Battery	<a href="https://www.ebay.it/itm/2pcs-4pcs-3-7V-500mAh-Li-po-Battery-4in1-Charger-for-JJRC-H37-BAYANGtoys-X20/401569276675?hash=item5d7f64e303:m:mZXRkX3zi4DNEltdezLixUg">https://www.ebay.it/itm/2pcs-4pcs-3-7V-500mAh-Li-po-Battery-4in1-Charger-for-JJRC-H37-BAYANGtoys-X20/401569276675?hash=item5d7f64e303:m:mZXRkX3zi4DNEltdezLixUg</a>	1	4,36€

#### TECHNOLOGY AND TOOLS USED

- Desktop CNC milling machine for the electronic board (PCB)
- Electronics bench to weld the components and debug the board
- 3D printing (SLA) to print the body
- 3D printer (FDM) to print the wristband

## 2. Step-by-step materialization

### Step 01 – Mill the electronic board (PCB) and weld the components

Extract the folder **esp32\_smartband\_prototyping\_board** from the **Zero2\_digitalfiles.zip** that includes all the files related to create the electronic board.

Follow the instructions to mill the electronic board using a Desktop CNC Milling Machine, then remove the excess material.

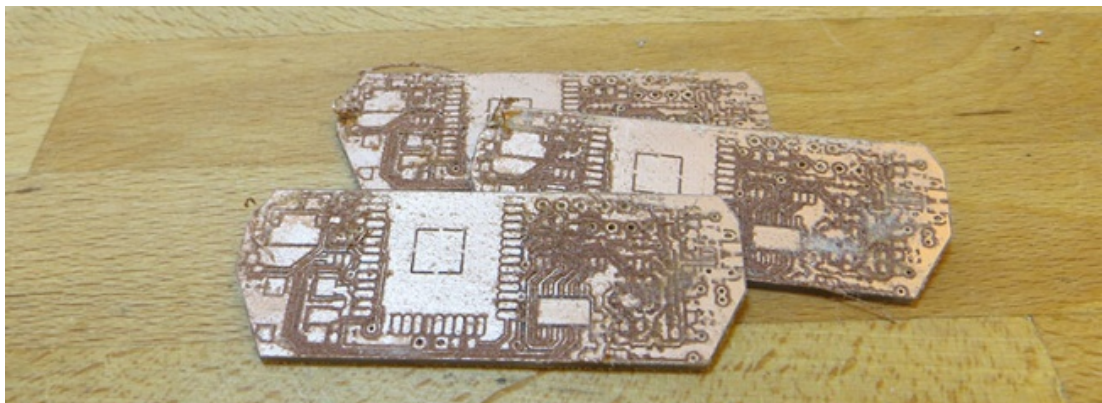


Fig. 2 and 3. The CNC milling machine in action and the final PCBs.

### Step 02 – Board programming

Extract from **DermAware\_Digitalfiles.zip** the file **DermAware\_esp32\_Arduino Code.txt** which includes the code to be load on the electronic board.

Use a programmer and an integrated development environment to load the code (in this case Arduino IDE). Then, verify the proper functioning of the board opening the serial monitor.



