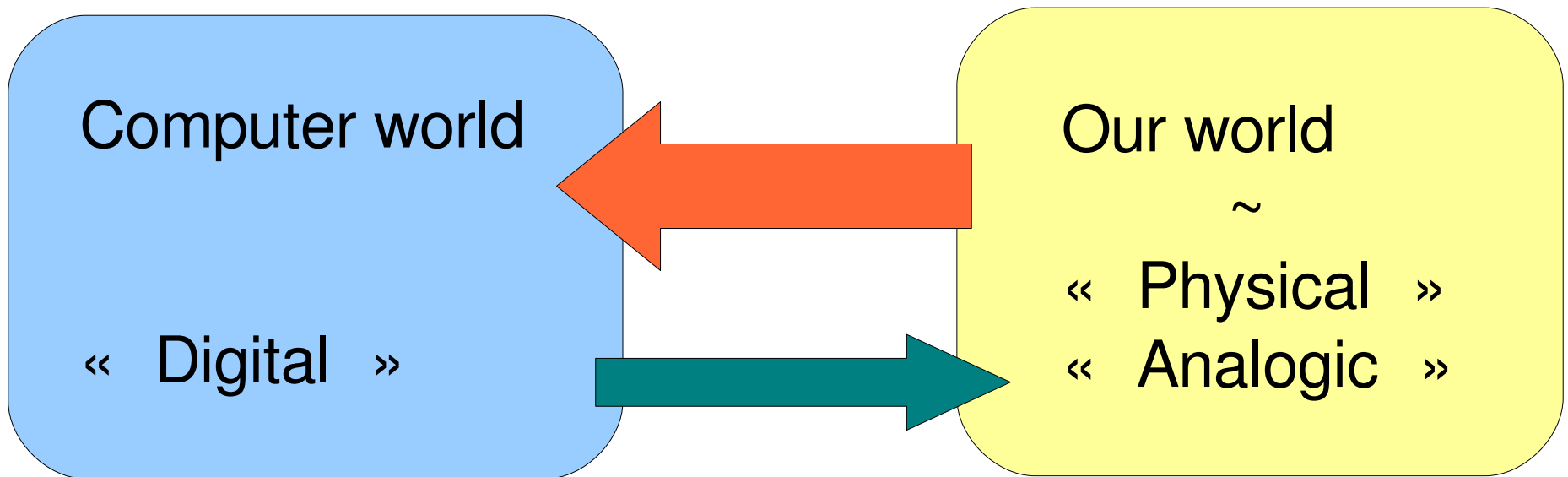


*Liber* LAB

*A pocket lab for all*

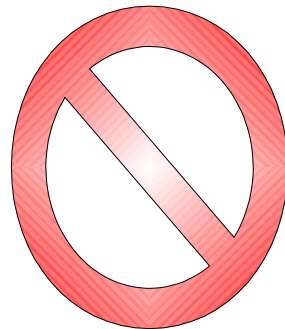
# Liberlab = Interface

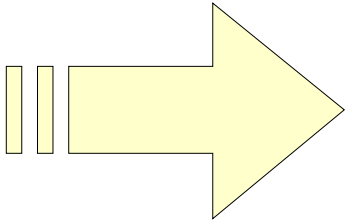


- Read a physical value, the state of an interruptor ...
- Control a LED, a relay, etc. ...

# Context

- For education (at least in France) :
  - expansive / closed / « Windows only »
  - Mainly for “measuring”, no time for exploration



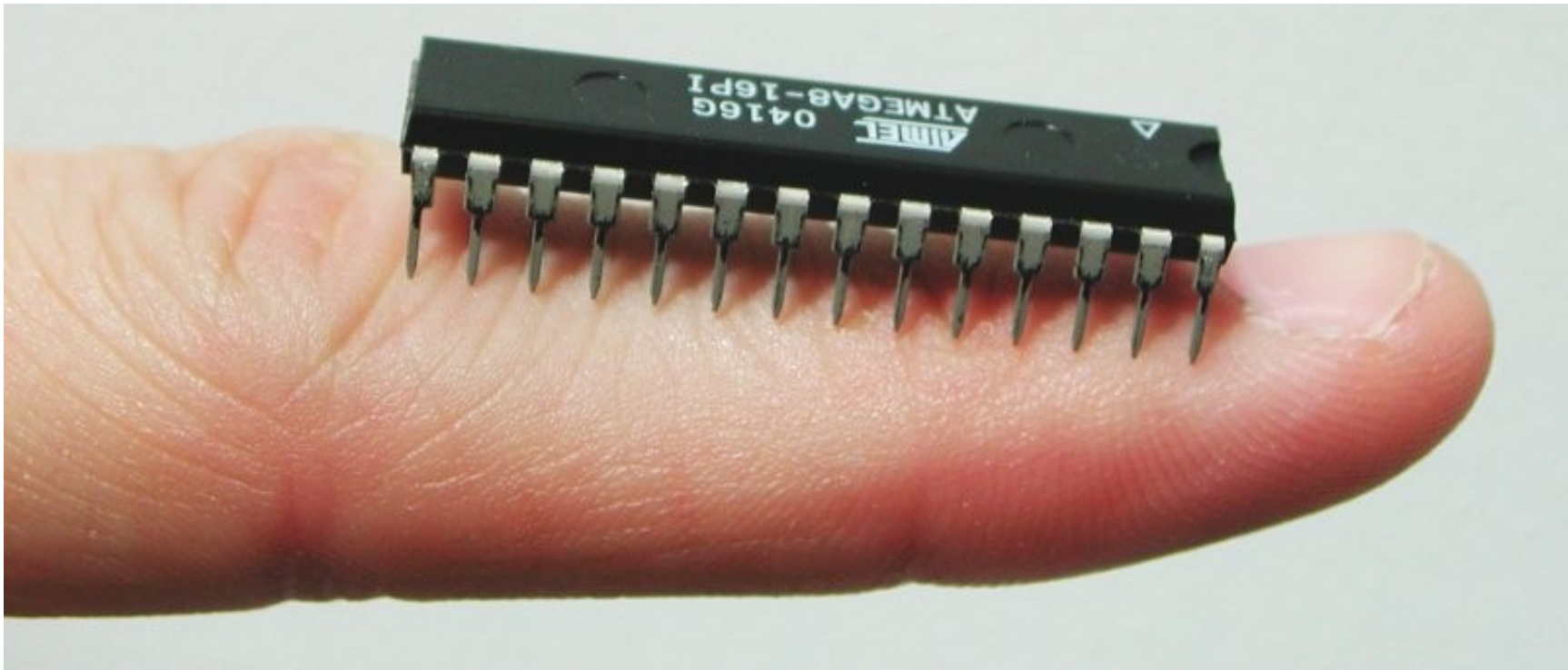


# Liberlab goals ?

- Interface :
  - very cheap (< 15 €)
  - « easy » to build (few components)
  - evolutive
  - multiplatform
  - Free / Open Source (also for the developments)
- Encourage innovative usages

