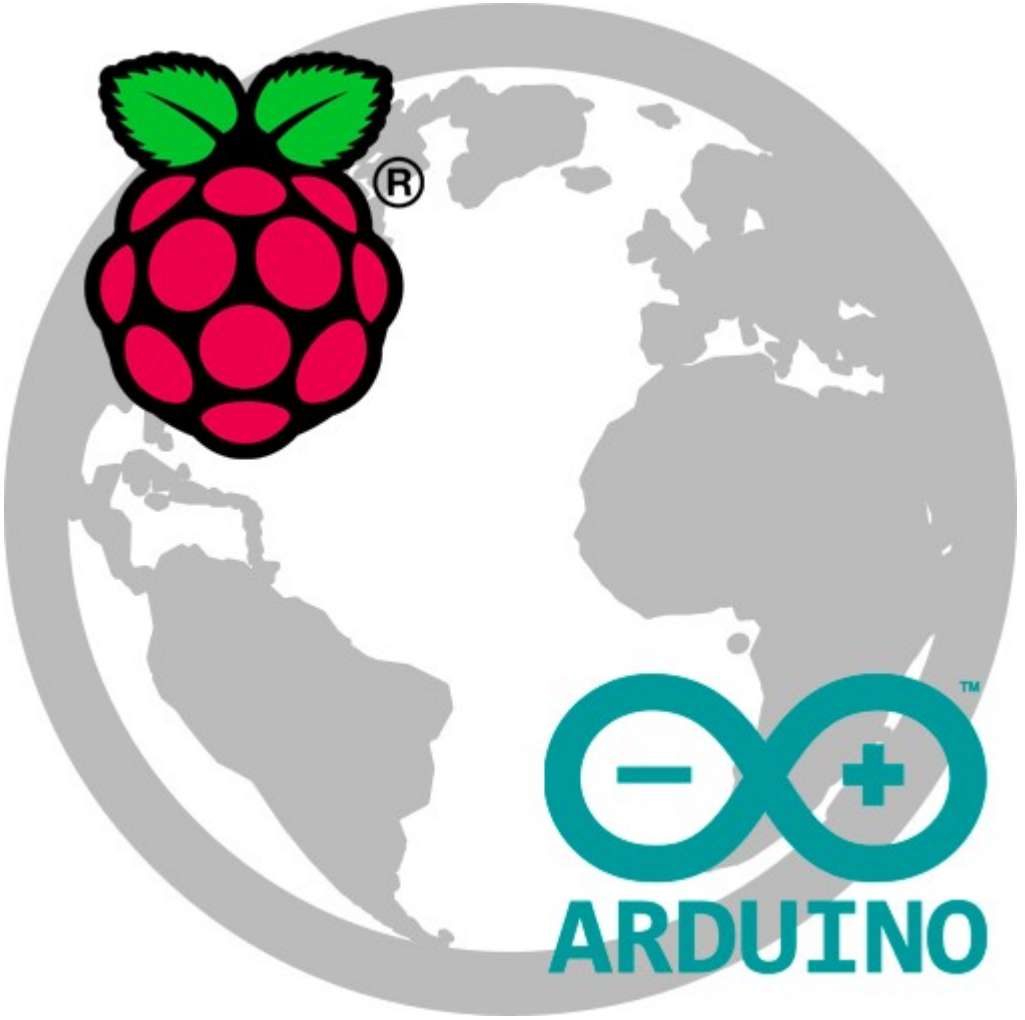
Arduino i Raspberry Pi



Telecos.cat
enginyers de telecomunicació,
electrònica i multimèdia-audiovisual

22, 24, 29 de novembre
i 1 de desembre 2016

electronics.cat
OPEN SOURCE HARDWARE & TRAINING

JESUÏTES El Clot
Escola del Clot

Arduino i Raspberry Pi

* Maneres de programar un Arduino (per blocs i des de l´IDE d´Arduino)
* Connexió de perifèrics a l´Arduino (entrades i sortides digitals, SPI, I2C, UART)
* Comunicació entre l´Arduino i l´ordinador
* Bluetooth i RS485
* Maneres de programar una Raspberry Pi (Python, BASH, C++, Qt)
* Connexió de perifèrics a la Raspberry Pi
* Automatització de processos amb la Raspberry Pi (sense entorn gràfic i amb entorn gràfic. Mode quiosc)
* Comunicació entre la Raspberry Pi i l´Arduino
* Comunicació entre la Raspberry Pi i l´ordinador
* Comunicació entre la Raspberry Pi i el núvol (Introducció a Internet de les coses i seguretat en les comunicacions)

