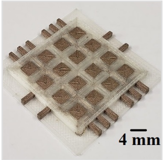

Fabrication and characterization of a pixel pressure detector using 3-D printable materials or classical PCB materials V.2

Version 2

Aug 31, 2020

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1 Works for me

dx.doi.org/10.17504/protocols.io.bkiskuee

German Sanchez

ABSTRACT

This protocol presents the fabrication process for a piezoelectric (3D printed or PCB) pixel pressure sensor using commercially available materials.

DOI

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PROTOCOL CITATION

German Sanchez 2020. Fabrication and characterization of a pixel pressure detector using 3-D printable materials or classical PCB materials. **protocols.io** https://dx.doi.org/10.17504/protocols.io.bkiskuee

KEYWORDS

Pixel detector, piezoelectric sensor, sensor, PCB, 3D

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Aug 31, 2020

PROTOCOL INTEGER ID

41266

MATERIALS

NAME	CATALOG #	VENDOR
3D printer filament PLA	154738374	Ali baba
Electrifi Conductive Filament	electrifi175	Multi3D
Cinta de Aluminio 425	70006385317	3M corporation

SAFETY WARNINGS

- Fabrication of a ZnO/PDMS Piezoelectric Triboelectric Nanogenerator requires the specialized people to work in a clena room

BEFORE STARTING

Install Autodesk inventor or any software able to design 3D structures

3D OR PCB PIXEL DETEXCTOR DESIGN

1 Into a 3D designer. In this case, inventor, generate an initial base of 38 mm * 38 mm with a thickness of 0.7 mm asshown:

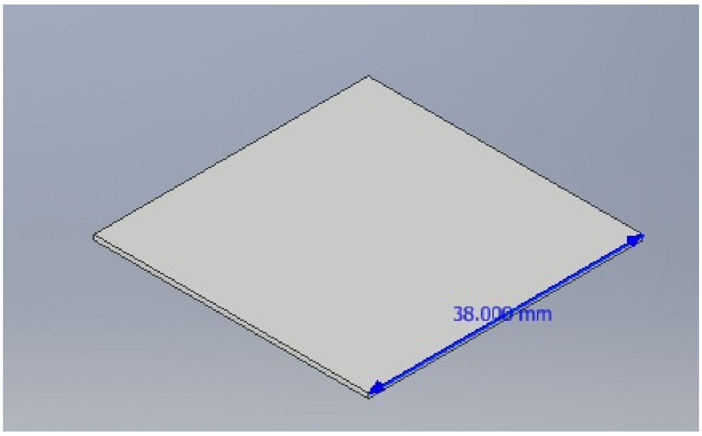

Figure 1: PLA base design

2 Create a different piece (the one that is expected to be printed in a conductive material), generating pixels of an area of 16 mm^2 , height of 2.1 mm symmetrically spaced (distance of 2.8 mm among them). Then generate paths of 1.4 mm of height and width of 1.4 mm. Each path goes to the border of the figure that is inscribed into a square of 38mm*38mm.