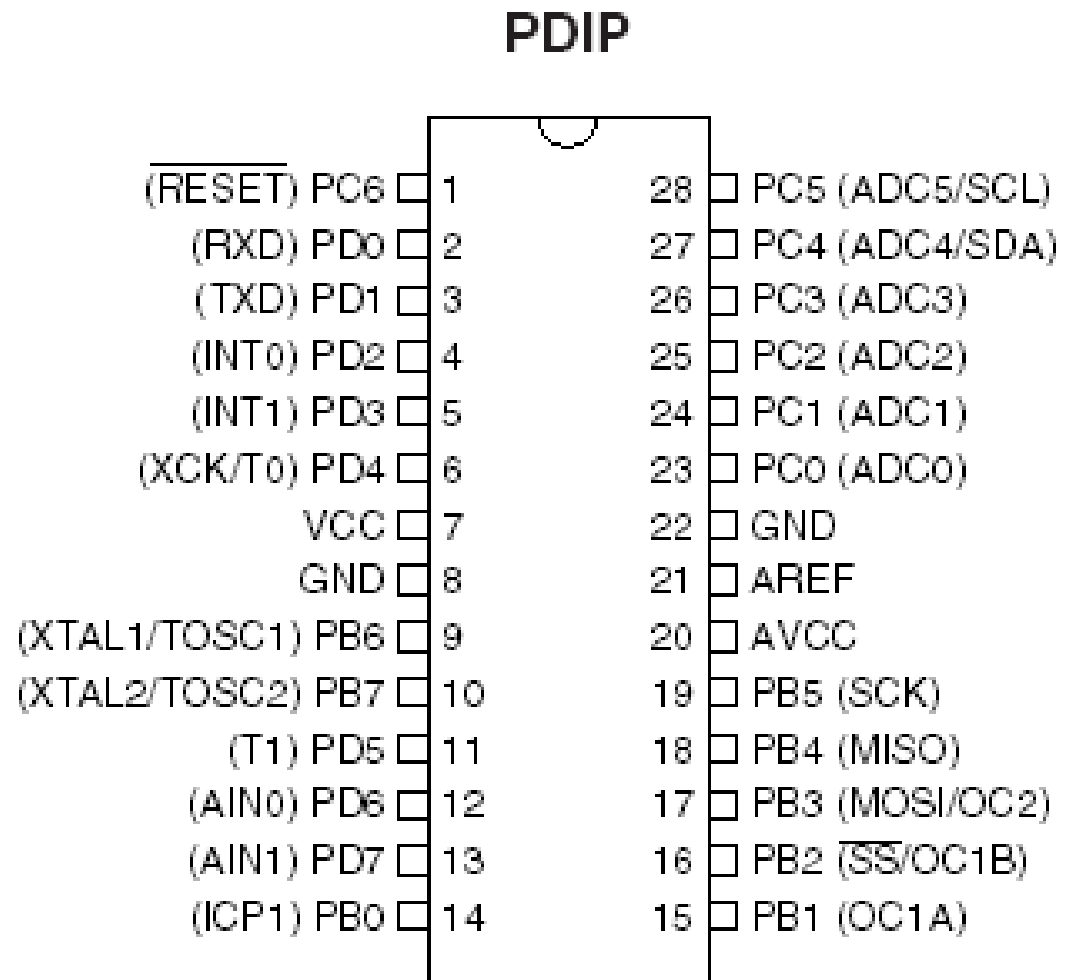
# The heart of the projet :

- Microcontrollers (cars, DVD players, ...)
- Atmel AVR atmega 8: Prix ~ 3 €

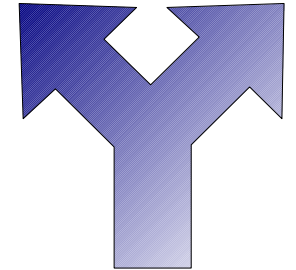


# Atmega8

- 1 Mhz -> 16 Mhz
- 23 IO, 6 ADC
- RS 232, etc
- **350 pages datasheet**
- **Liberlab firmware:**
  - 6 inputs/outputs
  - 4 Analogue channels



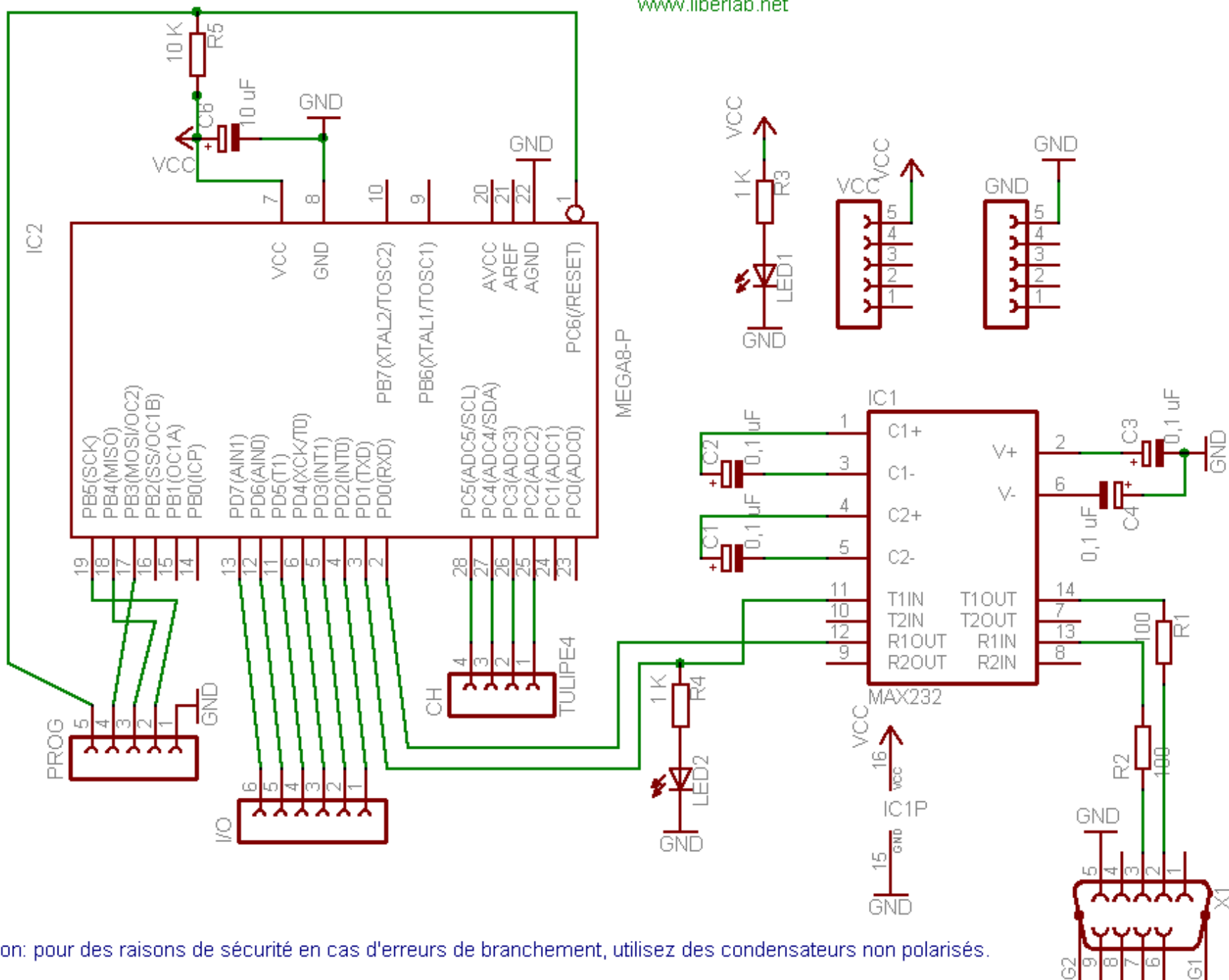
# Why Atmel AVR family ?