Telecos.cat
enginyers de telecomunicació, electrònica i multimèdia-audiovisual

22, 24, 29 de novembre i 1 de desembre 2016

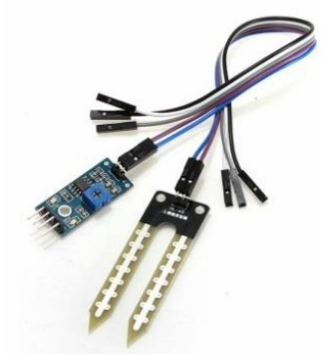
electronics.cat
OPEN SOURCE HARDWARE & TRAINING

JESUÏTES El Clot
Escola del Clot

Arduino i Raspberry Pi

Interacció amb el món físic

Sensors



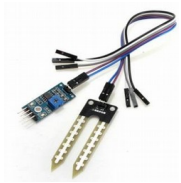
Lectura
d'informació

Actuadors

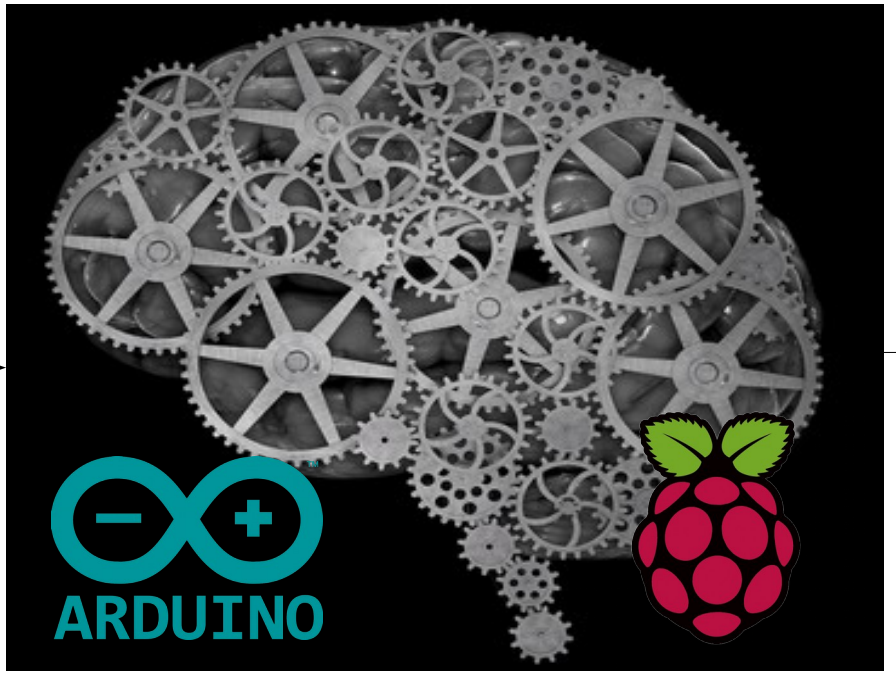
Escriptura
d'informació

Arduino i Raspberry Pi

Automatització del món físic



Sensors

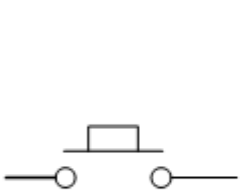


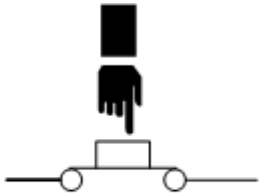
Actuadors

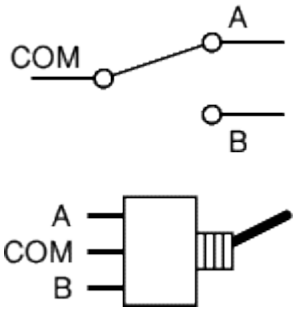
Sortida de sensors Escriptura -->	Entrada d'informació --> Lectura	Sortida d'informació Escriptura -->	Entrada d'actuadors --> Lectura

