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## Sensor made of Graphite

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### General features

- Easy to use
- Low cost
- Small size
- Short response time
- Android application
- Bluetooth connection
- Small sensitivity
- Two different samples



*Figure 1: Sensor made of graphite*

### Description

This overall sensor constituted of an PCB shield and a graphite sensor, and developed at the Physical Departement of INSA Toulouse, is for measuring resistor and tension of the graphite sample. The PCB shield was made for being connected on an Arduino Uno card. So, the PCB is composed by an Bluetooth module (for permissing bluetooth connection with an Android mobile), an OLED screen (for displaying values measured), a rotatory encoder (for changing the measure display) and a transimpedance circuit with a and low-pass filtering to extract useful information from the strain sensor. Also, we have made two different graphite sensors who change with the graphite concentration (ascending order) : HB, B.

With the Android application, you can connect the PCB to your phone and draw the resistor evolution of your sample on it.

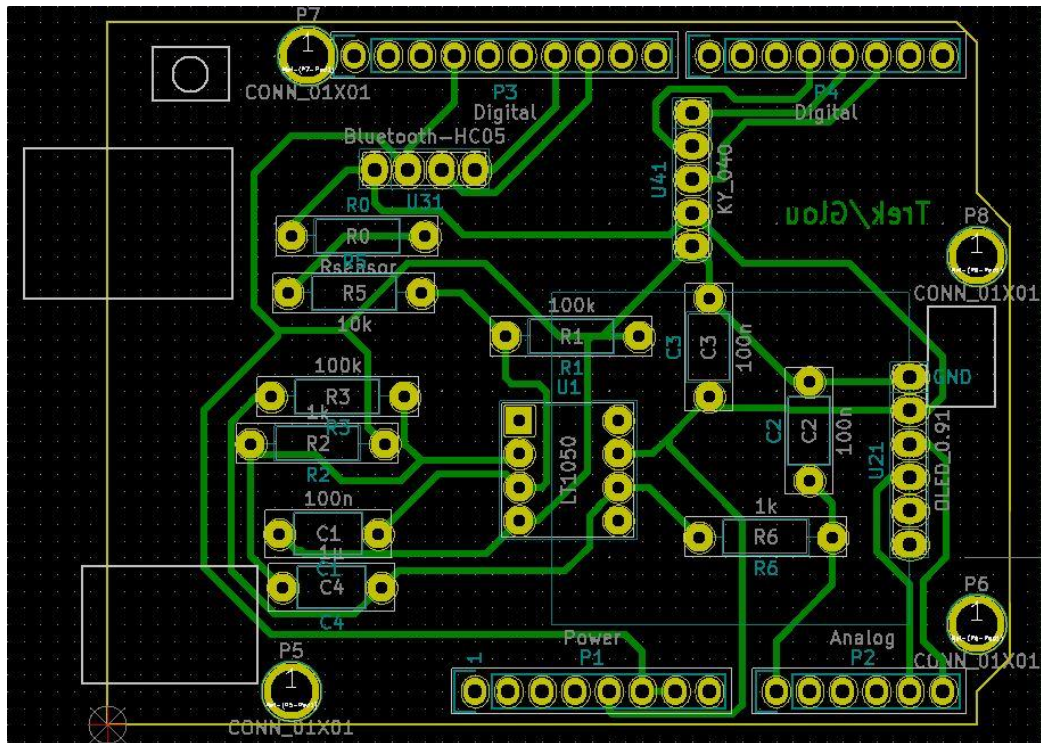


Figure 2: PCB shield KiCad

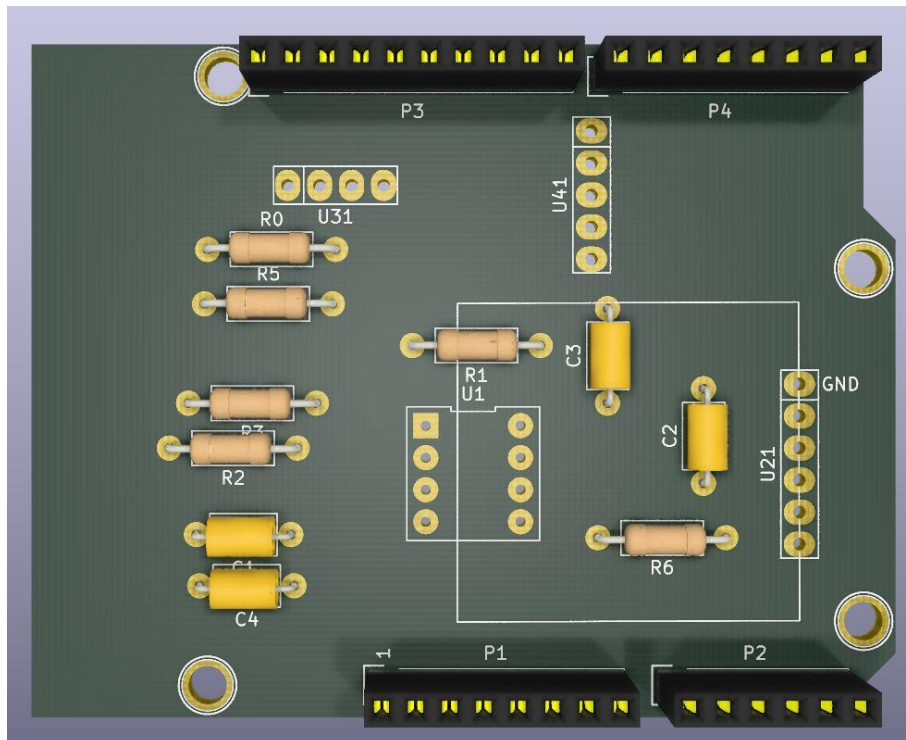
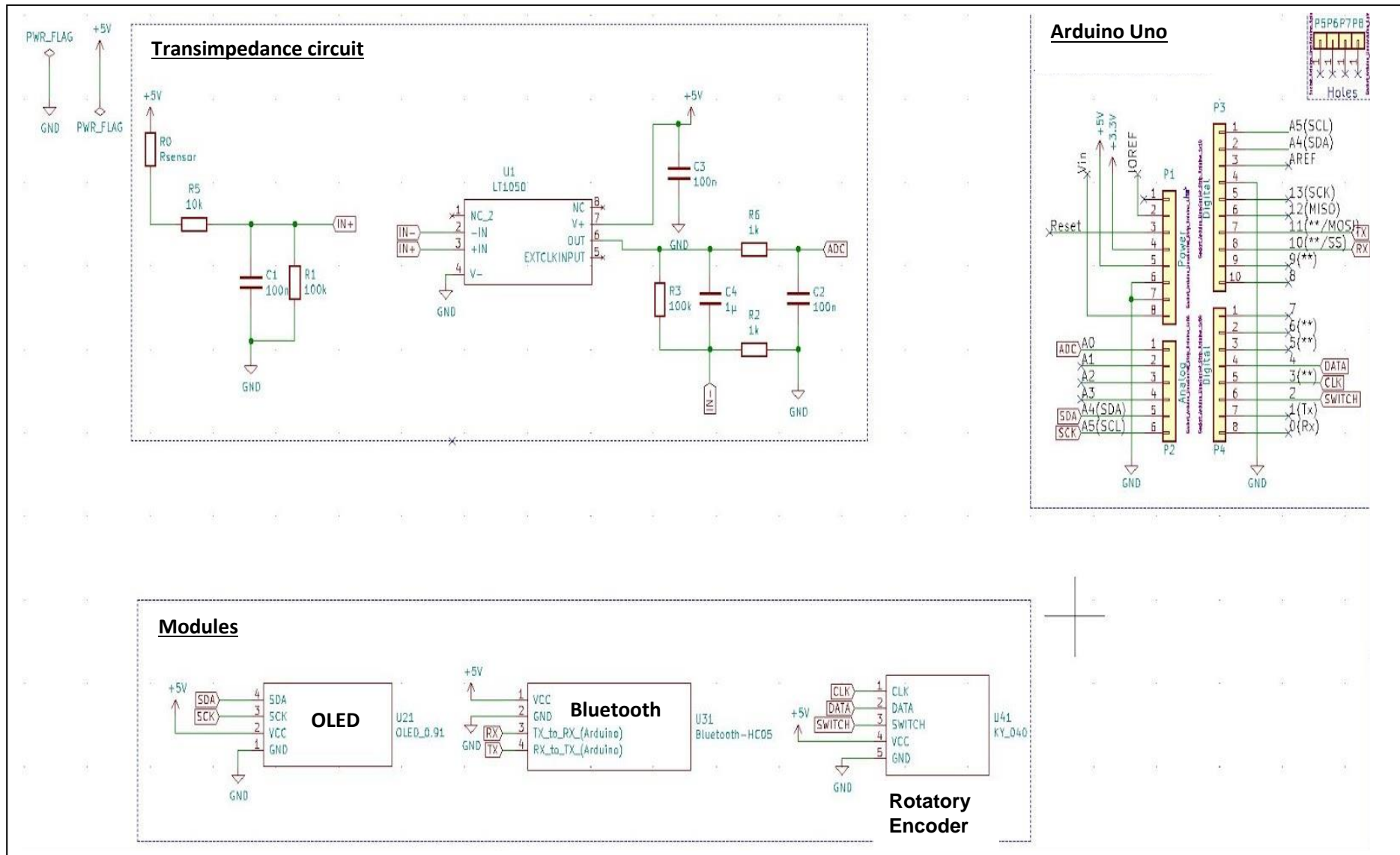


Figure 3: PCB shield Kicad (3D view)