- Less popular than PIC but :
  - one instruction per cycle (4 cycles for PICs)
  - excellent ratio quality/price
  - Free Software friendly ([AVRGCC](#), [Win AVR](#), etc...)
  - but for PICs: [Pyastra](#) .py -> .asm ->.hex
- Resources :
  - [Linux Focus articles](#) + [Tuxgraphics kits](#) (kit 11+ €)
  - community [AVRFreaks](#) , [Kits + books \(C\)](#)

# Scheme

LEF R1A3 Mini-board  
www.liberlab.net



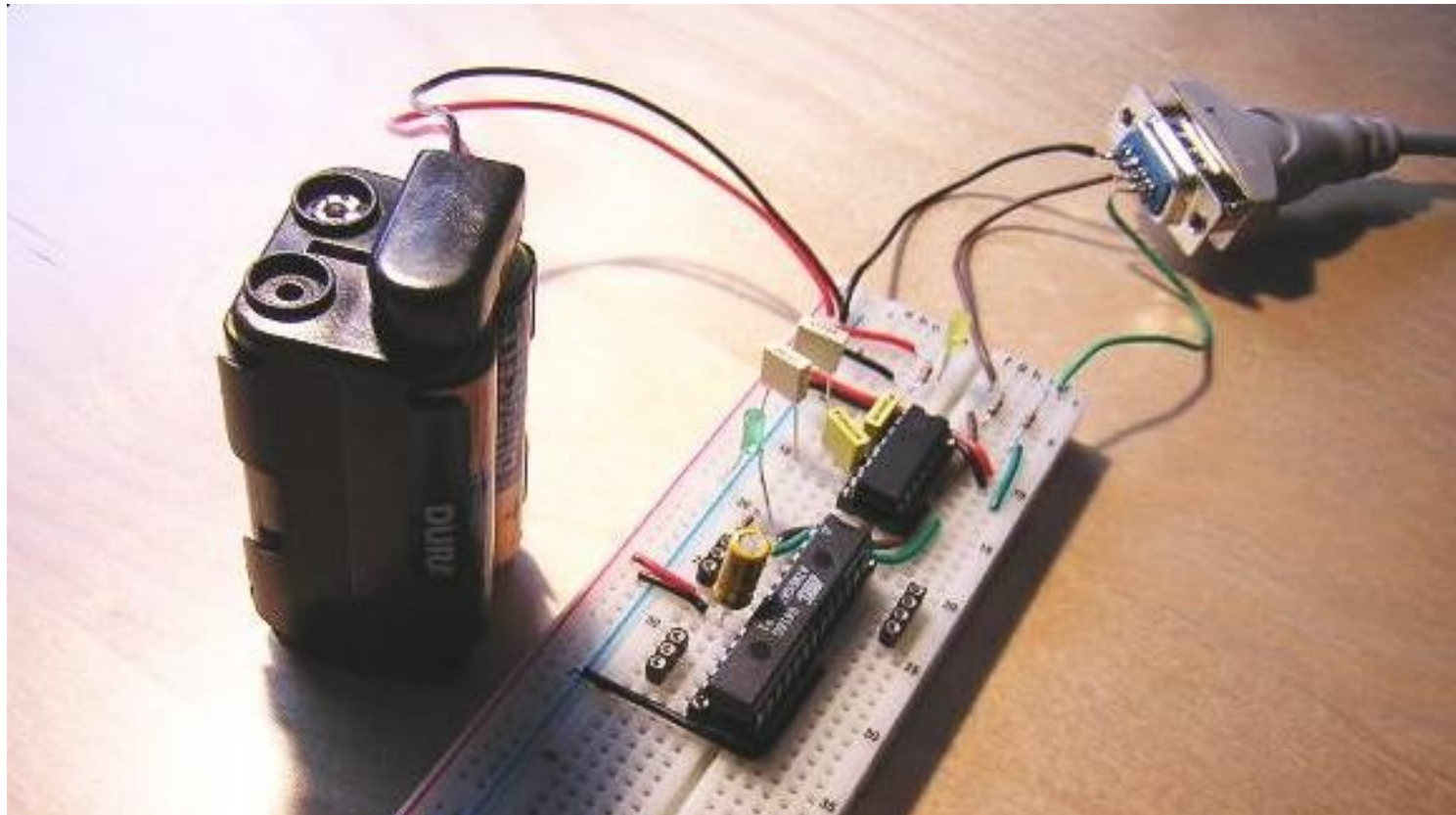
Attention: pour des raisons de sécurité en cas d'erreurs de branchement, utilisez des condensateurs non polarisés.