Arduino i Raspberry Pi

Lectura de l'estat d'un sensor digital

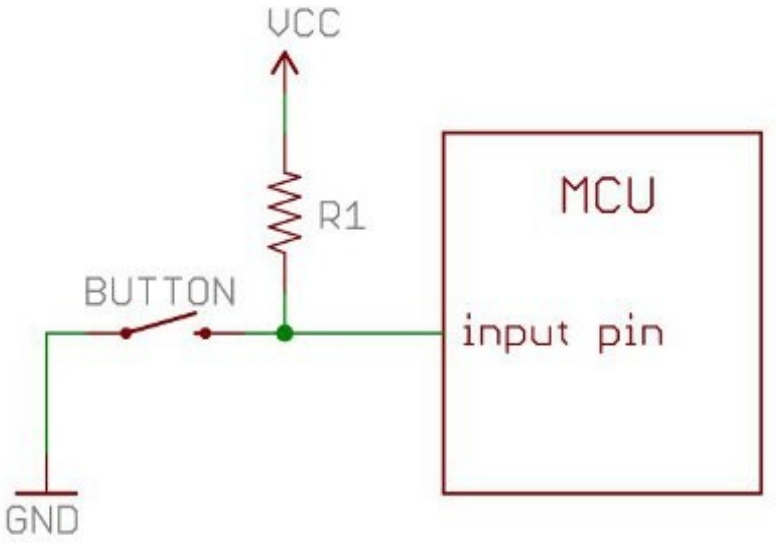






Cert : 1.8v, 3.3V, 5V

Fals : 0v



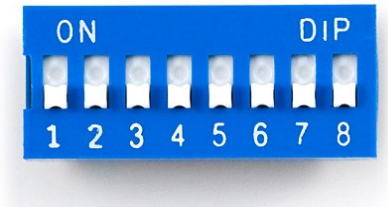
True / False

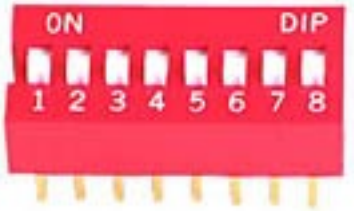
High / Low

Arduino i Raspberry Pi

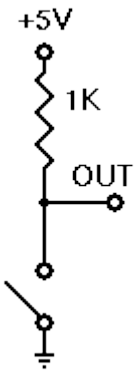
Lectura de l'estat d'un sensor digital

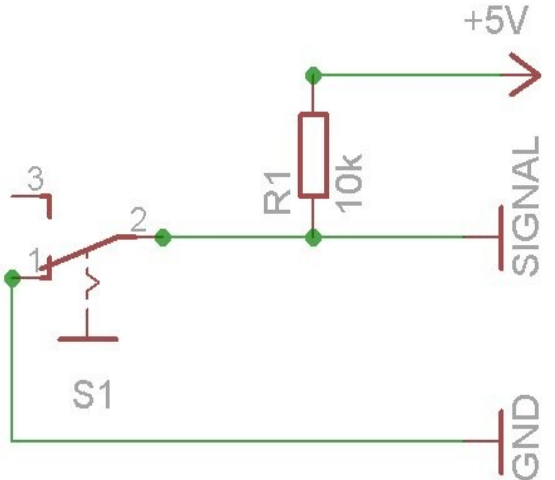
uSW : Microrruptor (dip-switch, microswitch)





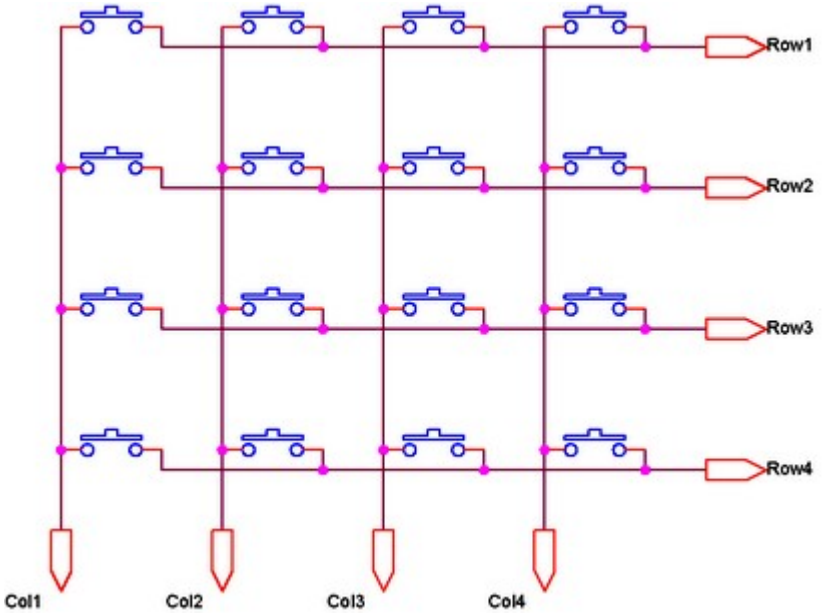
Pull-up : Connexió d'un resistor a alimentació per assegurar un nivell lògic a una entrada digital