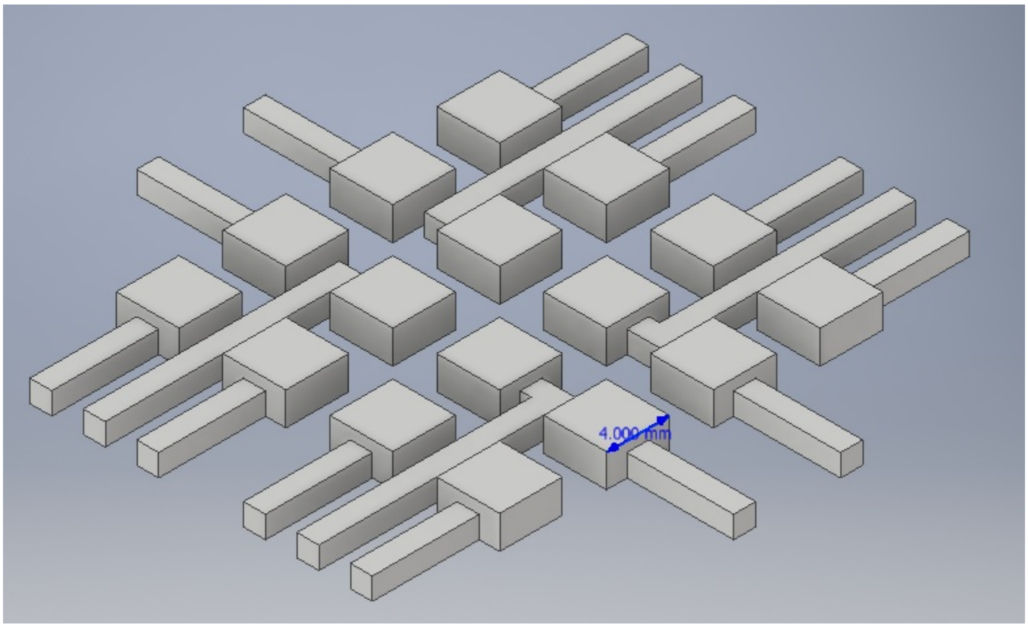

Figure 2: Conductive material pixels design

3 Finally generate a top layer to cover the pixels, as shown here:

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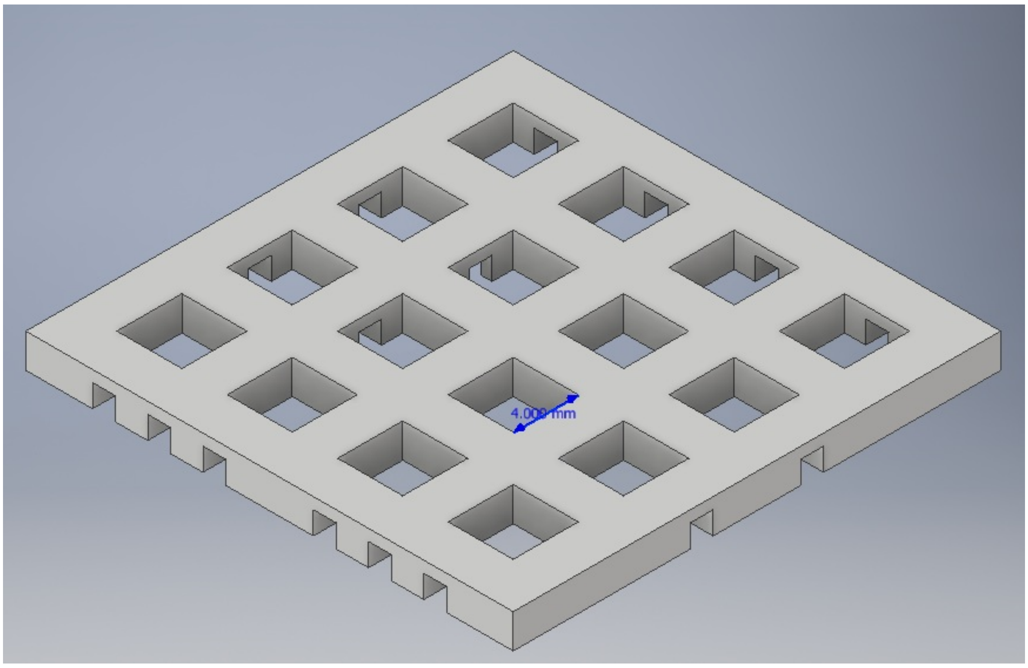

Figure 3: PLA covering layer

The squares are spaced 2.8 mm. The height of the holes is 2.1 mm and the height for the paths holes is 1.4 mm.

