Graphite strain sensor

Generals features

- Easy to use
- Low cost
- Reliable
- Environmental friendly
- Easily transportable

General description

The sensor is a sheet of paper, whose dimensions are given below, on which a layer of graphite is put.
It is a strain gauge composed of a network of graphite particles. The compression and expansion of the network affects the contacts between the particles and thus affects the conductivity.
By measuring the resistance value it is possible to trace the angle.
This sensor can be used with 2B and HB graphite pencil. In absolute, it can also be used with 6B,B and H pencil

Specifications

Type	Strain sensor
Materials	Graphite Paper
Measurand	Resistance
Type of sensor	Passive sensor
Power supply	5V
Typical response time	<10ms
Repeatability	Ten times

Dimensions
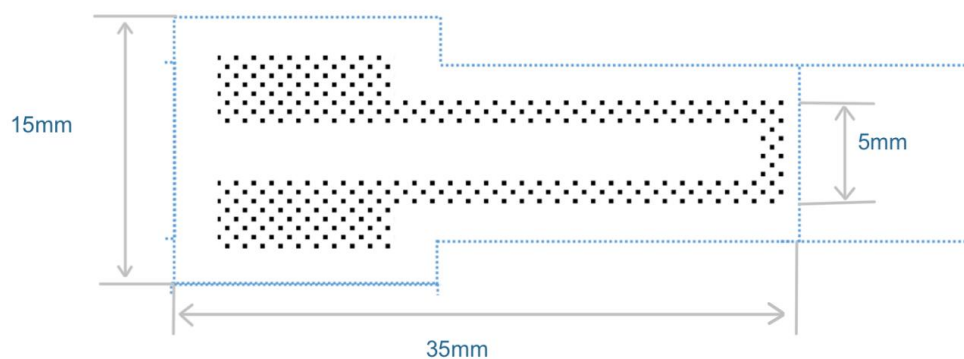
The dotted area represents the area where the graphite will be put.