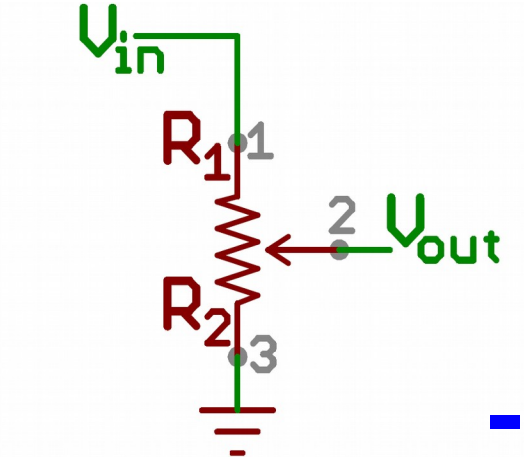
Arduino i Raspberry Pi

Lectura de la informació d'un teclat



Arduino i Raspberry Pi

Lectura d'informació analògica

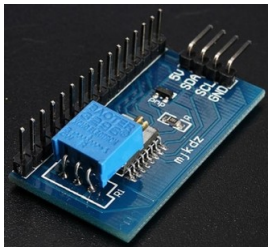


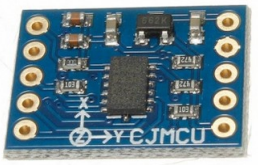
0..3,3V
0..5V
0..10V
-10..10V

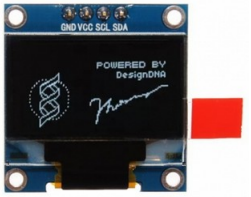
Arduino i Raspberry Pi

Protocols I2C (TWI), SPI i 1-Wire

I2C : Inter-Integrated Circuit

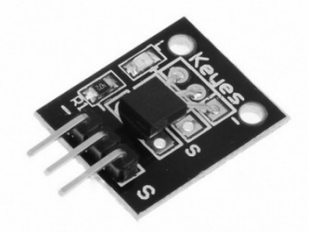


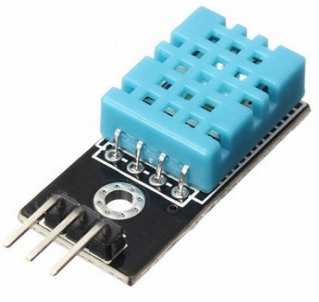




SPI : Serial Peripheral Interface Bus

1-Wire

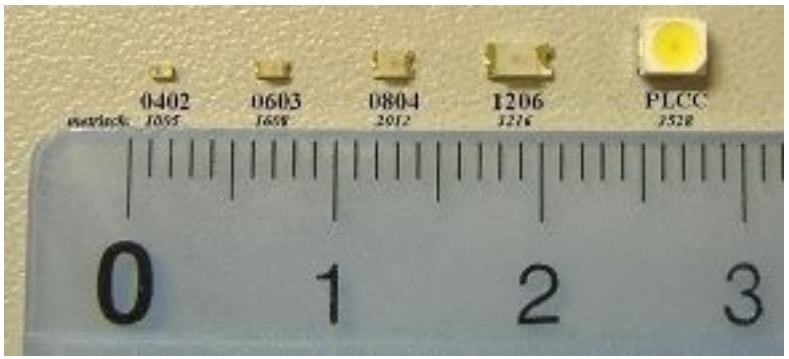


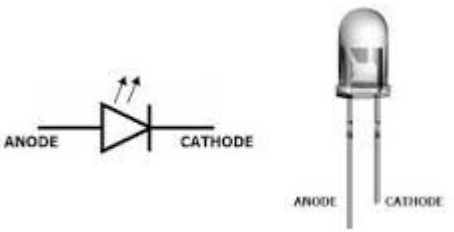