Figure 3: Global circuit



Bluetooth module HC05 :

PIN NUMBER	USAGE
1	+5V
2	GND
3	RX (Receive)
4	TX (Transmit)

OLED 0.91:

1	GND
2	+5V
3	SCK (Serial Clock)
4	SDA (Serial Data)

Rotatory Encoder KY-040 :

1	CLK
2	DATA
3	SWITCH
4	+5V
5	GND

**Specifications**

<b>Type</b>	Nanoparticle based sensor
<b>Materials</b>	Graphite (HB,B)
<b>Sensor type</b>	Passive sensor
<b>Resistor measurement</b>	Resistive measure
<b>Tension measurement</b>	Resistive measure
<b>Mountig</b>	Overall Sensor (PCB Shield + Sensor + Android application + Arduino Uno required) + toothless alligator clips
<b>Time Response</b>	Between 0.5s et 1s
<b>PCB Length</b>	66mm
<b>PCB Width</b>	53mm
<b>PCB Height (min and max)</b>	1.5mm
<b>PCB Mass</b>	29g
<b>PIN Diameter</b>	0.8 mm

**Standard use conditions**

FACTOR	TYPICAL VALUE
Temperature	20°C ± 5°C
Humidity	40 to 60%
Bluetooth distance	20m max
Nominal Area	0*
Deterator Area	Infini* <sup>2</sup>
Destruction Area	Infini* <sup>3</sup>

\* : A slight deformation changes the basic resistance of the sensor, so there is no Nominal Area.

\*<sup>2</sup> : When the sensor starts to be deformed, we are in the zone of deterioration, it is irreversible (single use).

\*<sup>3</sup> : The sensor is “destroyed” once folded (single use).

**Test graphs for different graphite concentration on the sample**

Variation de resistance relative en fonction de la deformation : HB et B