Electrical characteristics

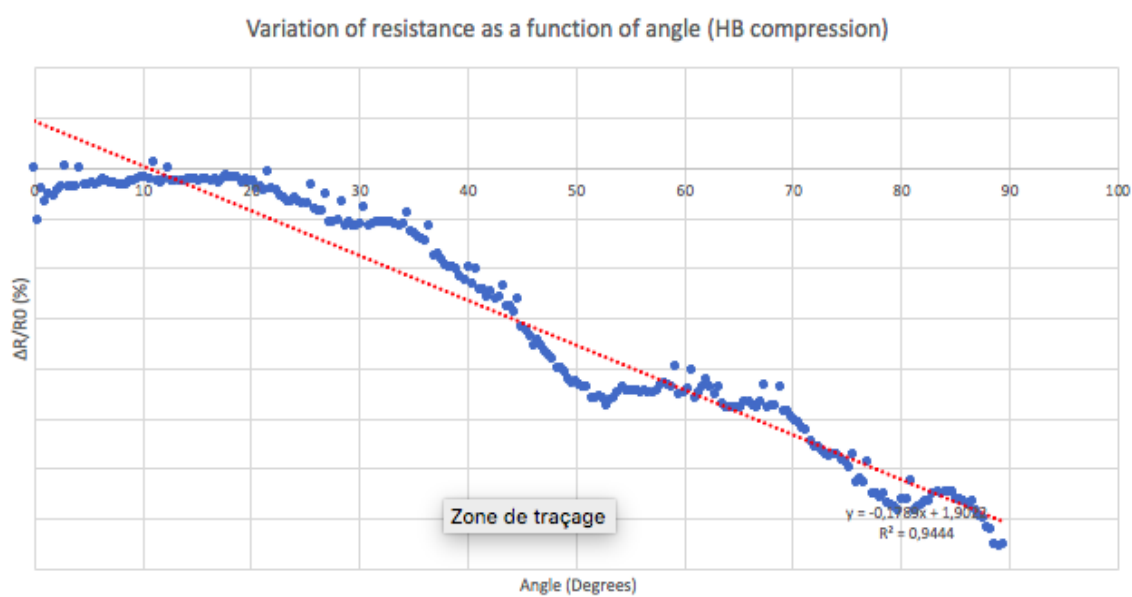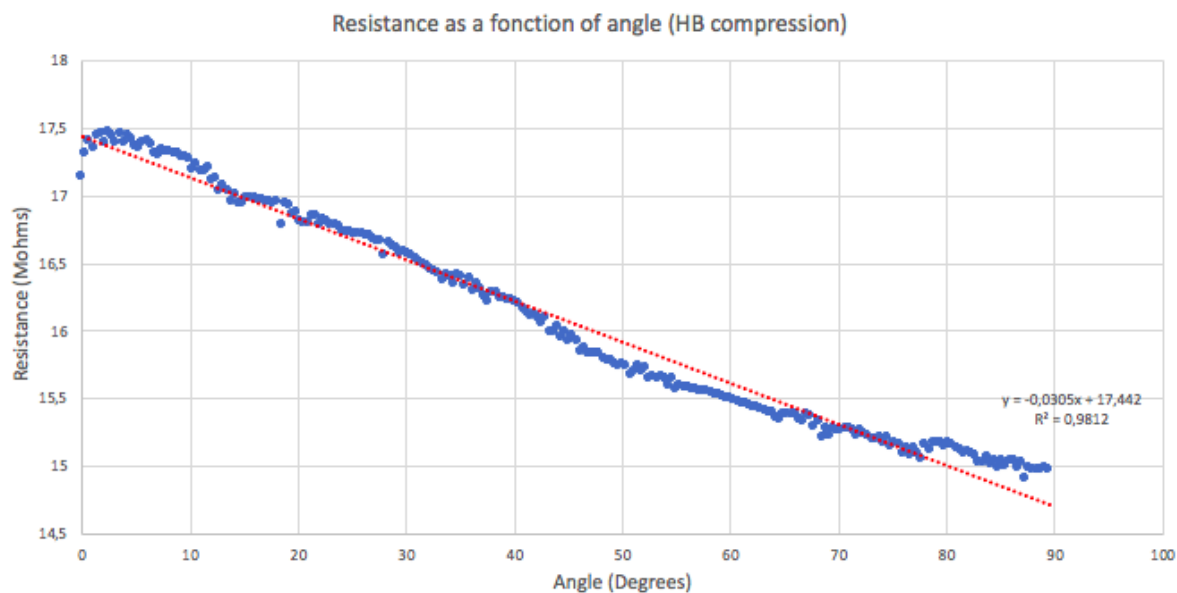The electrical characteristics have been measured with different pencils.

Compression:

	Min	Type	Max	Unit
Sensor voltage	0	/	5	V
HB pencil resistance	14,9	16,1	17,5	MΩ
2B pencil resistance	16,1	17,1	18,2	MΩ

Expansion:

	Min	Type	Max	Unit
Sensor voltage	0	/	5	V
HB pencil resistance	17,6	18,8	20,4	MΩ
2B pencil resistance	20,1	21,2	22,4	MΩ

