Etude et réalisation d'un tensiomètre électronique

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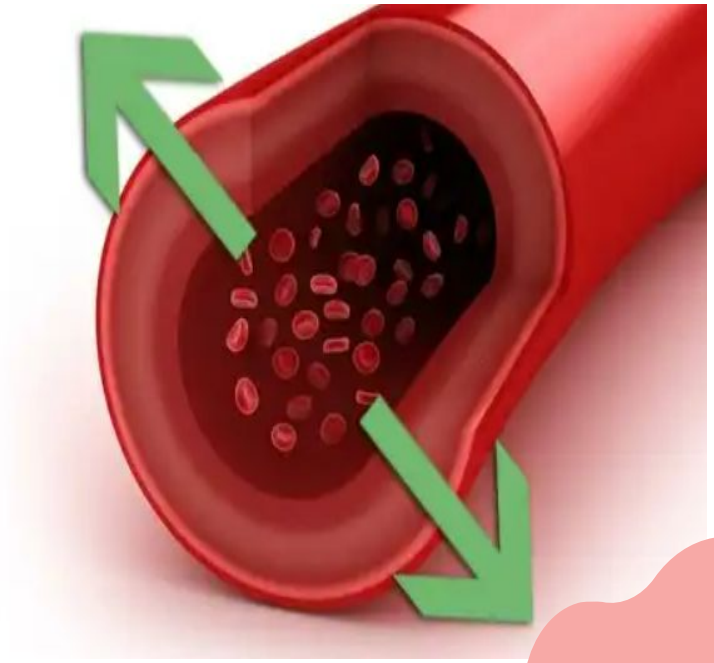
TABLE DES MATIÈRES

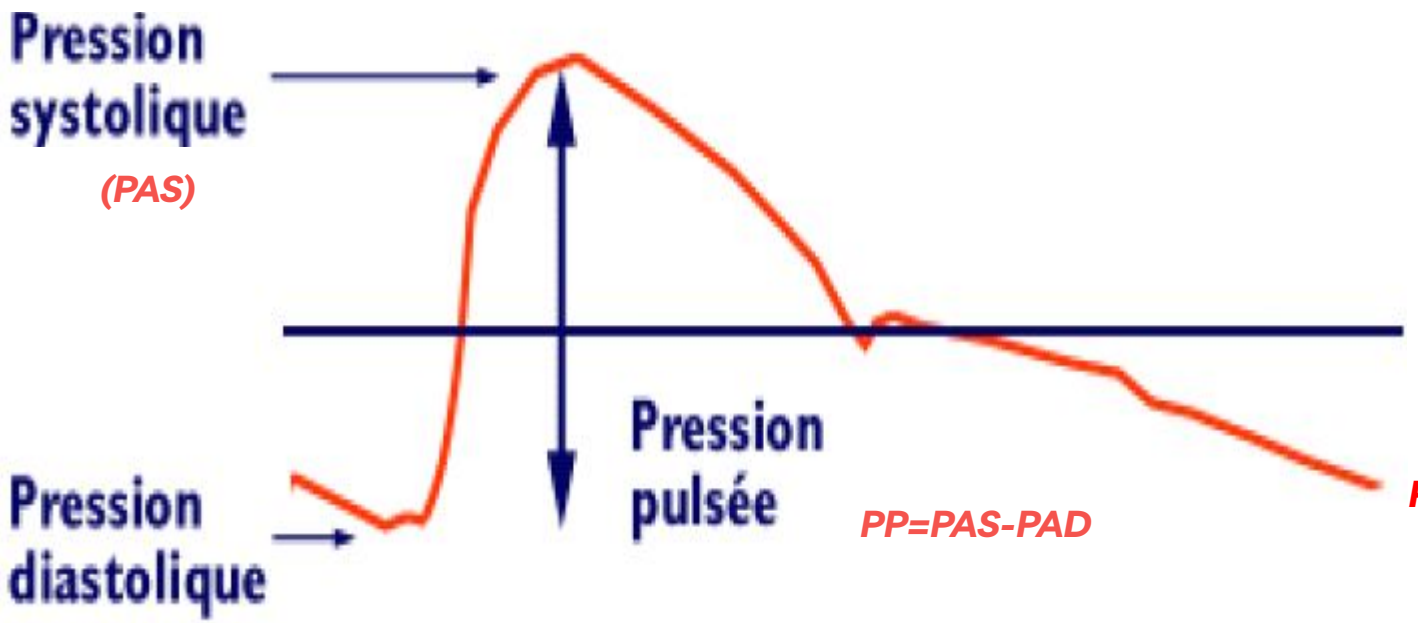
Qu'est ce que la pression artérielle?

La pression artérielle se définit comme une force
latérale exercée par le sang par unité de surface pariétale .

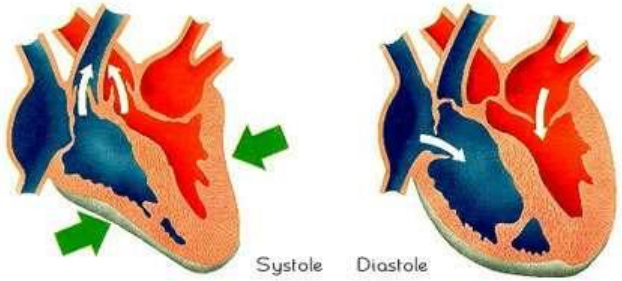


La pression artérielle (PA)