VCC= 5 V ou (4,5 V ou 6V par piles)

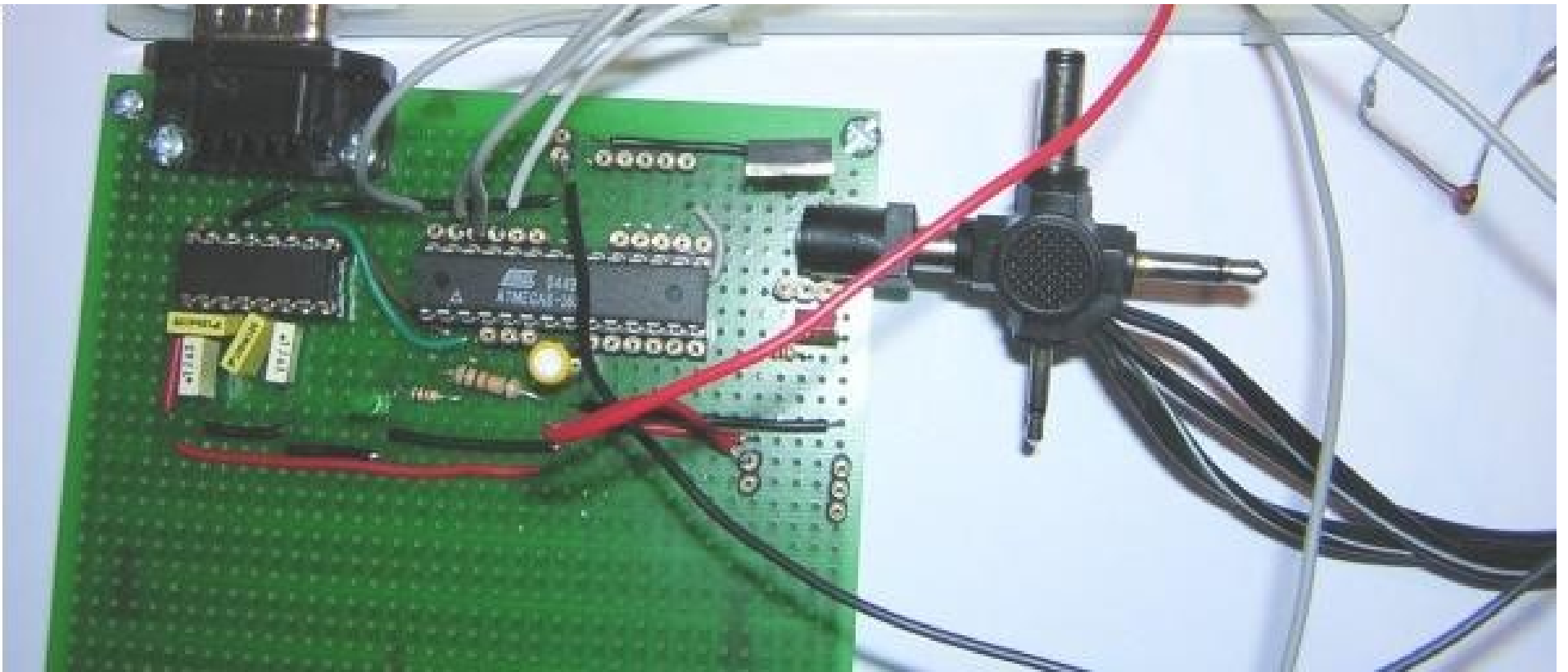


# Breadboard version

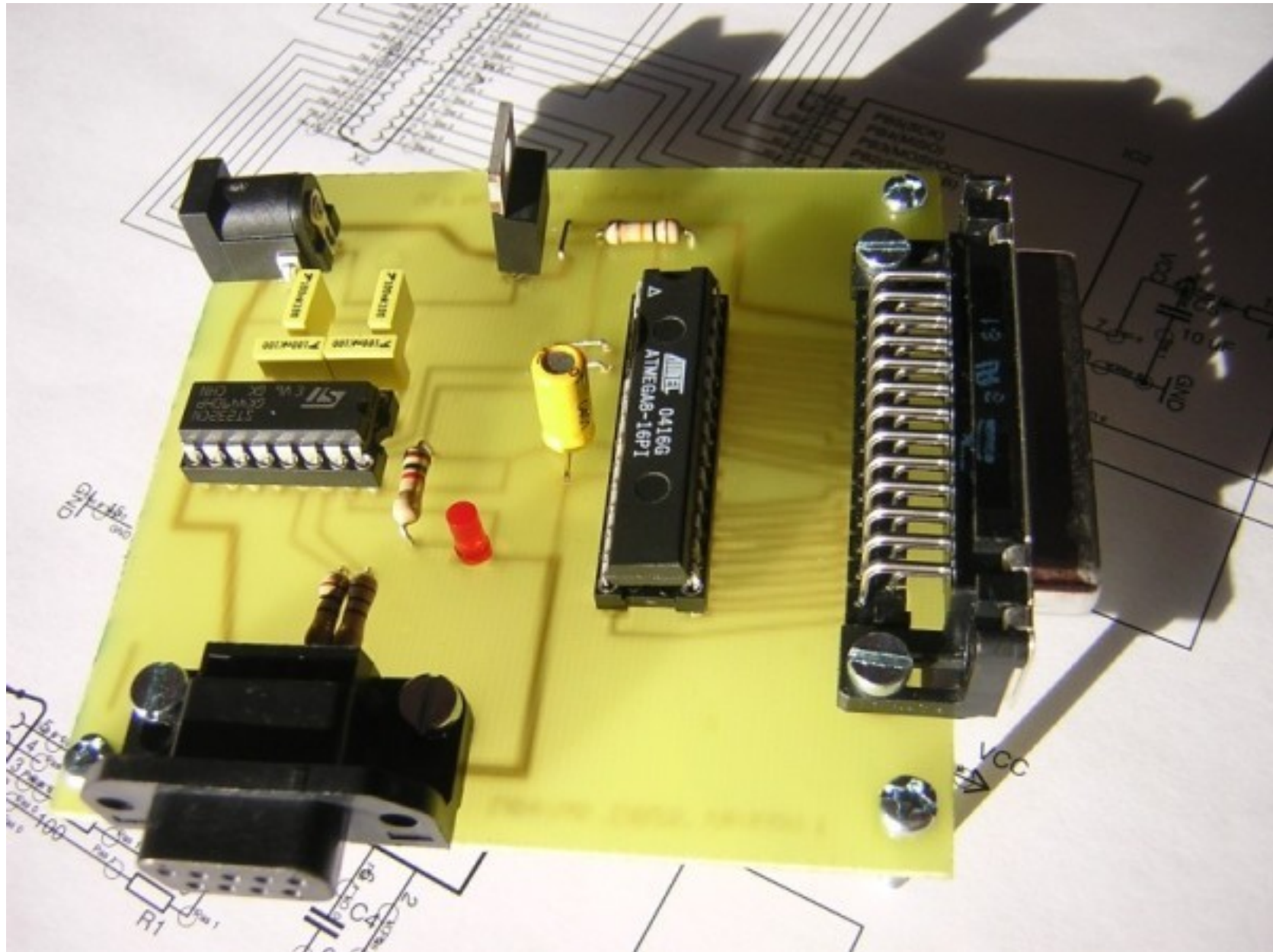
- Tutorial in pictures



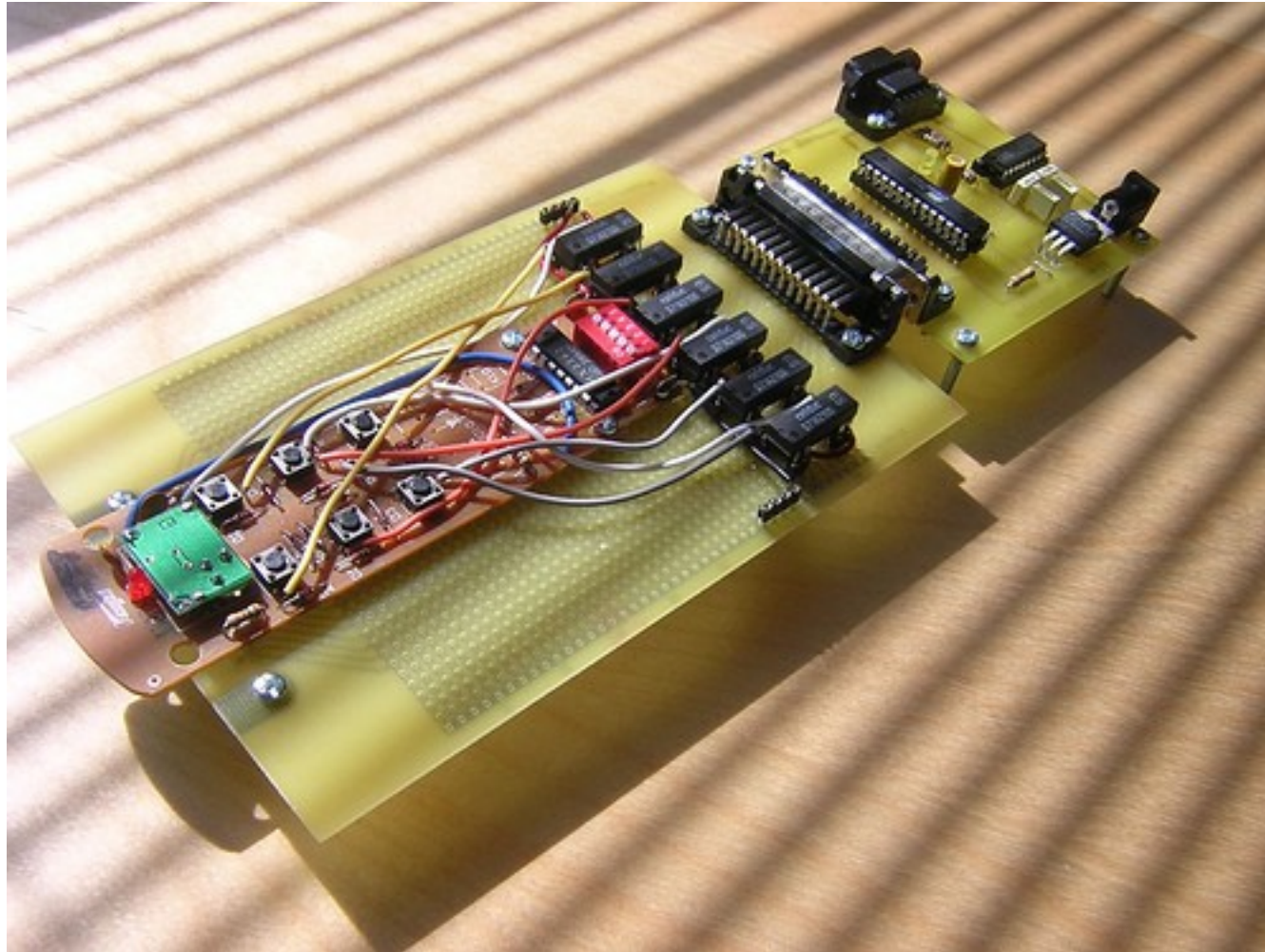
# Veroboard version



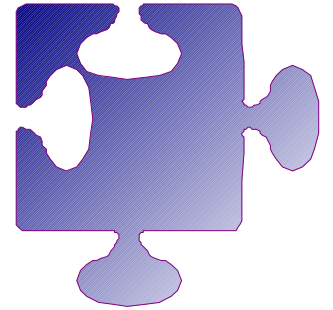
# PCB version



# PCB + daughter boards



# Liberlab Software



- Choice : Python
  - pyserial module
  - multiplateforme
- Liberlab Software (Tkinter)
- Liberlab Module (for your apps)
- + Environments « à la Squeak » / Logo

# Liberlab Software v 0.8

- Display 4 analogue channels + 6 Input/Output
- Manually control outputs (LED, relays, etc.)
- On the fly computation
- Record channels and on the fly computation
- Automation of outputs in function of V1 to V4

# Liberlab Software (WinXP)

The screenshot displays the Liberlab software interface, which is divided into several functional areas:

- Main Window (Liberlab software):**
  - Graph:** A plot showing four waveforms (red, yellow, white, and blue) over time. The vertical axis is labeled from 0V to 4V.
  - Measurement Panel (Right):** Displays real-time voltage measurements for four channels:
    - Mesure Voie 1 (volts): 4.14
    - Mesure Voie 2 (volts): 2.84
    - Mesure Voie 3 (volts): 2.54
    - Mesure Voie 4 (volts): 2.58Buttons for "Mesurer", "Effacer", and "Pause" are located below the measurements.
  - Acquisition Control:** A slider for "Vitesse d'acquisition (en 1/100s)" is set to 0. Below it, buttons for "Enregistrer" and "Stop" are present.
  - Navigation:** A "Quitter" button is located at the bottom right of the main window.
- Bottom Left Panel (Valeurs physiques et calculs en continu):**
  - Four calculation fields are shown:  $f1(V1,V2,V3,V4) = V1/1000$ ,  $f2(V1,V2,V3,V4) = \exp(V2)^3 + 1$ ,  $f3(V1,V2,V3,V4) = V1 + V2$ , and  $f4(V1,V2,V3,V4) = \sin(V4) + 1$ .
  - Below these fields, numerical results are displayed: 0.0041, 52.44, 6.98, and 1.53.
  - Buttons for "Quitter", "Mesurer", and "Pause" are at the bottom.
- Bottom Right Panel (Automatisation des sorties digitales):**
  - Contains logic expressions for digital outputs based on V1, V2, V3, and V4.
  - Buttons for "Valider 1" through "Valider 6" are provided for each expression.
  - Buttons for "Quitter", "Mesurer", and "Pause" are at the bottom.