Typical Performance Characteristics

Resistance as a fonction of angle (HB compression)
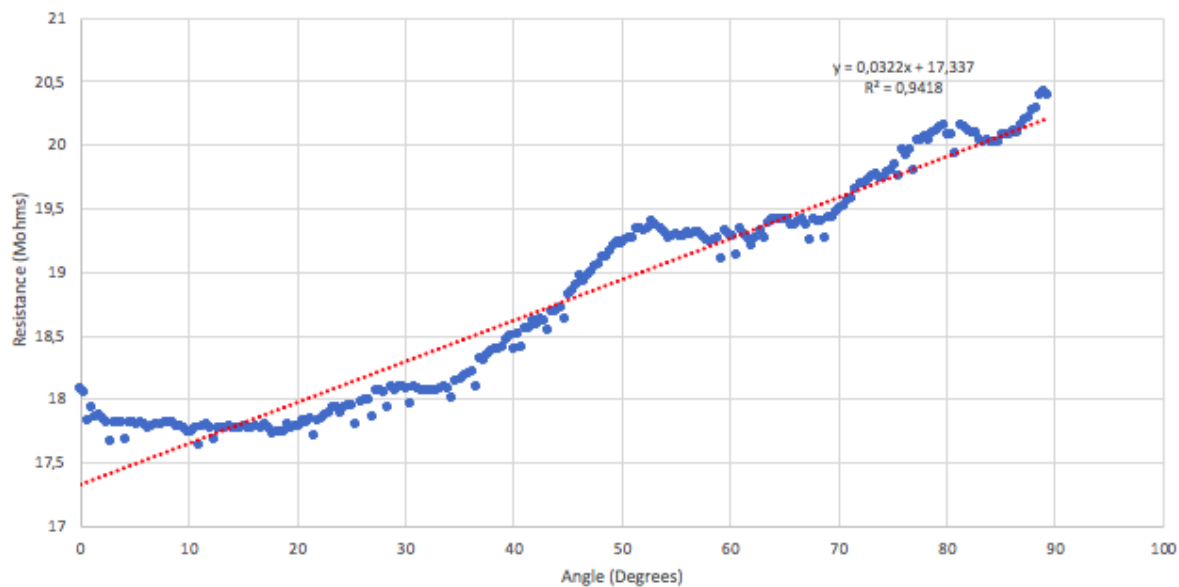
$y = -0,0305x + 17,442$
$R^2 = 0,9812$

Variation of resistance as a function of angle (HB compression)

Zone de traçage

$y = -0,1789x + 1,90...$
$R^2 = 0,9444$

Resistance as a fonction of angle (HB expansion)

$y = 0.0322x + 17.337$
$R^2 = 0.9418$

Variation of resistance as a function of angle (HB expansion)

$y = 0.1597x - 0.6143$
$R^2 = 0.9652$

Resistance as a function of angle (2B compression)

$y = -0{,}0232x + 18{,}093$
$R^2 = 0{,}9824$

Variation of resistance as a function of angle (2B compression)

$y = -0{,}1053x + 0{,}102$
$R^2 = 0{,}9326$

Resistance as a function of angle (2B expansion)

$y = 0,0216x + 20,186$
$R^2 = 0,93$

Variation of resistance as a function of angle (2B expansion)