Pression artérielle systolique/diastolique

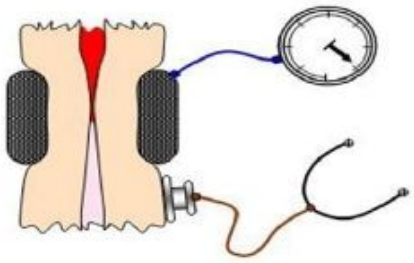


Sphygmogramme

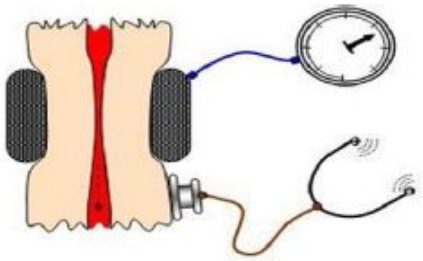


Méthodes de mesure de la pression artérielle

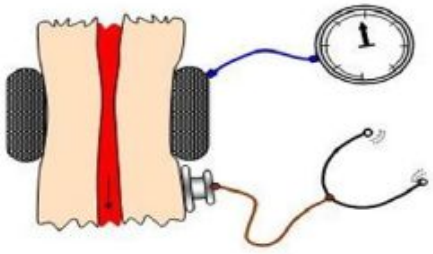
La Méthode Auscultatoire



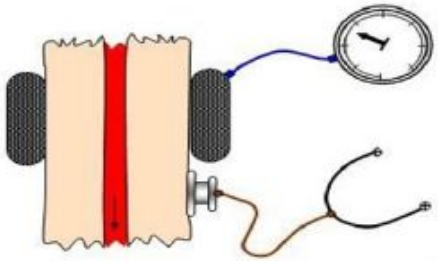
Phase 1



Phase 2



Phase 3



Phase 4

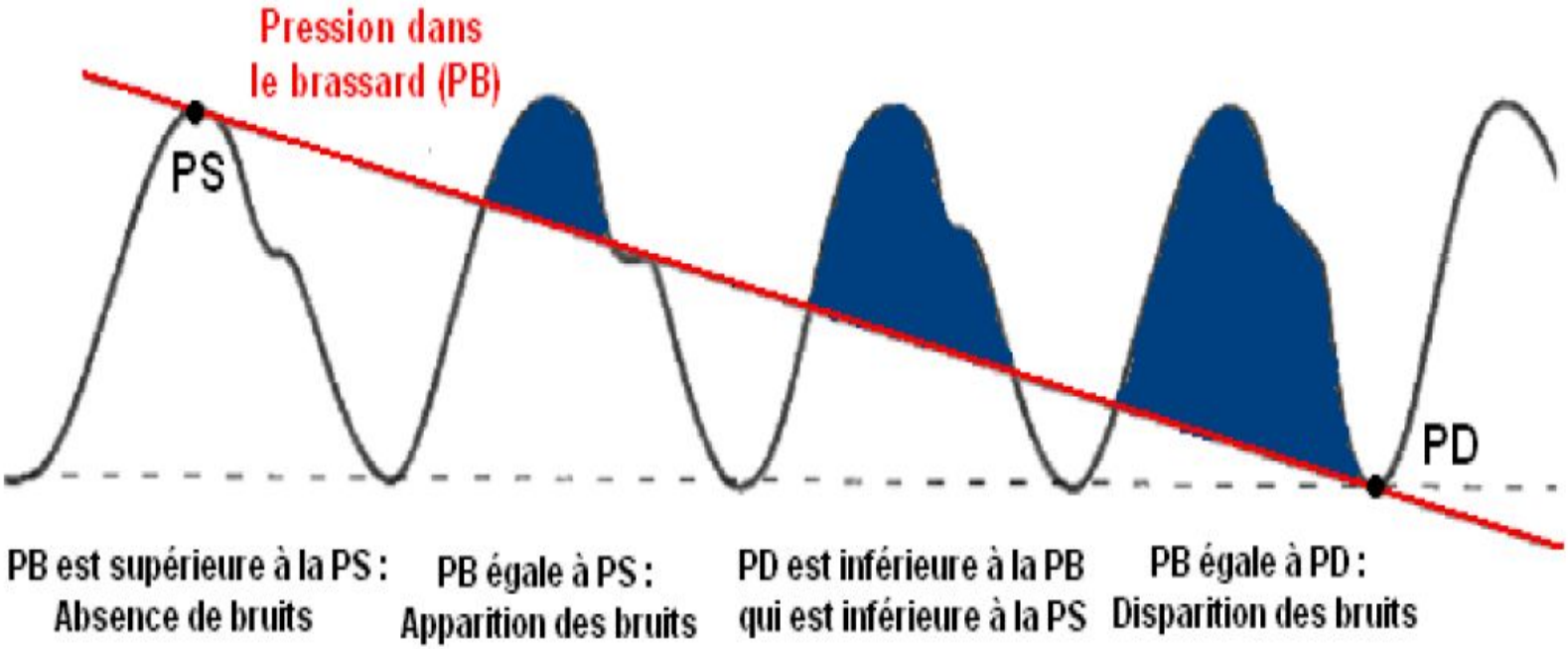
Schéma représentant la méthode auscultatoire

Phase 1 : Le premier battement net caractérise la valeur systolique .

Phase 2 : Les bruits deviennent prolongés et intenses , soufflants .

Phase 3 : L'intensité des bruits diminue et peut même parfois disparaître .

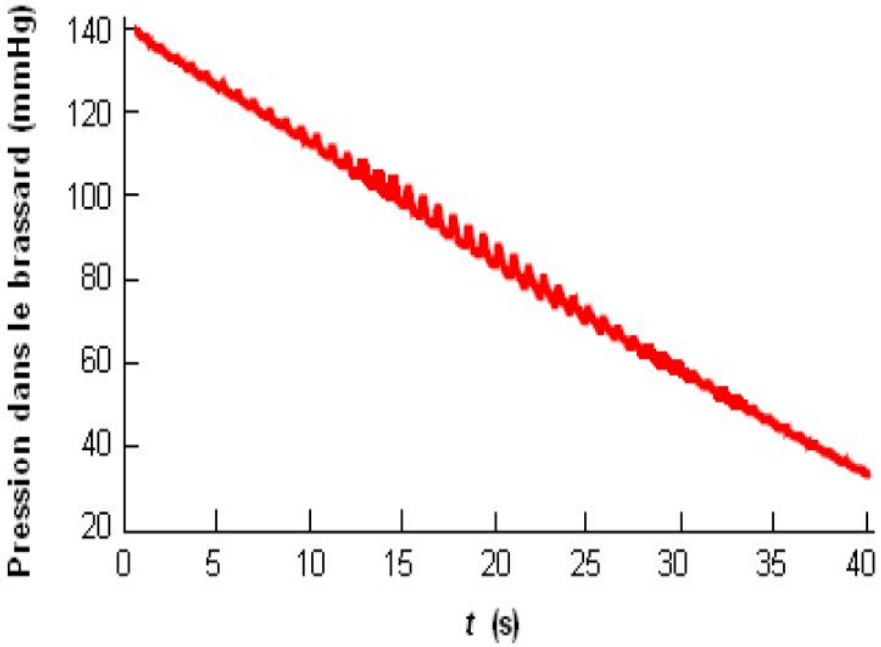
Phase 5 : Disparition des bruits , le dernier battement correspond la valeur diastolique .

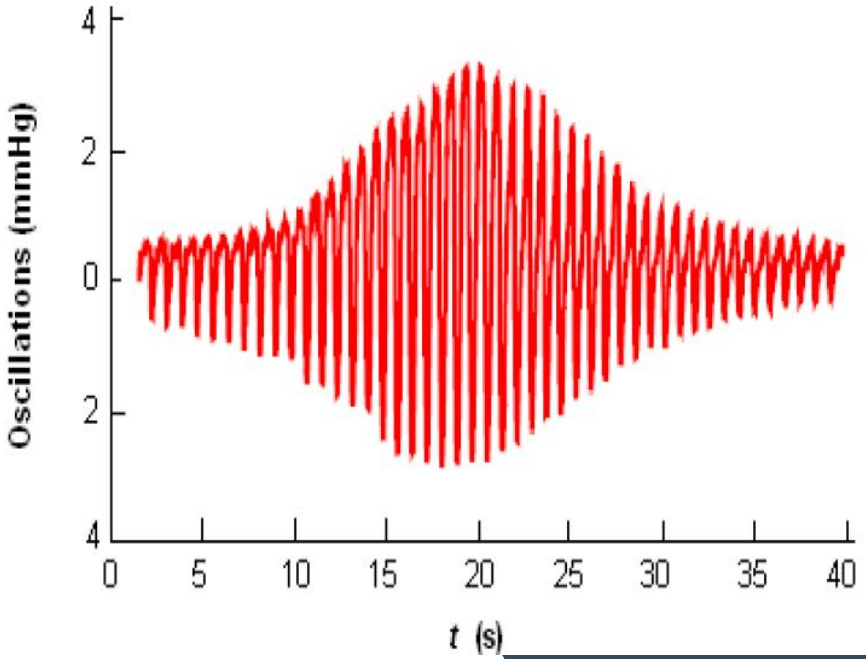


La relation entre pression artérielle , pression brassard et bruits de Korotkoff

PS : Pression Systolique
PD : Pression Diastolique

La Méthode oscillométrique





Calcul de la PAS et PAD d'un signal oscillométrique

PAS= Rs xAm

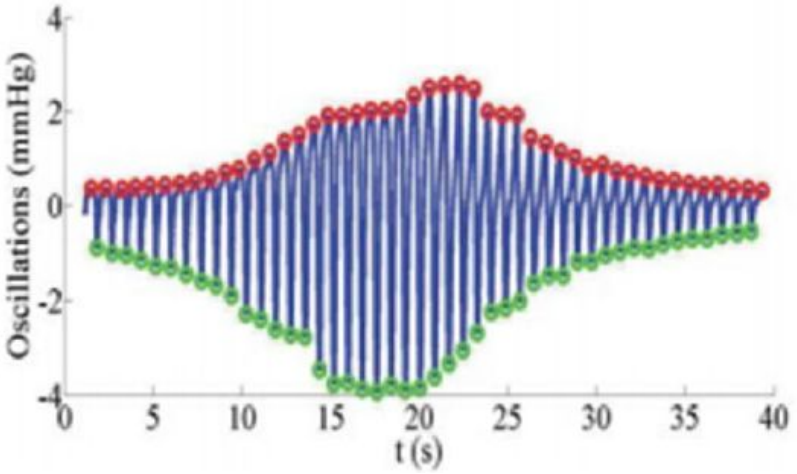
PAD = Rd xAm

PAS: pression artérielle systolique exprimée en mm Hg

PAD : pression artérielle diastolique exprimée en mm Hg

Rs : ratio systolique en mm Hg / mm Hg

Rd : ratio diastolique en mm Hg / mm Hg



Localisation des maximums (en rouge) et minimums (en vert)