# Liberlab Software (Linux)

Applications Places System 12 °C Fri 31 Mar, 11:31

mesures1.csv (~/Desktop) - VIM

```
File Edit View Terminal Tabs Help
1, t (s), V1, V2, V3, V4, f1, f2, f3, f4
2, 0.004, 4.4, 4.48, 4.34, 2.62, 0.0044
3, 0.009, 4.39, 4.47, 4.34, 2.62, 0.0044
4, 0.018, 4.39, 4.47, 4.34, 2.62, 0.0044
5, 0.029, 4.4, 4.47, 4.34, 2.62, 0.0044
6, 0.039, 4.4, 4.48, 4.34, 2.62, 0.0044
7, 0.045, 4.39, 4.47, 4.34, 2.62, 0.0044
8, 0.055, 4.4, 4.48, 4.34, 2.62, 0.0044
9, 0.064, 4.4, 4.47, 4.35, 2.62, 0.0044
10, 0.084, 4.39, 4.47, 4.34, 2.62, 0.0044
11, 0.102, 4.39, 4.47, 4.34, 2.62, 0.0044
12, 0.114, 4.39, 4.47, 4.34, 2.62, 0.0044
13, 0.12, 4.39, 4.47, 4.34, 2.62, 0.0044
14, 0.143, 4.39, 4.47, 4.34, 2.62, 0.0044
15, 0.158, 4.39, 4.47, 4.34, 2.62, 0.0044
16, 0.17, 4.4, 4.47, 4.34, 2.62, 0.0044
17, 0.181, 4.39, 4.47, 4.34, 2.62, 0.0044
18, 0.186, 4.39, 4.47, 4.34, 2.62, 0.0044
19, 0.206, 4.4, 4.48, 4.34, 2.62, 0.0044
20, 0.223, 4.39, 4.47, 4.34, 2.62, 0.0044
21, 0.242, 4.39, 4.47, 4.35, 2.62, 0.0044
22, 0.247, 4.39, 4.47, 4.34, 2.62, 0.0044
23, 0.256, 4.4, 4.47, 4.34, 2.62, 0.0044
24, 0.264, 4.4, 4.47, 4.34, 2.62, 0.0044
25, 0.273, 4.4, 4.48, 4.34, 2.62, 0.0044
26, 0.281, 4.39, 4.47, 4.34, 2.62, 0.0044
27, 0.289, 4.39, 4.47, 4.34, 2.62, 0.0044
28, 0.297, 4.39, 4.47, 4.34, 2.62, 0.0044
29, 0.305, 4.4, 4.47, 4.34, 2.62, 0.0044
30, 0.313, 4.4, 4.48, 4.34, 2.62, 0.0044
31, 0.335, 4.4, 4.48, 4.34, 2.62, 0.0044
32, 0.34, 4.4, 4.47, 4.35, 2.62, 0.0044
33, 0.35, 4.39, 4.47, 4.35, 2.62, 0.0044
34, 0.359, 4.39, 4.47, 4.34, 2.62, 0.0044
35, 0.368, 4.39, 4.47, 4.34, 2.62, 0.0044
36, 0.375, 4.39, 4.48, 4.34, 2.62, 0.0044
37, 0.384, 4.4, 4.48, 4.34, 2.62, 0.0044
38, 0.393, 4.4, 4.48, 4.34, 2.62, 0.0044
39, 0.504, 4.4, 4.48, 4.34, 2.62, 0.0044, 264.05, 8.88, 3.5,
40, 0.511, 4.4, 4.47, 4.35, 2.62, 0.0044, 262.77, 8.87, 3.5,
```

**Liberlab software**

Options Physical values and computation Automation About

Measure of channel 1 (volts): 1.7

Measure of channel 2 (volts): 1.44

Measure of channel 3 (volts): 0.63

Measure of channel 4 (volts): 2.63

Measure Clear Pause

Data capture speed (in 1/100 s): 0

Recording in a file: Record Stop

Quit

Click on the graph to 'read' a voltage

Analogic channels selection: 1 2 3 4

Digital outputs: 1 2 3 4 5 6

Digital inputs: 1 2 3 4 5 6

**Automation of digital outputs**

Enter conditions in fonction of V1, V2, V3 and/or V4:

output1 ON if: V1<4	output2 ON if: 4.0<V2<4.3	output3 ON if: V1+V2>2	output4 ON if: V4>2	output5 ON if:	output6 ON if:
---------------------	---------------------------	------------------------	---------------------	----------------	----------------

Validate 1 Validate 2 Validate 3 Validate 4 Validate 5 Validate 6

Quit Measure Pause

**Physical values and on-the-fly computation**

f1(V1,V2,V3,V4)=	f2(V1,V2,V3,V4)= exp(V2)*3	f3(V1,V2,V3,V4)= V1+V2	f4(V1,V2,V3,V4)= sin(V4) + 3
------------------	----------------------------	------------------------	------------------------------