$y = 0,128x + 0,0649$
$R^2 = 0,9824$
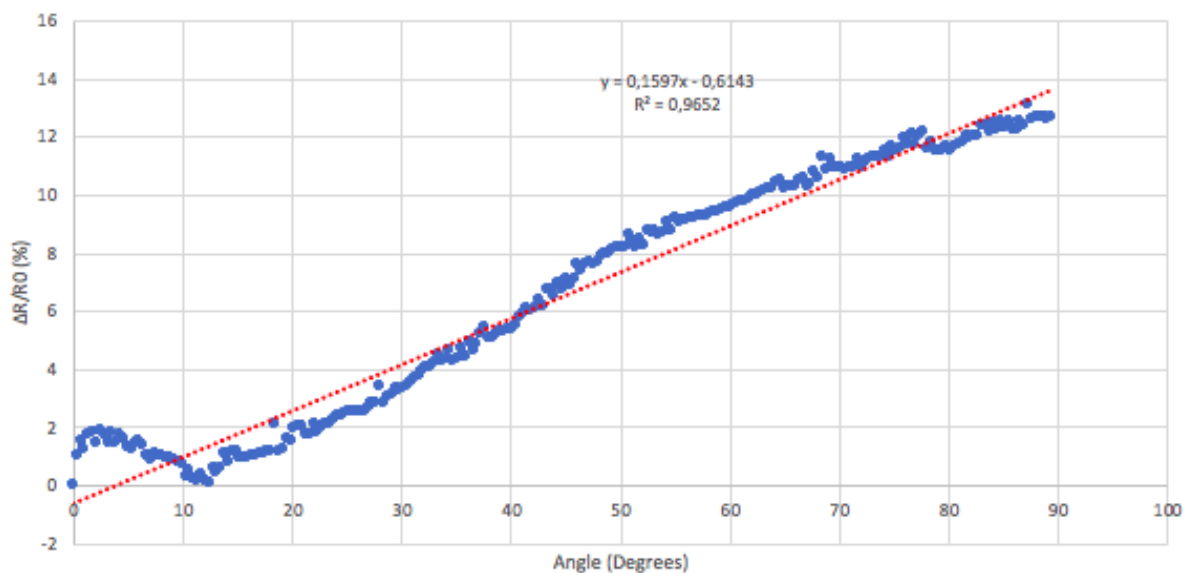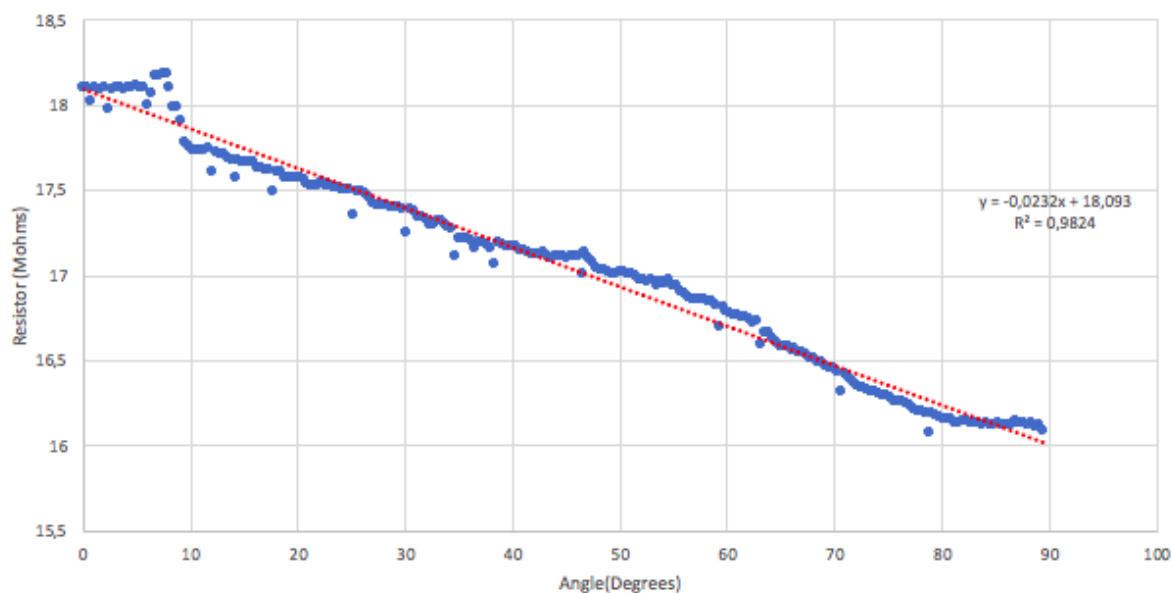