Composants et procédures de tests

Description du système

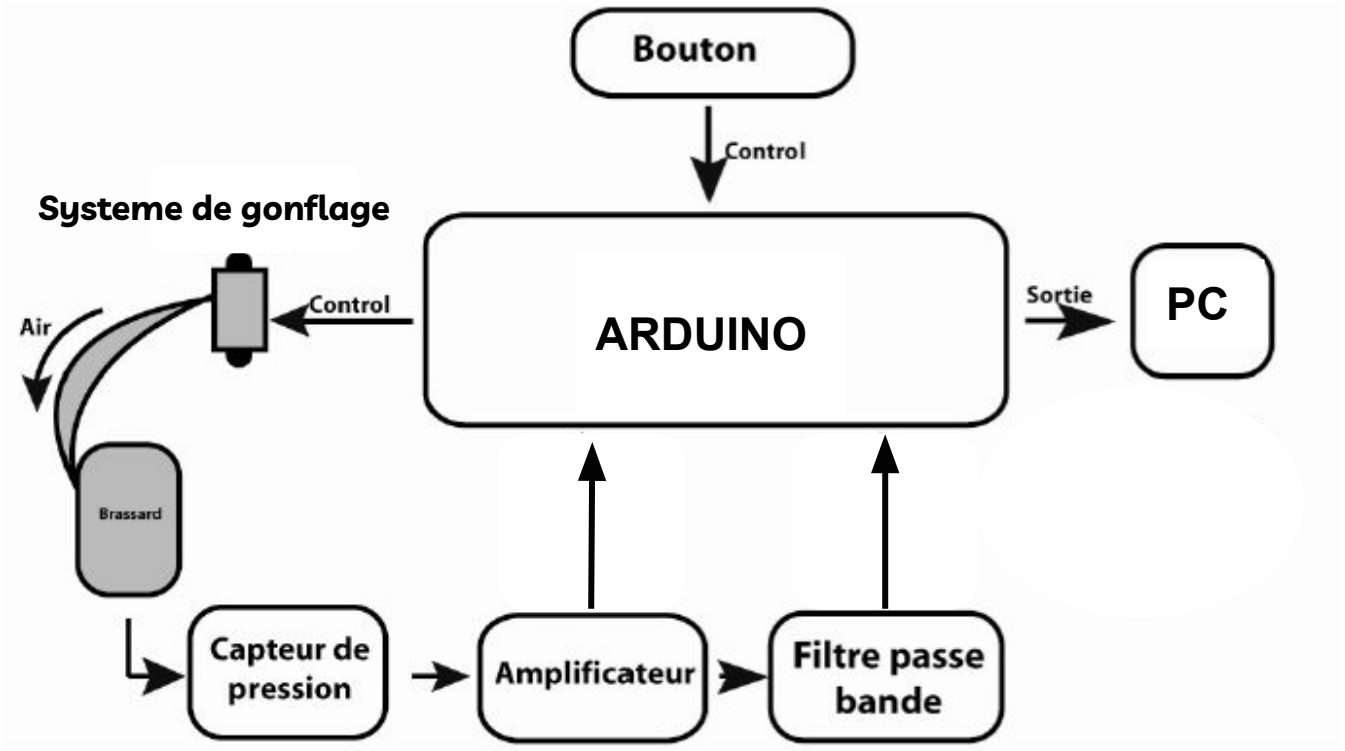
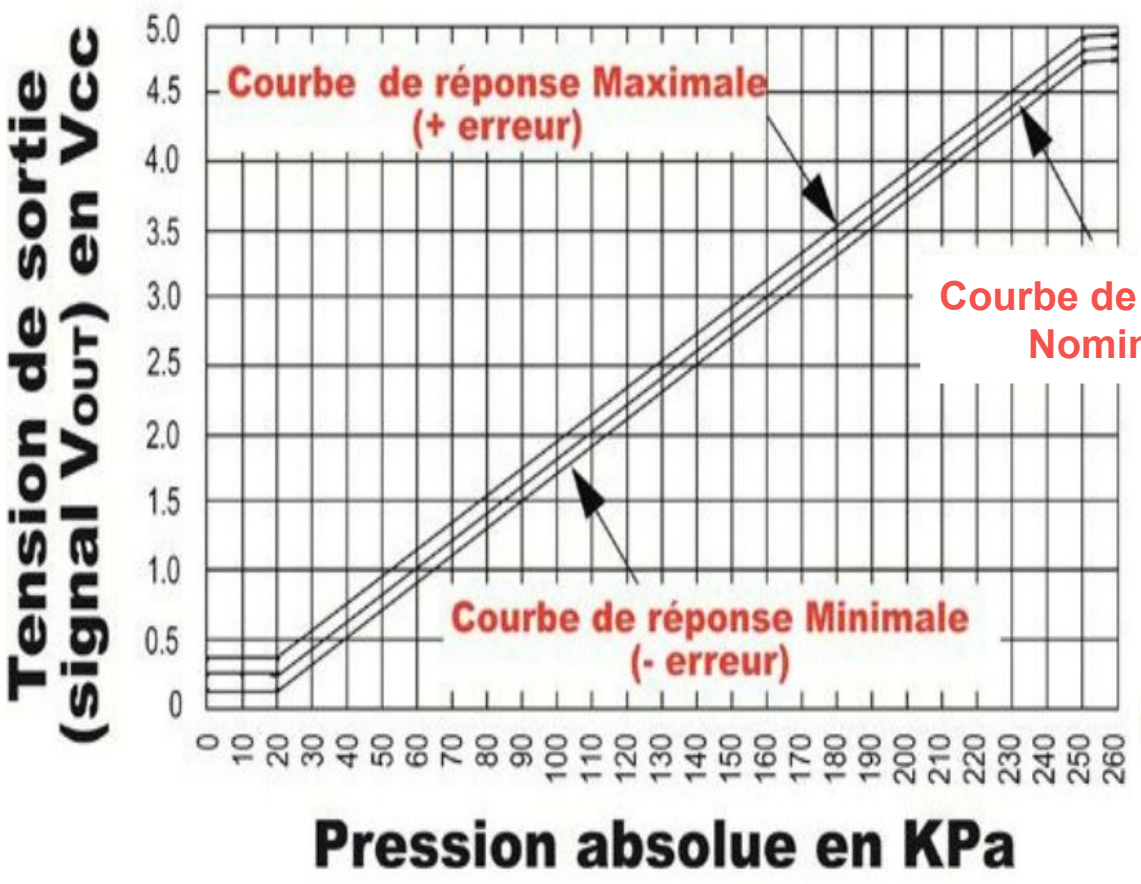
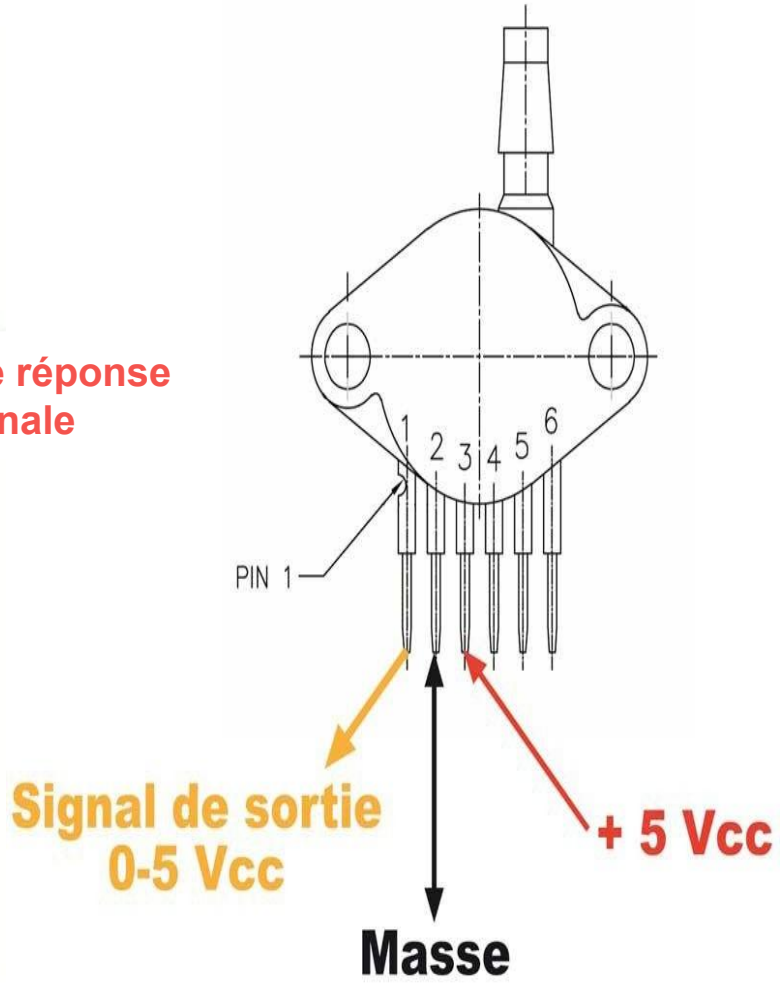