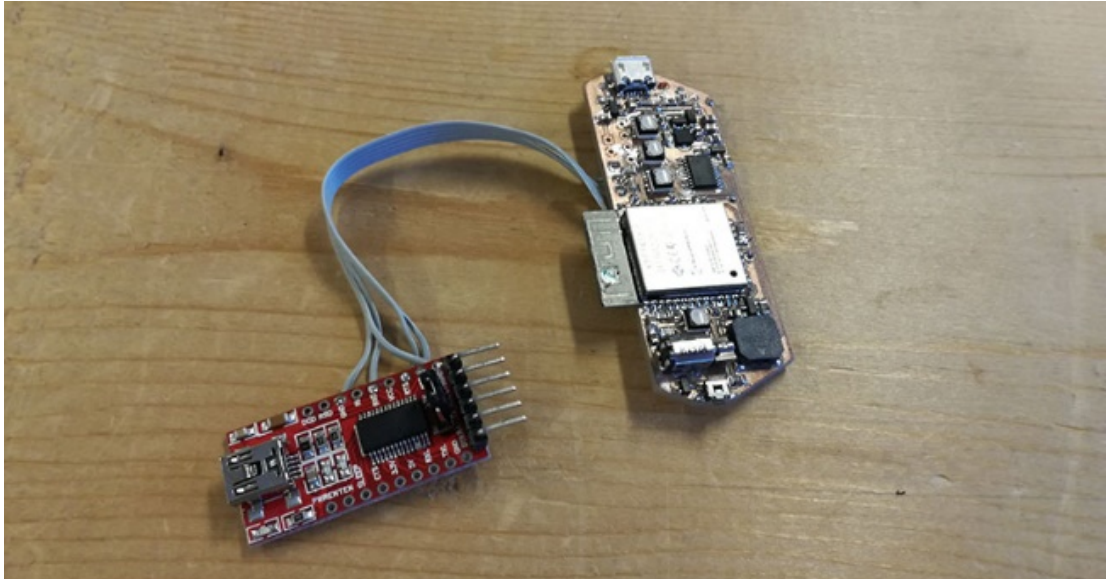


Fig. 5. The board with the programmer.

### Step 03 – DermAware shells 3D printing (SLA)

Download from DermAware\_Digitalfiles.zip both the three .stl files named: **DermAware\_Switch.stl**, **DermAware\_Bottom.stl**, and **DermAware\_Top.stl**. These files include the geometry to be opened through a 3D printing software. Verify the printing settings, according to the printer used (SLA and/or FDM), and then proceed with the 3D printing operations.