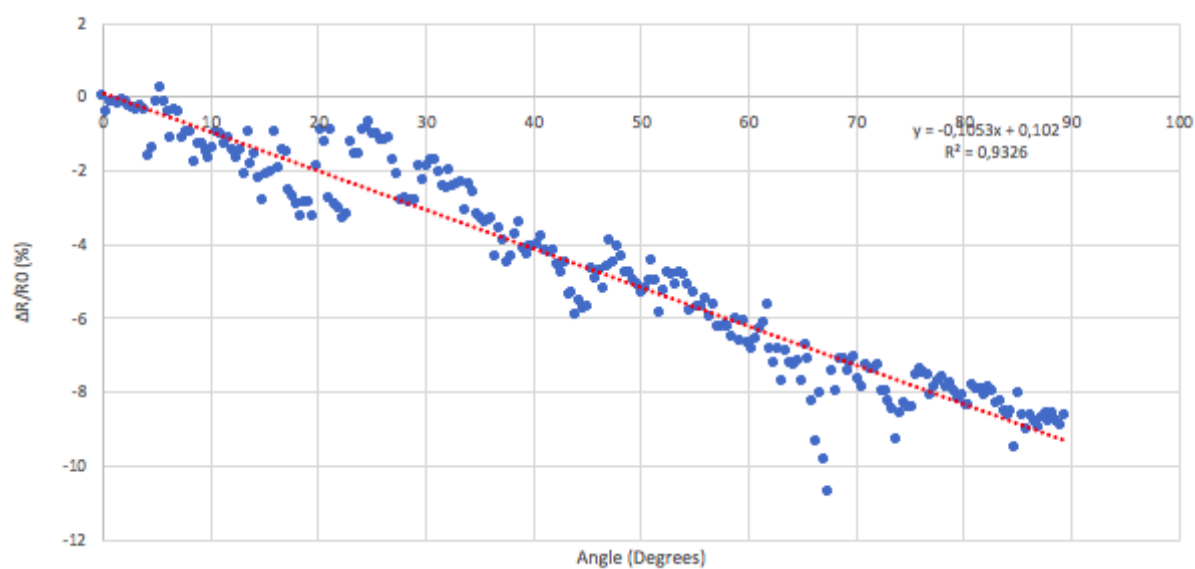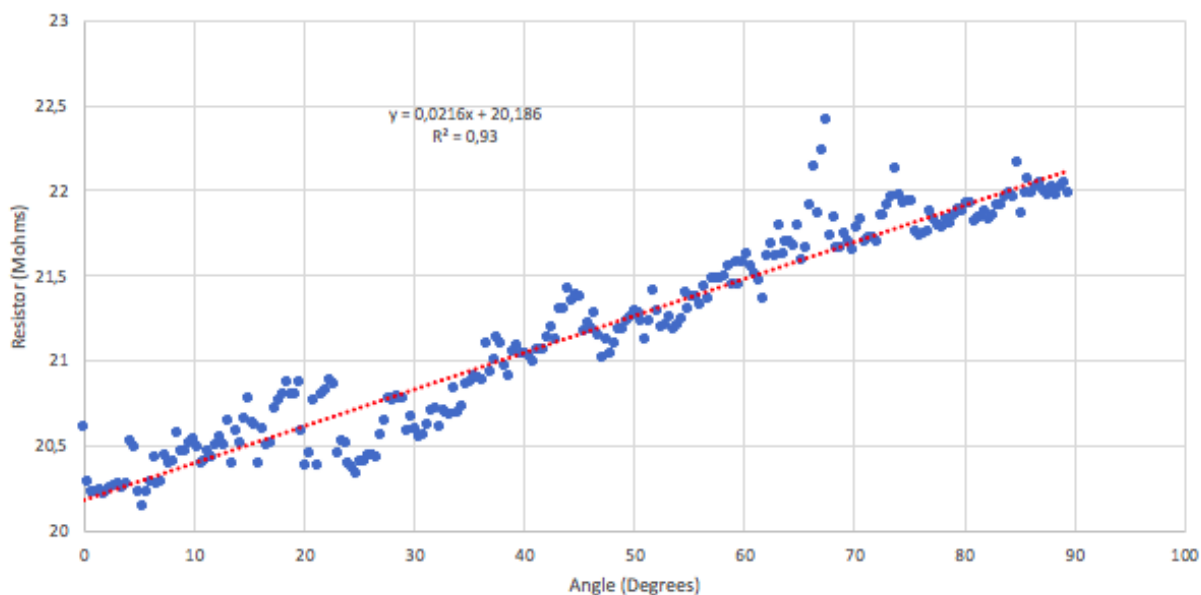