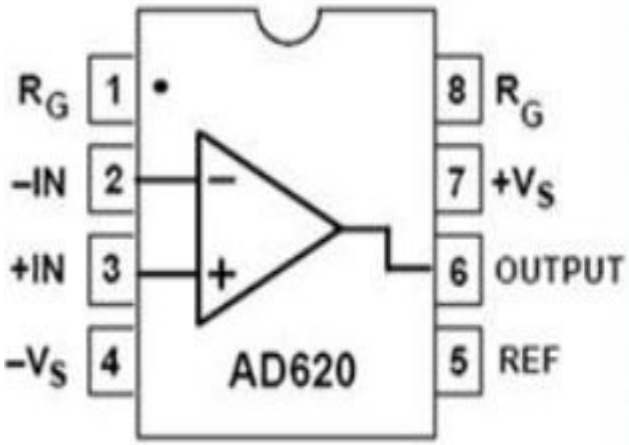
Schéma de bloc du dispositif pour mesurer la pression artérielle

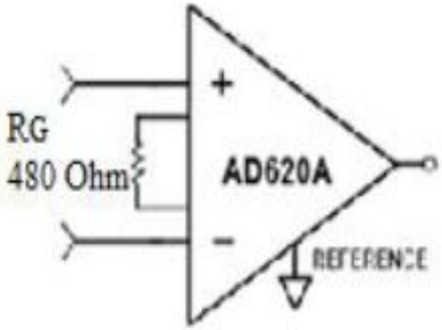
Capteur de pression





Amplificateur DC





l'Amplificateur d'instrumentation AD620AN

$$G = 1 + \frac{49.4\ \text{k}\Omega}{RG}$$

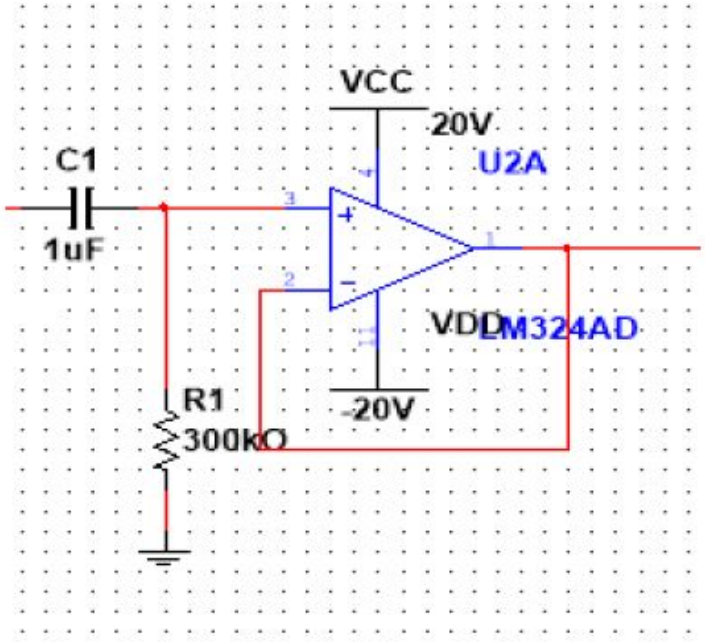
Remarque : Comme on a besoin d'un gain environ 100 fois , on choisit une résistance de 48

Filtre passe-haut

La fréquence de coupure de ce filtre est donnée par

$fc=\frac{1}{2\pi RC}$ telle que : R1=300kΩ et C1=1µF.

Alors : fc=0.531Hz.