Validate f1 Validate f2 Validate f3 Validate f4

0.0017 + 12.67 + 3.14 + 3.49

Quit Measure Pause

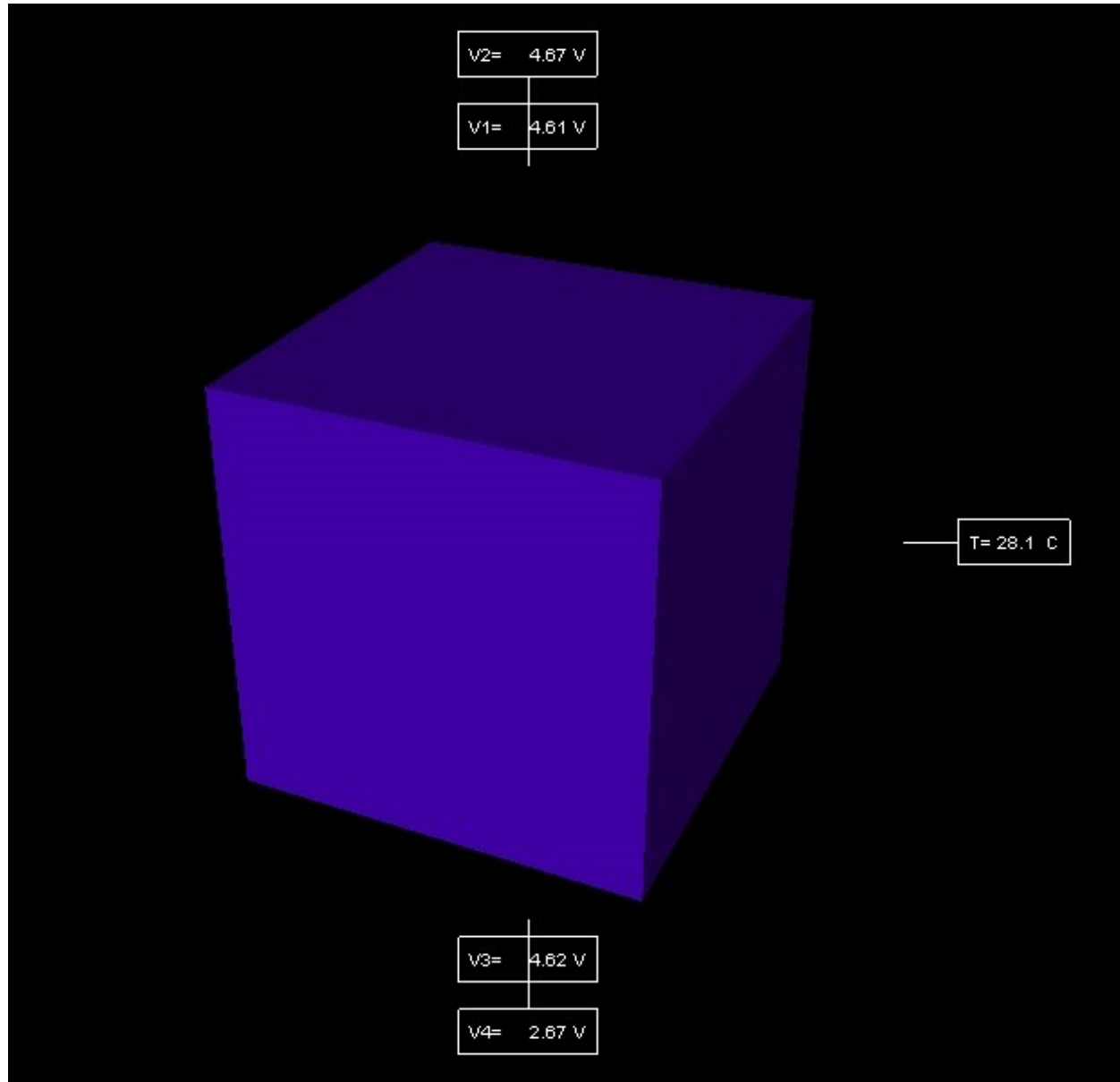


# Liberlab Python module

- Module tutorial at [www.liberlab.net](http://www.liberlab.net)

```
from liberlab import *  
monLiberlab= Liberlab()  
monLiberlab.read("analog4",2)  
monLiberlab.command("io1 on")
```

# A Vpython “hello world”



# Xturtles and Liberlab

SPE 0.8.2.a - SPE 0.8.2.a

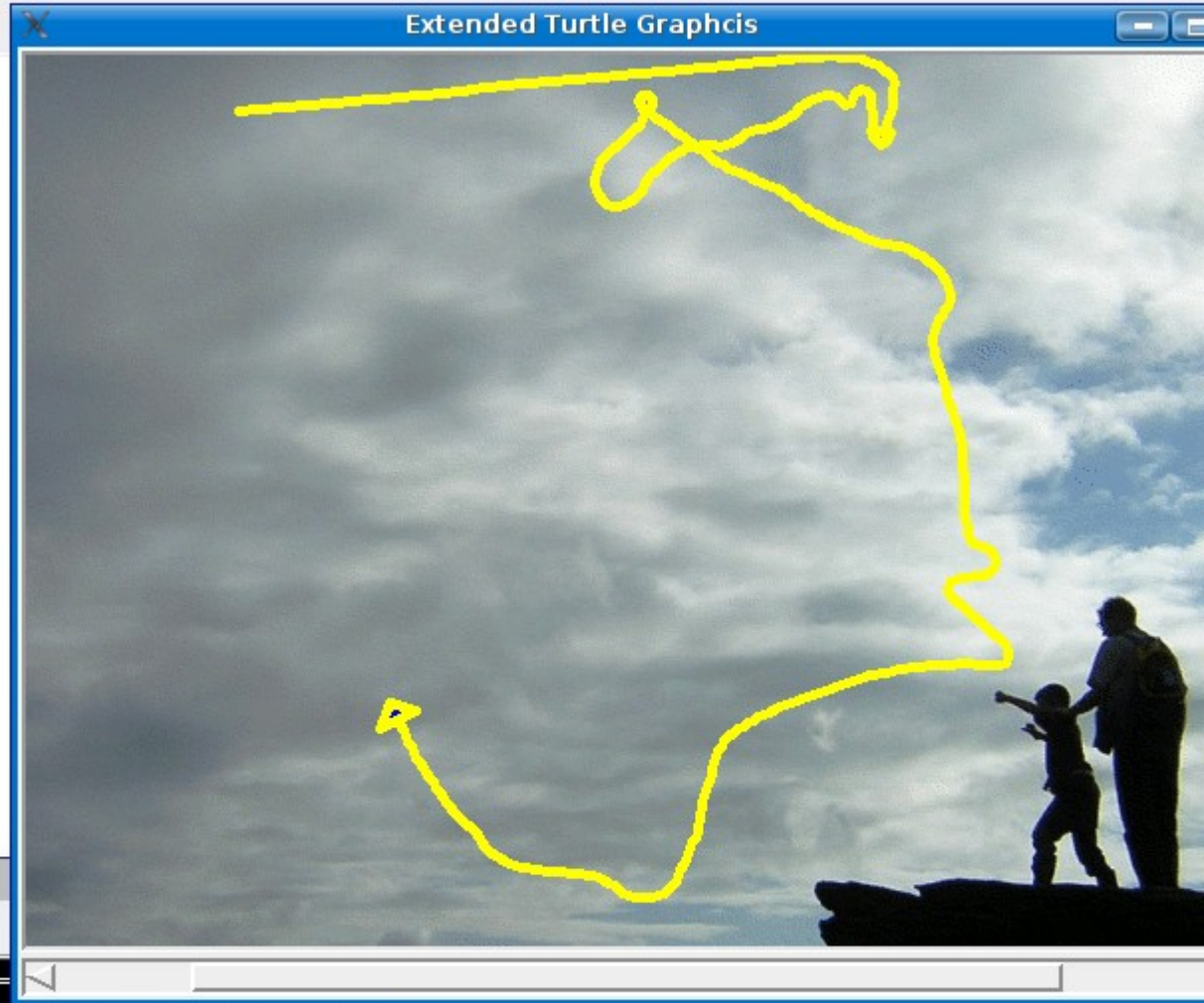
File Edit View Tools Links Help



temperature.py X liberlabOscillo.py X liberlabBee.py X

Source Uml PyDoc

```
2 from xturtle import *
3 from liberlab import *
4
5 myLiberlab = Liberlab(port)
6 sensibility = 400
7
8 t1 = Pen() # Create a Turtle
9
10 t1.pen(pencolor="yellow", fillcolor="blue",
11 t1.penup()
12 t1.setpos(-200,200)
13 t1.speed(0)
14 t1.pendown()
15 t1.bgpic("mybg.gif")
16
17 while 1:
18     V1= myLiberlab.read("analog1")
19     V2= myLiberlab.read("analog2")
20     diff = (V1-V2)*sensibility
21     print "Delta left/right eyes = ", diff,
22     print "\tTurtle position = ", t1.pos()
23     t1.setheading(-diff)
24     t1.fd(3)
25
```