4 As a final step to get this structure, align the pieces as shown:

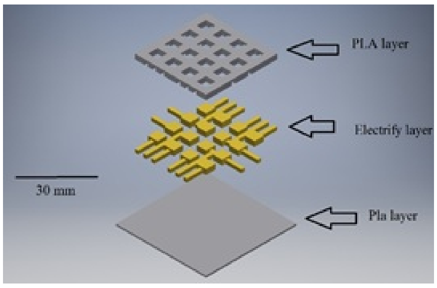

Figure 4: Assembly

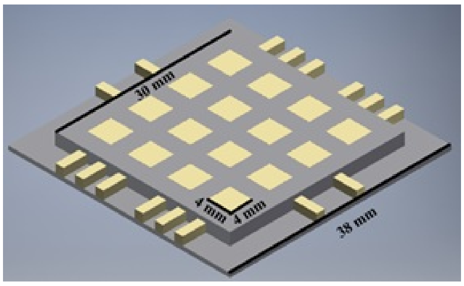

Figure 5: FInal base structure

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Step 4 includes a Step case.

USING PCB DESIGN INSTEAD OF 3D-DESIGN

step case

USING PCB DESIGN INSTEAD OF 3D-DESIGN

The other alternative to generate a pixel dectector is using a PCB inspired design with the folowing sub-steps:

1. Generate a device with pixels of 16 mm^2 of area equally spaced (Copper)
2. Use a pin board in each side of the PCB
3. connect them ensuring the paths go in the middle between the pixels they're going across
4. Add an antisolder layer to cover the paths but not the pixels

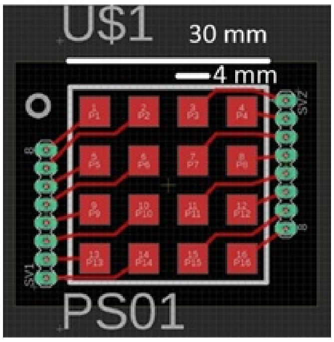
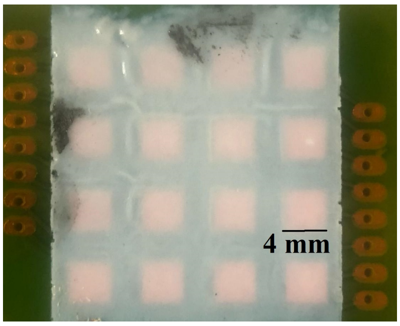


Figure 6: PCB design

5 With the two options, the 3D or the PCB inspired one, ask a clean room assistant to follow this protocol and add a 100 nm nanocompiste layer on the structure you've chosen before:

Carlos A Perez-Lopez, J.A Perez-Taborda, Alba Avila.Fabrication of a ZnO/PDMS Piezoelectric Triboelectric Nanogenerator.**protocols.io**
dx.doi.org/10.17504/protocols.io.zj8f4rw

At this step, the possible results should look like this:



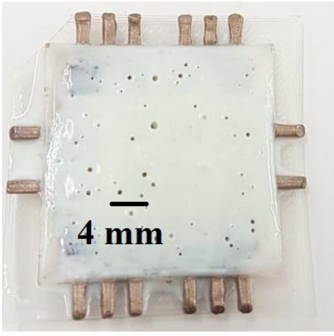
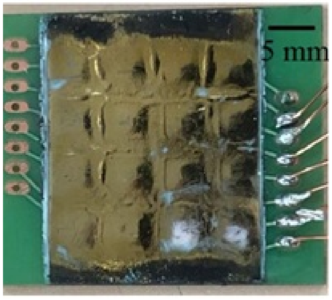


Figure 7: Nanocomposite layer for PCB design

Figure 8: Nanocomposite layer for 3-D design

6 Finally, its required to add a conductive layer. There are two options as well:

1. Use an (Au) layer of 200 nm over the nanocomposite layer:
2. Add aluminium tape (firt remove the glue with alcohol) to get the results as shown:



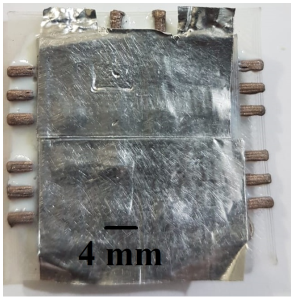


Figure 9: Final result for PCB design

Figure 10: Final result for 3-D design

Sensors Characterization

7 Set up a stage for measurements as shown in the figure 11:

Materials:

* Power supply
*Arduino Uno
 * Motor DC Crouzet 60

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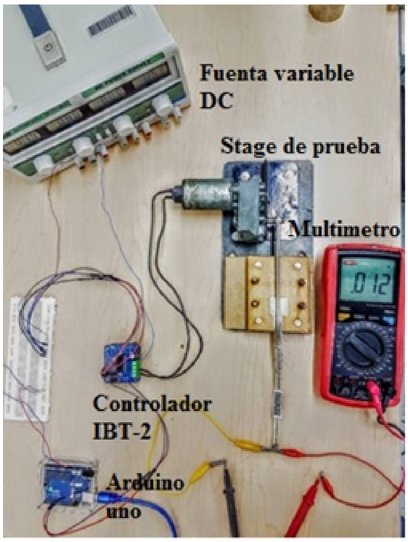

Figure 1: Stage for characterization

Follow the next schematic to connect arduino:

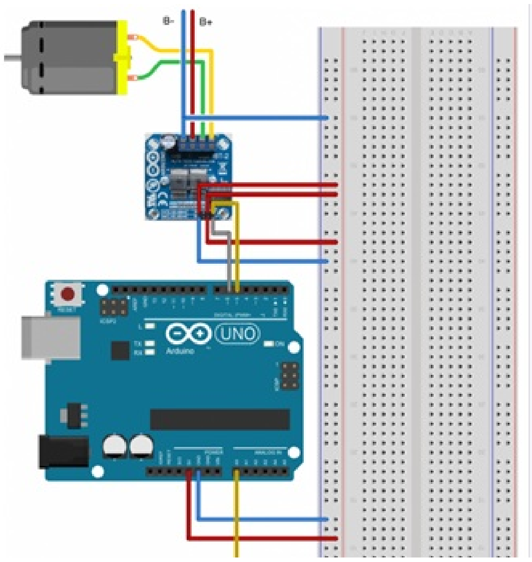

Figure 12: Schematic of arduino connection

Place the sensor below the impact area of the stage:

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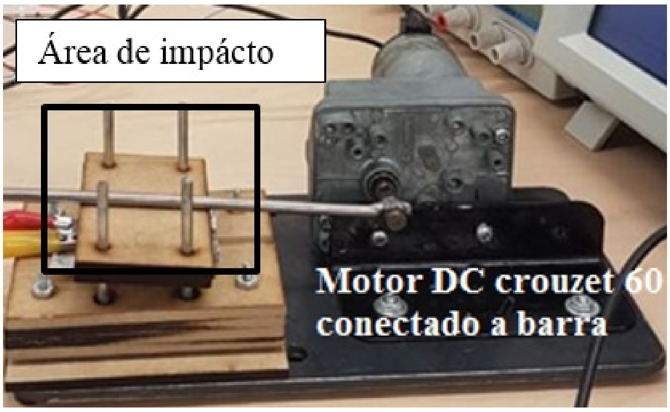

Figure 13: Stage for characterization

8 Connect the oscilloscope terminals to either one pixel PCB copper terminal or a electrifi filament if using the 3D sensor, and the other terminal to the second electrode of the sensor (conductive tape/ gold film).

9 Run the code hosted at https://github.com/gasanchez10/Zno-Nanocomposite

You can either set the frequency of the stage and the power it uses.

10 Finally check the data on the oscilloscope's screen. Register the data and start data processing.

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