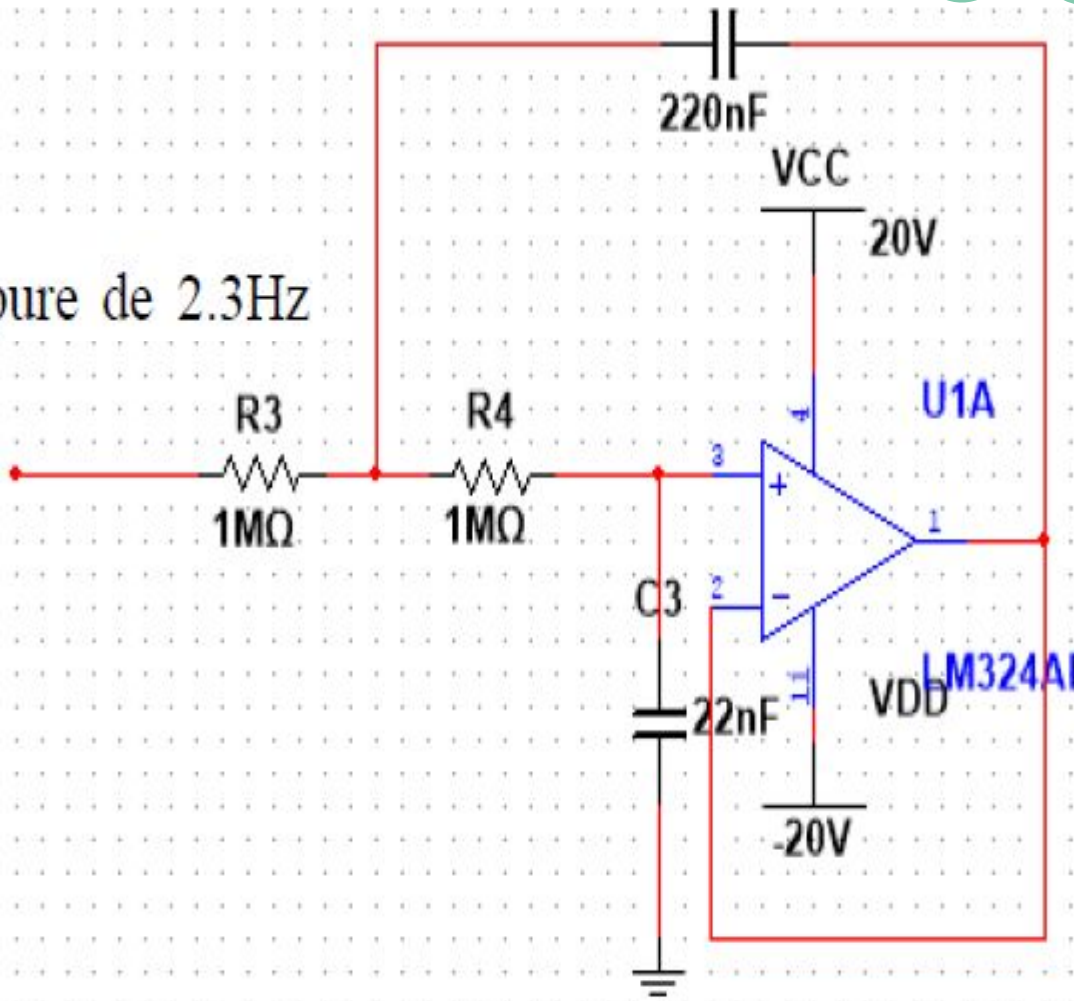


Filtre passe haut de Type RC

Filtre passe-bas 2 ème ordre

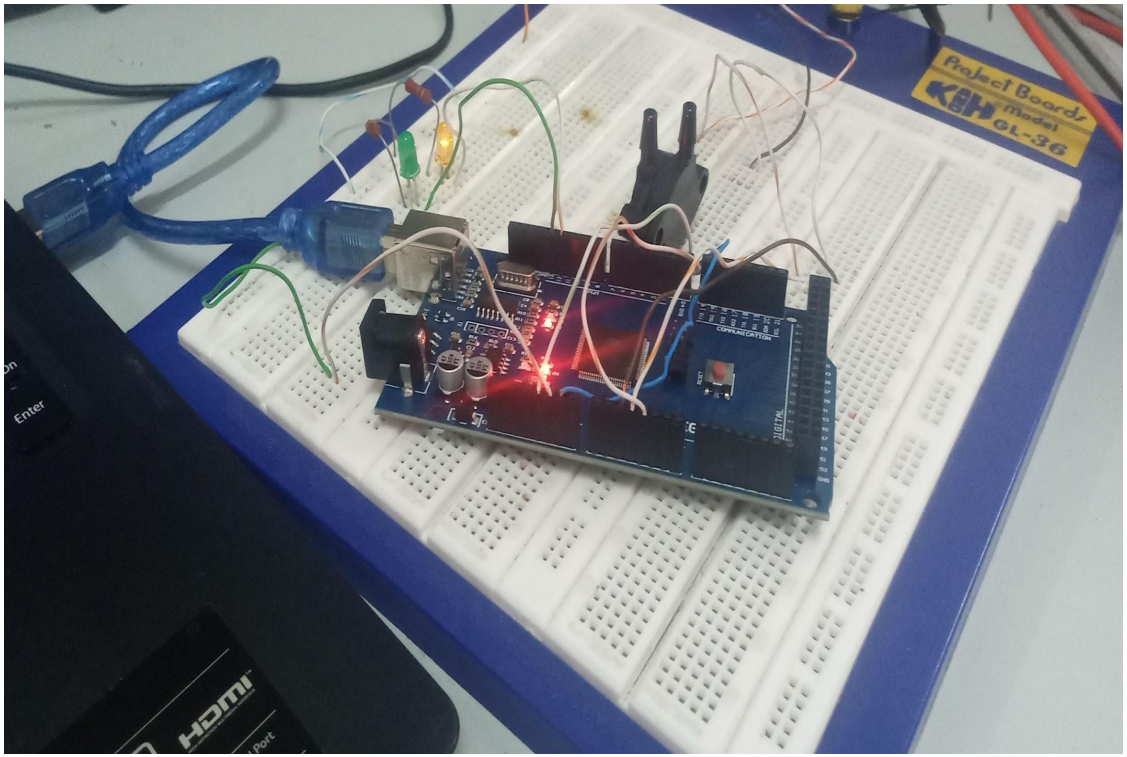
Ce filtre avec sa fréquence de coupure de 2.3Hz

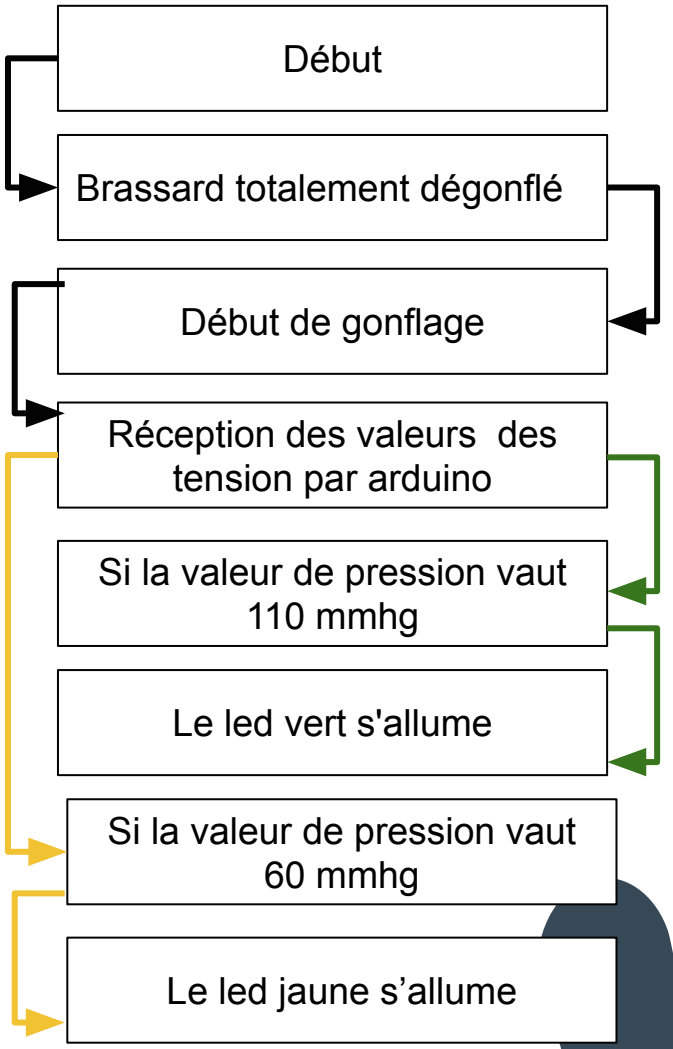
$$fc = \frac{1}{2\pi\sqrt{(R3R4C2C3)}}$$