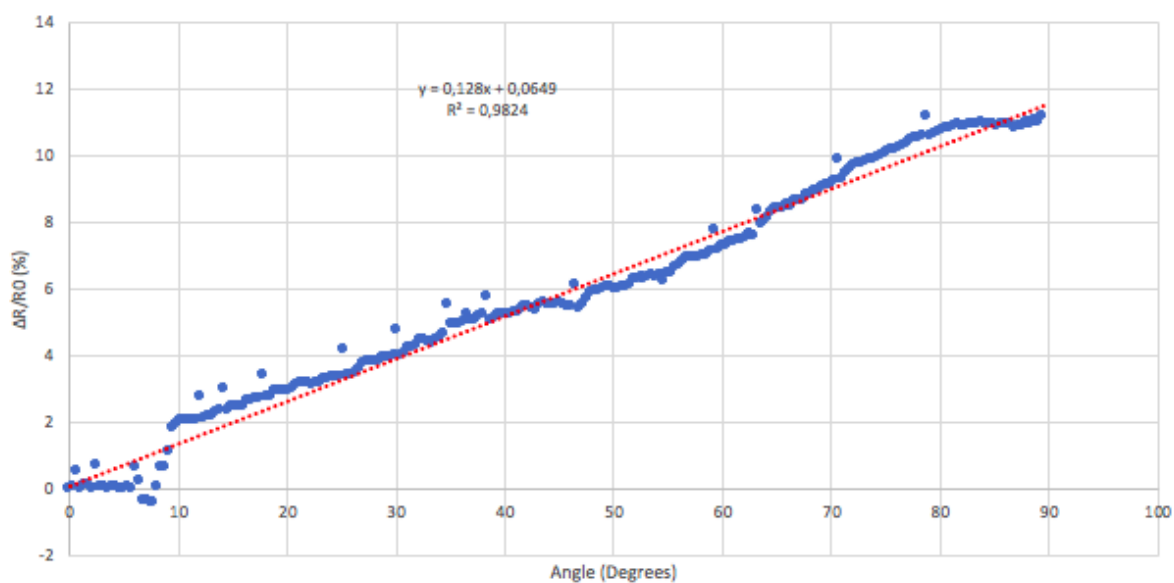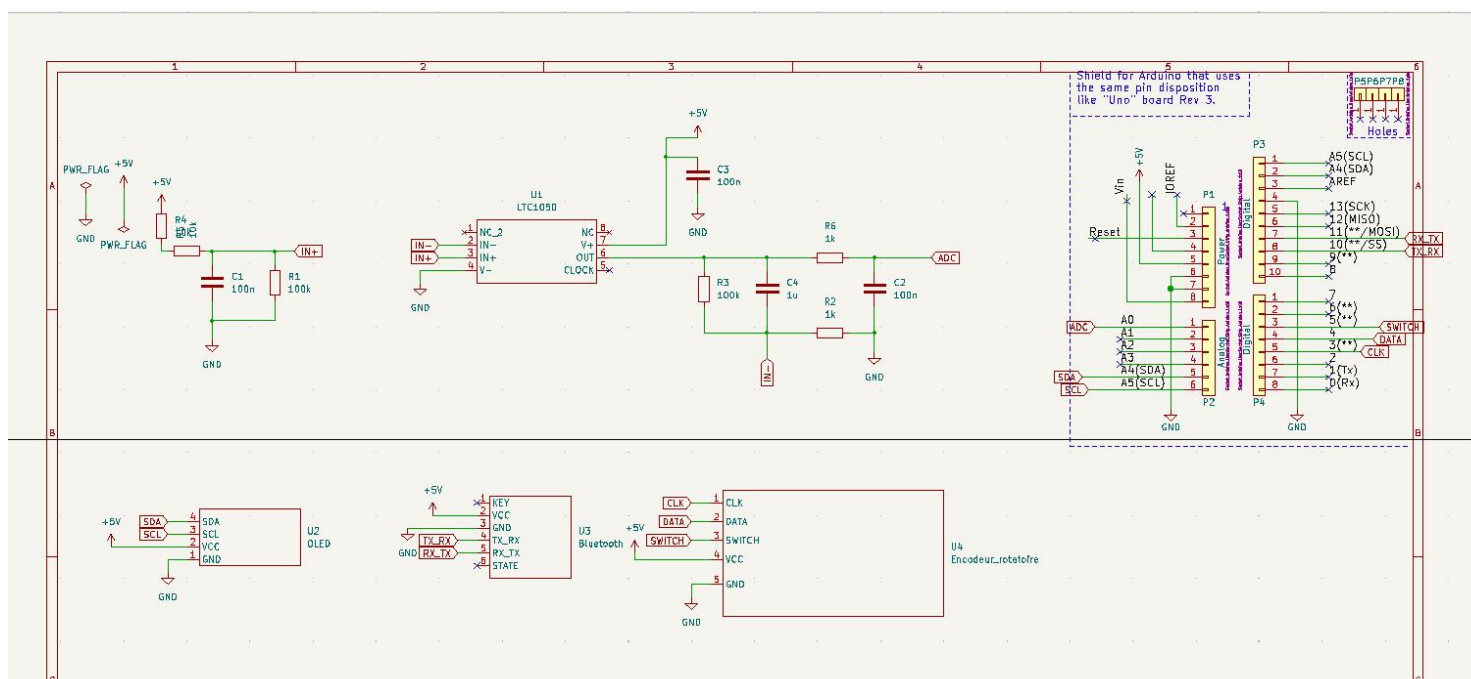
Measures Conditions and application