Shell - SPE

Session Edit View Bookmarks Settings Help

```
Delta left/right eyes = -132.8125 Turtle position =
Delta left/right eyes = -136.71875 Turtle position = (-85.59, -161.21)
Delta left/right eyes = -132.8125 Turtle position = (-85.58, -159.15)
Delta left/right eyes = -134.765625 Turtle position = (-87.62, -156.95)
Delta left/right eyes = -132.8125 Turtle position = (-89.73, -154.82)
Delta left/right eyes = -128.90625 Turtle position = (-91.77, -152.62)
Delta left/right eyes = -130.859375 Turtle position = (-93.65, -150.29)
Delta left/right eyes = -126.953125 Turtle position = (-95.62, -148.02)
```

ex Notes Donate

defaults

Line 00007

Column 000

# Xturtles and Liberlab

SPE 0.8.2.a - SPE 0.8.2.a

File Edit View Tools Links Help

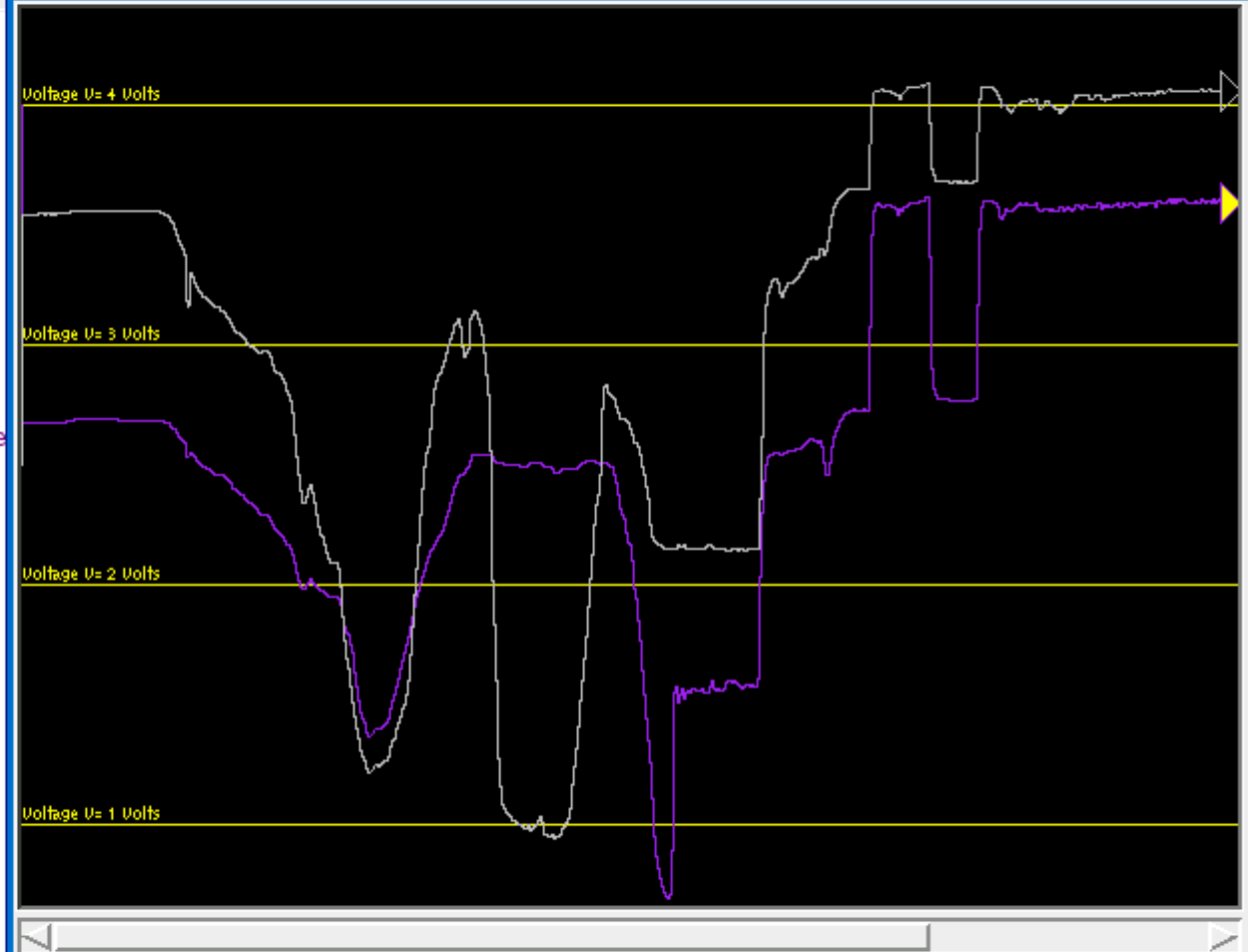


temperature.py X liberlabOscillo.py X

Source Uml PyDoc

```
2 from xturtle import *
3 from liberlab import *
4
5 Wx, Wy = 800,600
6 myLiberlab = Liberlab(port)
7
8 t1 = Pen() # Ceate Turtle 1
9 t1.speed(0)
10 t2 = Pen() # Ceate Turtle 2
11 t2.speed(0)
12
13 def pattern():
14     "Use a turtle to draw voltage line"
15     t1.bgcolor("black")
16     t1.color("yellow")
17     for i in range(5):
18         t1.fd(Wx)
19
20 pattern()
21
22 t1.pen(pencolor="purple", pensize=1)
23 t2.pen(pencolor="grey", pensize=1)
24 t1.penup(); t2.penup()
25 t1.setx(-Wx/2); t2.setx(-Wx/2)
26 t1.pendown(); t2.pendown()
27
28 while 1:
29     V1= myLiberlab.read("analog1")
30     V2= myLiberlab.read("analog2")
31     t1.sety(V1*Wy/5-Wy/2)
32     t2.sety(V2*Wy/5-Wy/2)
33     t1.fd(1); t2.fd(1)
34     if t1.xcor() > (Wx/2):
35         t1.setx(-Wx/2); t2.setx(-Wx/2)
```

Extended Turtle Graphics



# Liberlab and Cherrypy

Liberlab on-Line [www.liberlab.net](http://www.liberlab.net)

Voie1 = 3.8720703125 Volts  
Voie2 = 3.8037109375 Volts  
Voie3 = 1.6796875 Volts  
Voie4 = 2.705078125 Volts

[LED1 on](#) | [LED2 on](#) | [LED3 on](#)  
[LED1 off](#) | [LED2 off](#) | [LED3 off](#)



Minimiser | Maximiser | Fermer

Terminé

démarrer

3 Explorateur Wind... | C:\Python24\python... | Liberlab Live - Mozilla ...

No Calendars | Opeg Notebook

FR | 18:40

# Conclusion

- Future developments:
  - web collaboration, speed, etc.
- Questions ?
- More informations here :  
<http://www.liberlab.net>