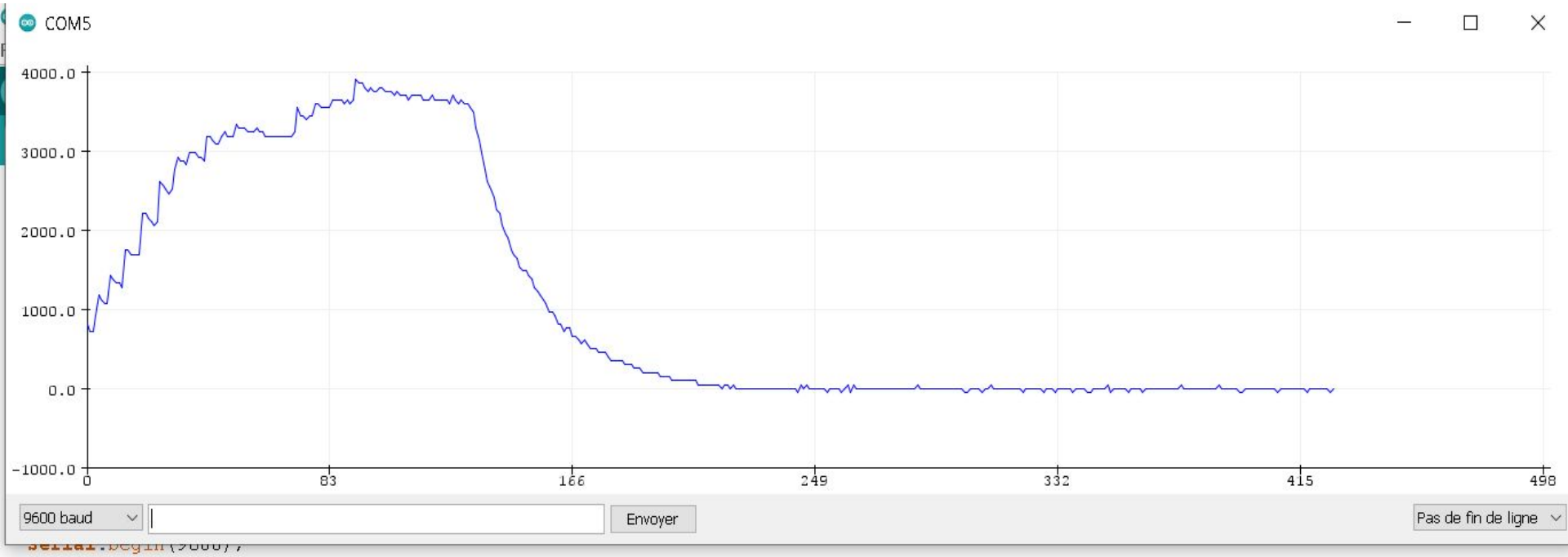
avec R3=R4=1MΩ, C2=220nF, C3=22nF

Réalisation du projet





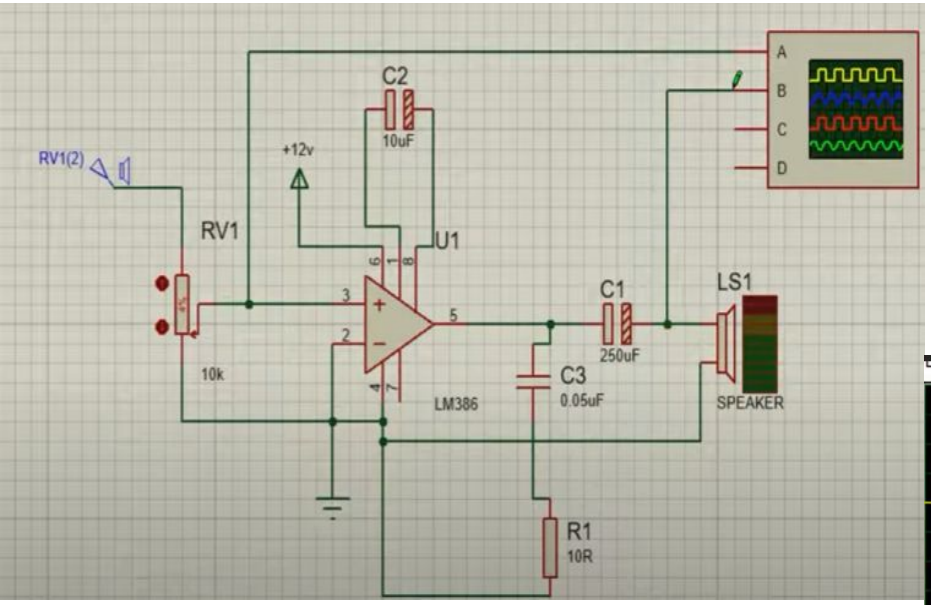
Test du circuit réalisé

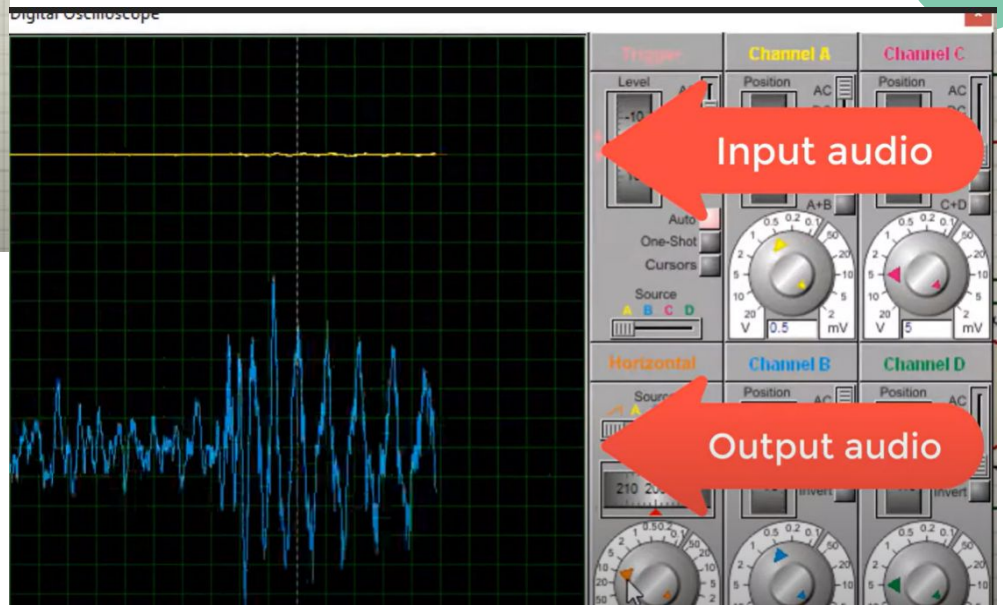



```
  // declare the ledPin as an OUTPUT:
  pinMode(ledPin1, OUTPUT);
  pinMode(ledPin2, OUTPUT);
  digitalWrite(ledPin2,LOW);
  digitalWrite(ledPin1,LOW);
}

void loop() {

  rawValue = analogRead(A4);

  sensorsystPin1 = analogRead(A2);
  sensordiastPin2 = analogRead(A3);
  //Serial.print("Raw A/D is  ")
  //Serial.println(rawValue);
```