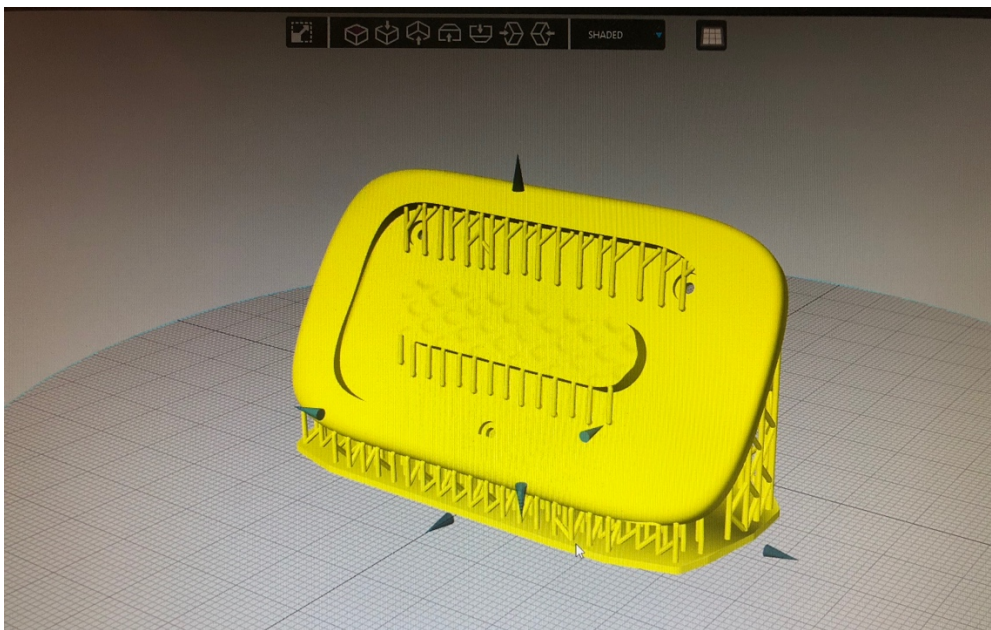


Fig. 6. The Shell

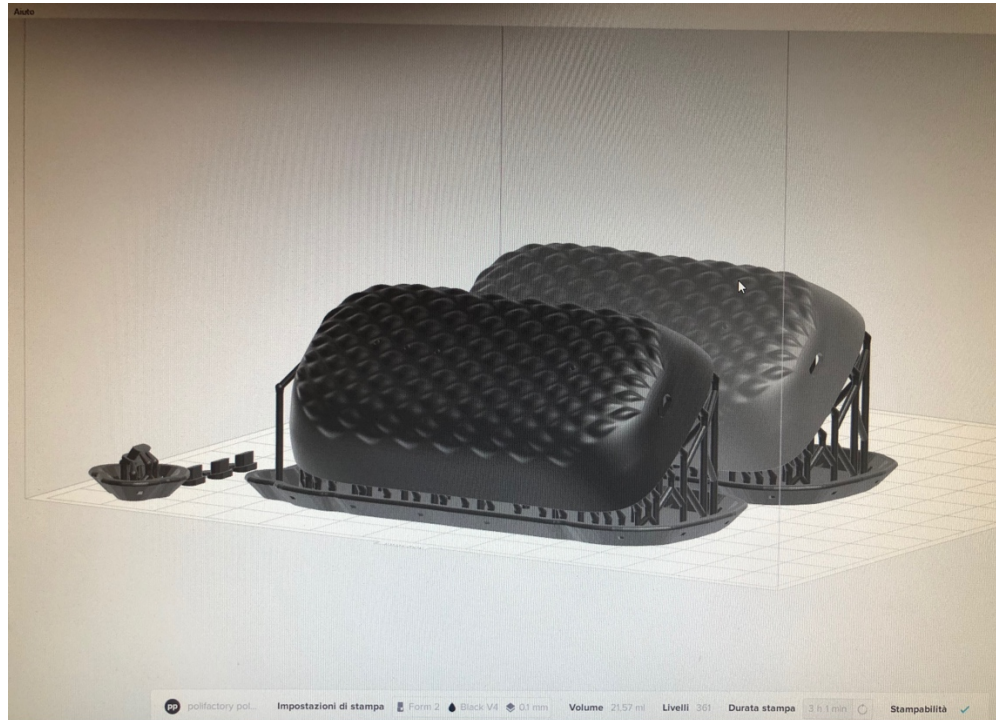


Fig. 5a. – 5b.: 3D printing the DermAware shells using a SLA printer.

#### **Step 04 – Wristband cutting and metal buttons insertion**

Download from zip DermAware\_Digitalfiles.zip the file named **DermAware\_Wristband.svg**. This file includes the outline drawings of the wristband to be cut with a laser cut machine. Check on software of the laser cut that colours and thickness of the drawing lines are correctly set-up (the red lines are for the internal cuts, the black one is for the external cut).

#### **Step 05 – Final assembly**

Assemble the device starting from inferior shell: connect the board with the battery and arrange them inside the inferior shell. Then place the small switch inside the top shell and the close the two shells using three small screws After continue with the placement of the board, which must be connected with the battery.

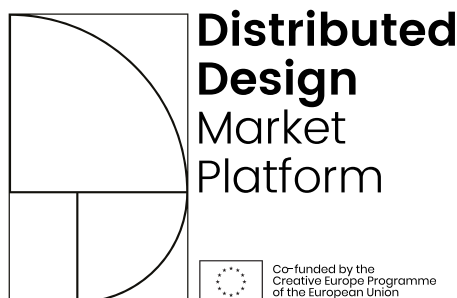
Lastly, close the device with the superior shell and Zero2 is finally assembled and ready to be used.

### 3. Credits

DERMAWARE 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 Market Platform with the related documentation.

The authors of DERMAWARE are **Nicolò Bisi, Nur Eral, and Mattia Fantoni**. Co-authors of the project are **Polifactory** (Polifactory - Politecnico di Milano), and **Angelo Geraci, Nicola Corna, Fabio Garzetti, Nicola Lusardi** (Department DEIB, Politecnico di Milano).

DERMAWARE is a project developed with the collaboration of Polifactory within the Distributed Design Market Platform 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 DDMP logos have to be inserted (a .svg file with the two logos is included in the .zip folder named Dermap\_digitalfiles.zip)

### 4. Downloadable files

DERMAWARE files can be download at:

**[www.polifactory.polimi.it/polifactory\\_progetti/ddmp-fabcare?lang=en](http://www.polifactory.polimi.it/polifactory_progetti/ddmp-fabcare?lang=en)**

CONTACT: Mattia Fantoni (mail to: [mattiafantoni@gmail.com](mailto:mattiafantoni@gmail.com))