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/*
Analog input, analog output

Reads an analog input pin, uses voltage to calculate pressure,
pressure is converted to velocity using v=k*sqrt(P), velocity
is converted to flow rate, flow rate is integrated over time to
determine total volume passed through the spirometer.
Total time is recorded by pressing appropriate buttons on the device.
Results are printed to an LCD screen.

*/
// include the library code
#include <LiquidCrystal.h>

// initialize library with the numbers of the interface pins
LiquidCrystal lcd(8, 9, 4, 5, 6, 7);

  const int analogInPin = A1; // Analog input pin, connected to pressure sensor
  const int analogButton = A0; // Button

  //Variables to change
  float inputVolt = 0; // Voltage read from pressure sensor (in bits, 0 to 1023)
  float volt_0 = 2.5; //Initial voltage
  float volt = 0; // Voltage (converted from 0-255 to 0-5)
  float pressure_psi = 0; // Pressure value calculated from voltage, in psi
```

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  float pressure_pa = 0; // Pressure converted to Pa
  float massFlow = 0; // Mass flow rate calculated from pressure
  float volFlow = 0; // Calculated from mass flow rate
  float volume = 0; // Integral of flow rate over time

  //Constants
  float vs = 5 ; // Voltage powering pressure sensor
  float rho = 1.225; // Density of air in kg/m3
  float area_1 = 0.000415; // Surface area in m2
  float area_2 = 0.0000283; // Surface area in m2
  float dt = 0;
  int button = 0; // Value of button



void setup() {
  // put your setup code here, to run once:
 // set up the LCD's number of columns and rows
  lcd.begin(16,2);
  lcd.print("Volume =");

}

void loop() {
  // put your main code here, to run repeatedly:
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  // Check if button is pressed, if so enter program condition
  lcd.setCursor(0,1);
  button = analogRead(analogButton);

  if(button>100 && button<150)
  {
  inputVolt = analogRead(analogInPin); // Voltage read in (0 to 1023)
  volt = inputVolt*(vs/1023.0);
  pressure_psi = (15/2)*(volt-2.492669); // Pressure in psi
  pressure_pa = pressure_psi*6894.75729; // Pressure in Pa
  massFlow = 1000*sqrt((abs(pressure_pa)*2*rho)/((1/(pow(area_2,2)))-(1/(pow(area_1,2))))); // Mass flow of air
  volFlow = massFlow/rho; // Volumetric flow of air
  volume = volFlow*dt + volume; // Total volume (essentially integrated over time)
  dt = 0.001;
  delay(1);
  }
  lcd.print(volume);
}
```