Optimisation

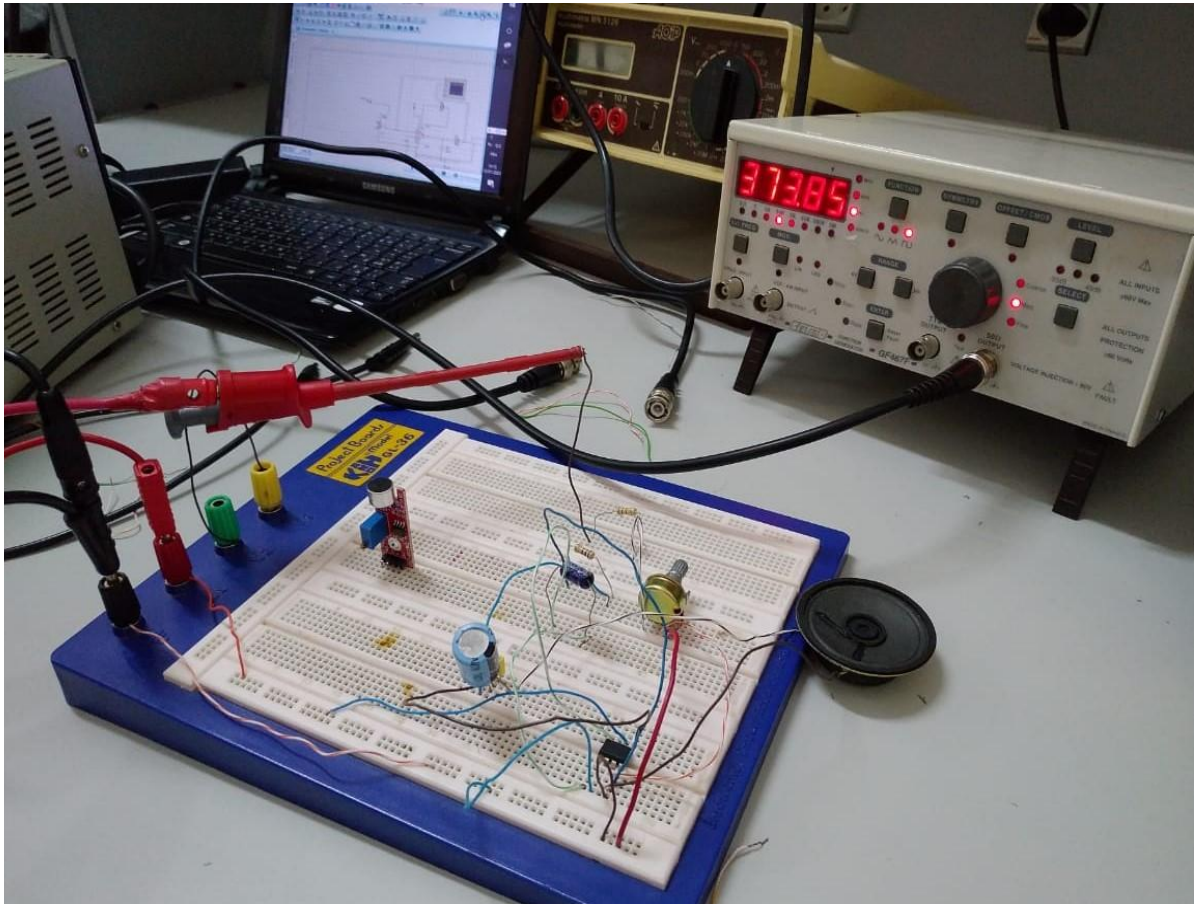
Montage amplificateur audio





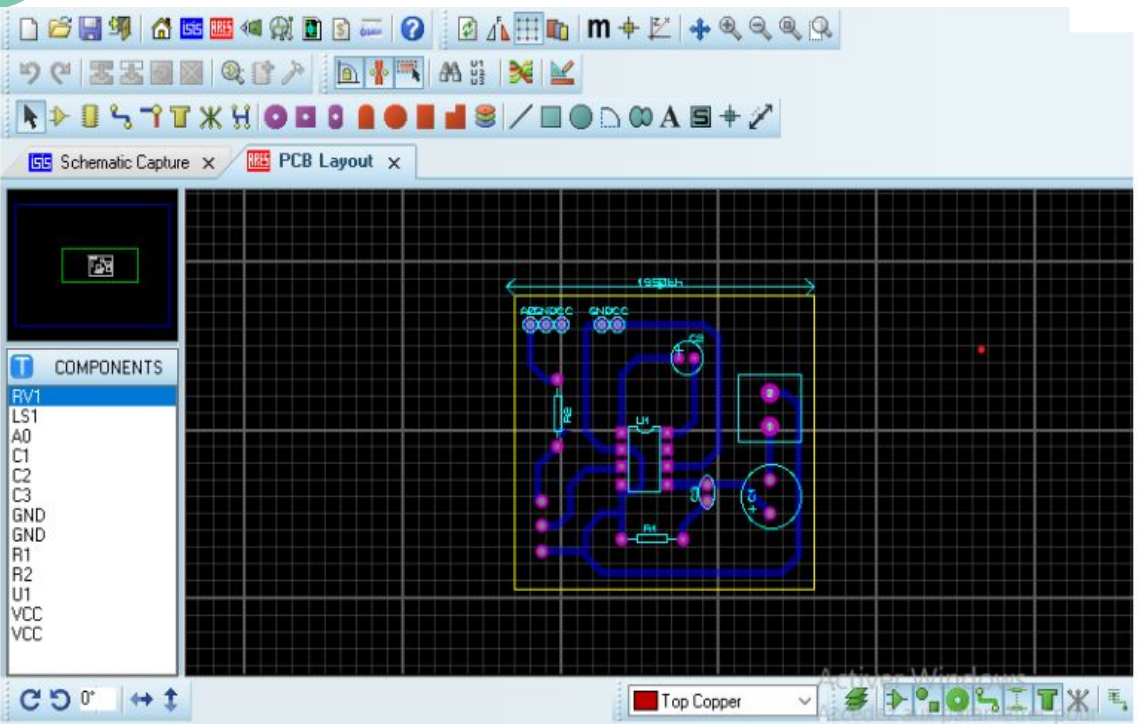
Simulation Isis

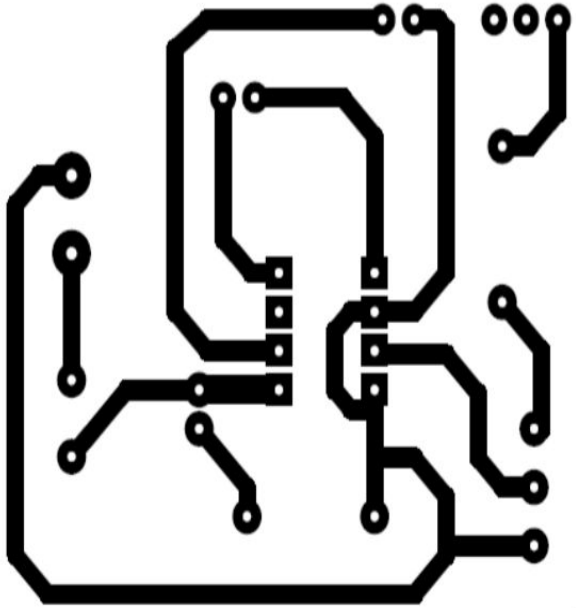
Réalisation sur circuit imprimé



LM386 Audio Amplifier sur la plaque d'essai

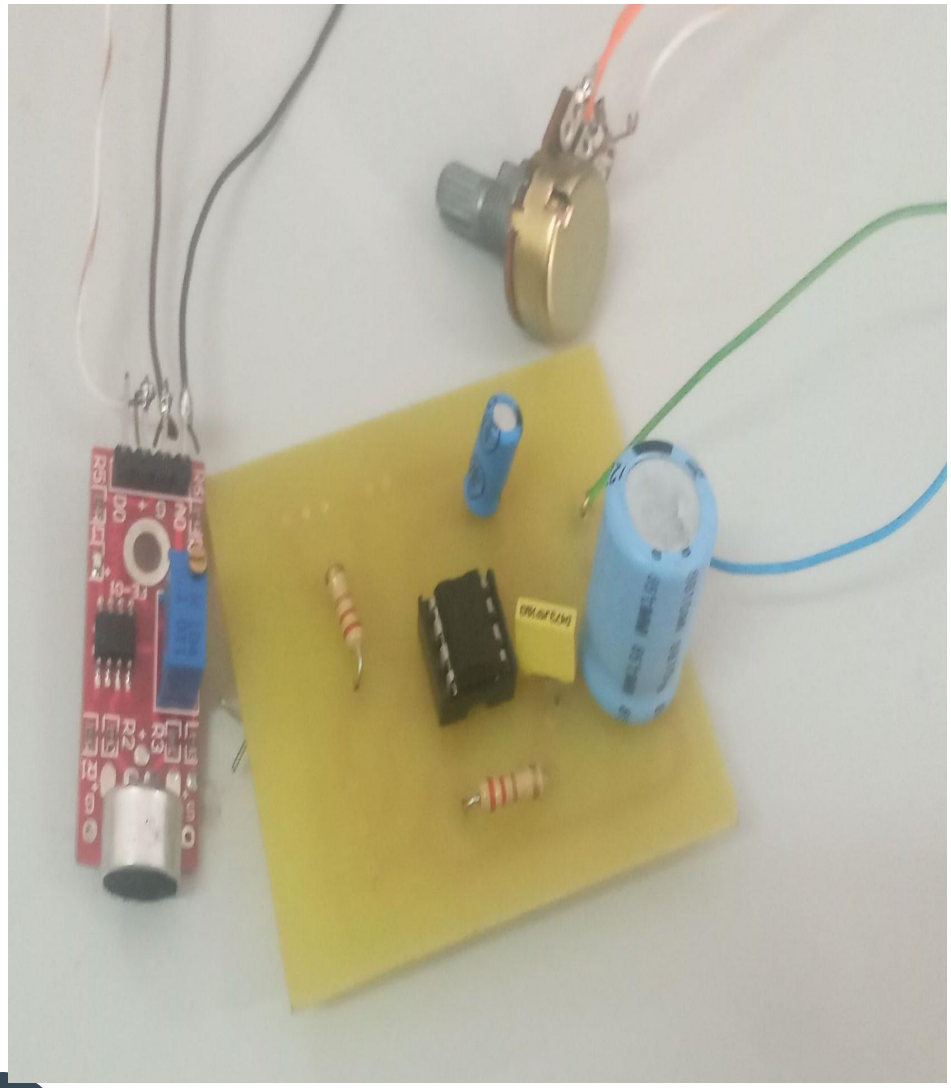
La partie de soudage

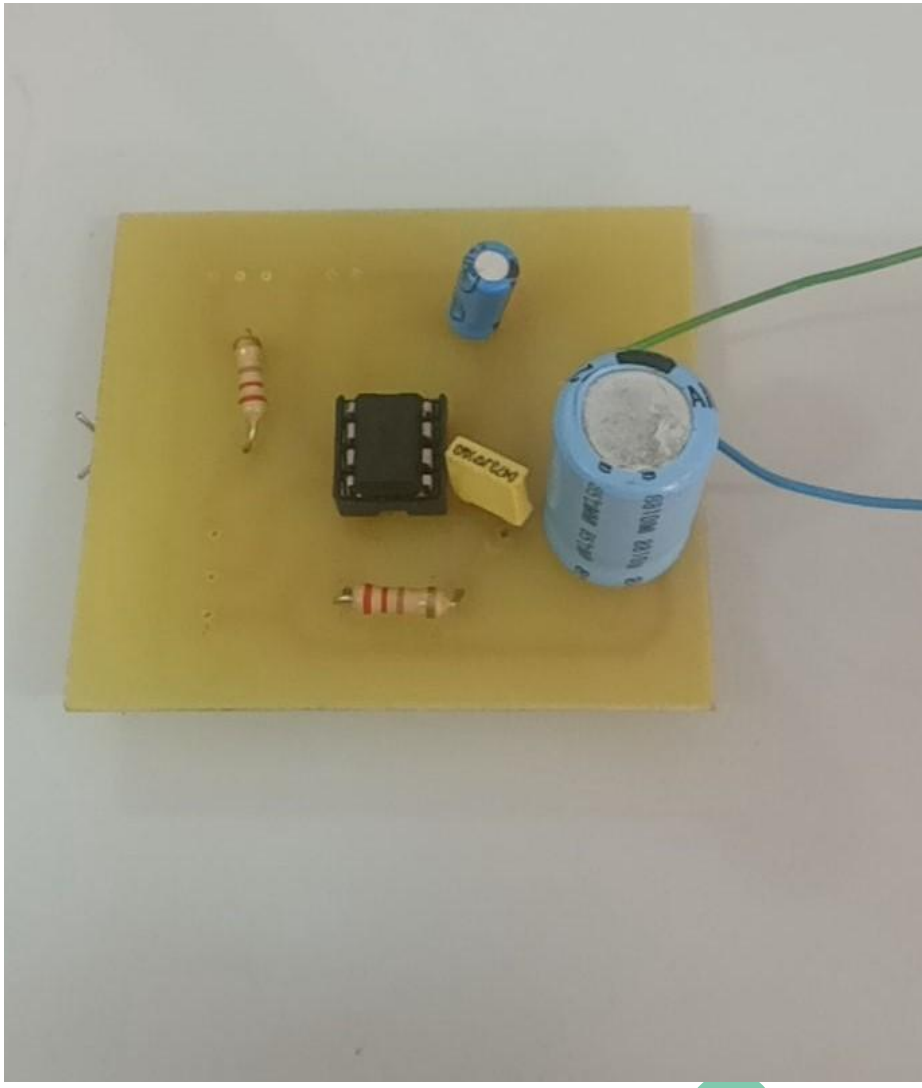




Circuit imprimé

Résultat de la partie optimisation





MERCI POUR VOTRE ATTENTION

ANNEXE

projet_tension | Arduino 1.8.6

Fichier Édition Croquis Outils Aide

projet_tension

```
int rawValue; // A/D readings
int offset = 36; // zero pressure adjust
int fullScale = 922; // max pressure (span) adjust
float pressure; // final pressure

int sensorPinl = A0;    // select the input pin for the potentiometer
int sensorsystPin2 = A2;
int sensordiastPin3 = A3;
float pressuresyst;
float pressurediast;

int ledPinl = 13;      // select the pin  de degonflage for the LED gonflage vert
int ledPin2 = 12;     // select the pin de gonflage for the LED degonflage jaune
int sensorValue = 0;  // variable to store the value coming from the sensor
float systole = 0;
float diastole = 0;

void setup() {
  Serial.begin(9600);
```

1

projet_tension

```
  Serial.begin(9600);
  // declare the ledPin as an OUTPUT:
  pinMode(ledPinl, OUTPUT);
  pinMode(ledPin2, OUTPUT);
}

void loop() {
  sensorsystPin2 = analogRead(A2);
  sensordiastPin3 = analogRead(A3);
  digitalWrite(ledPin2,LOW);
  digitalWrite(ledPinl,LOW);
  rawValue = analogRead(A0);

  //Serial.print("Raw A/D is  ")
  //Serial.print(rawValue);
  pressure = ((rawValue - offset) * 500.0 / (fullScale - offset))*7.500617;// pressure conversion
  pressuresyst = ((sensorsystPin2 - offset) * 500.0 / (fullScale - offset))*7.500617;// pressure conversion