This sensor has been used with an electronic circuit. All measurements were made with the following circuit :
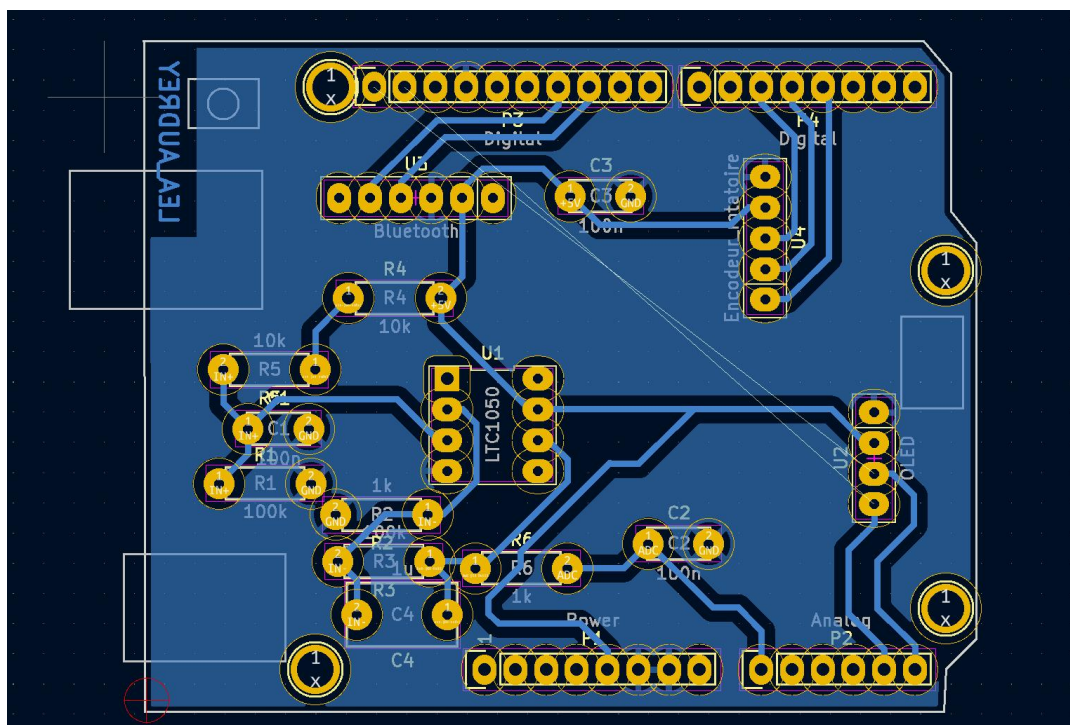
According to the following schematic

The components are the followings:
- Arduino Uno
- LTC1050
- Bluetooth module HC05
- OLED 128x64
- Rotary encoder GT055
- R4 : Paper Sensor

The sensor is connected to a low-pass filter that filters out voltage and current noise. It is also connected to a transimpedance amplifier that amplifies the signal. The capacitor connected to the power supply allows it to filter the noise of this one.