  pressurediast = ((sensordiastPin3 - offset) * 500.0 / (fullScale - offset))*7.500617;// pressure conversion
```

2

3

projet_tension

```
Serial.print("   The pressure is  ");
Serial.print (pressure, 1); // one decimal place
Serial.println("  mmhg");
delay(500); // delays readings

 Serial.print("   pressuresyst  ");
Serial.print (pressure, 1); // one decimal place
Serial.println("  mmhg");
delay(500); // delays readings

Serial.print("   pressurediast  ");
Serial.print (pressure, 1); // one decimal place
Serial.println("  mmhg");
delay(500); // delays readings

 if ( pressure<pressuresyst) {
 // turn the ledPin on
digitalWrite(ledPin2, HIGH);
```

projet_tension

```
rawValue = analogRead(A0);
pressure = ((rawValue - offset) * 500.0 / (fullScale - offset))*7.500617;// pressure conversion
Serial.print("   The pressure is  ");
Serial.print (pressure, 1); // one decimal place
Serial.println("  mmhg");
delay(500); // delays readings

 }
 else {
 systole = pressure;
 // turn the ledPin off:

digitalWrite(ledPin2, LOW);

  if ( pressure>pressurediast){

  rawValue = analogRead(A0);
  pressure = ((rawValue - offset) * 500.0 / (fullScale - offset))*7.500617;// pressure conversio
Serial.print("   The pressure is  ");
```

4

projet_tension

```
   Serial.print("   The pressure is  ");
   Serial.print("pressure, 1" ); // one decimal place
   Serial.println("  mmhg");
   delay(500); // delays readings
     }


     // turn the ledPin on
   digitalWrite(ledPin1, HIGH);
    }
    diastole= pressure;
    // turn the ledPin off:
  digitalWrite(ledPin1, LOW);

   Serial.print("   The pressure value is  ");
   Serial.print(systole , 1); // one decimal place
   Serial.print (diastole ,1);
   Serial.println("  mmhg");
}
```

5