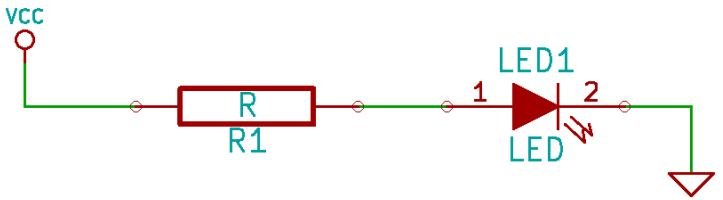
Arduino i Raspberry Pi

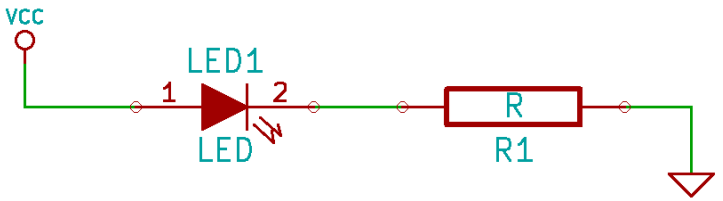
Escriptura d'estat a un actuador digital

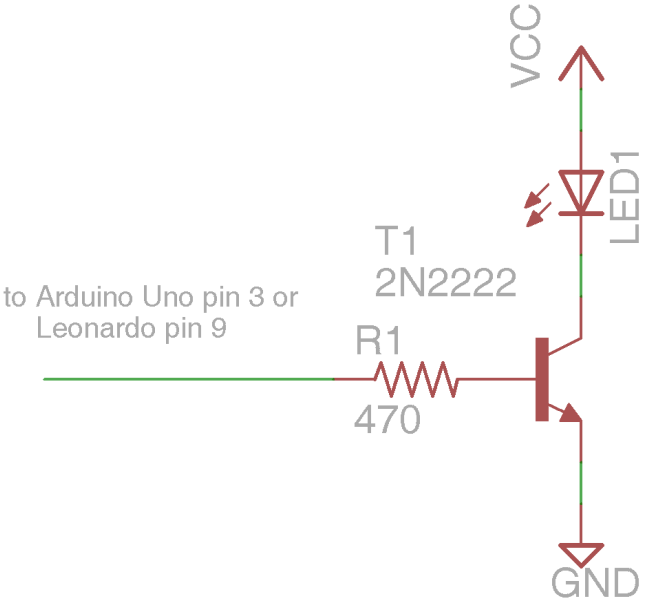
LED : Díode emissor de llum











Arduino i Raspberry Pi

Escriptura d'estat a un actuador digital

Relé : Sistema electromecànic que modifica l'estat d'un commutador. Amb una tensió de control petita s'activa un electroimant podent controlar tensions molt superiors.

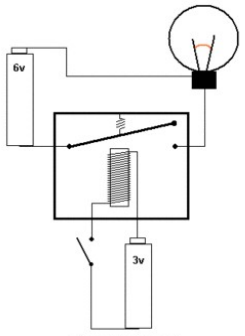


Figure 1: Relay off

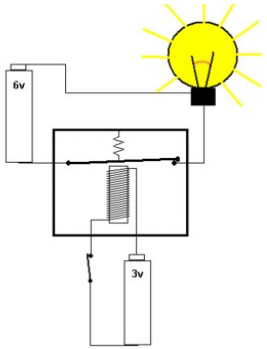
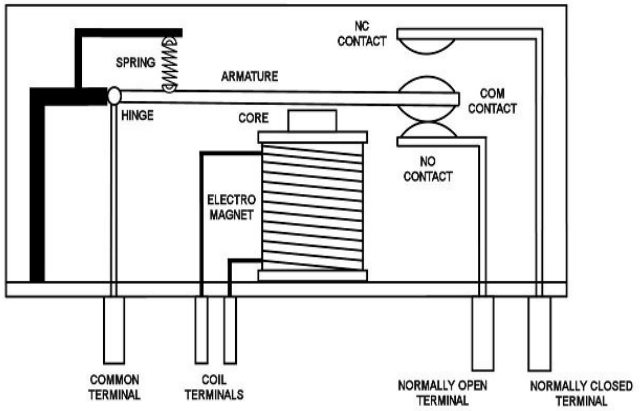
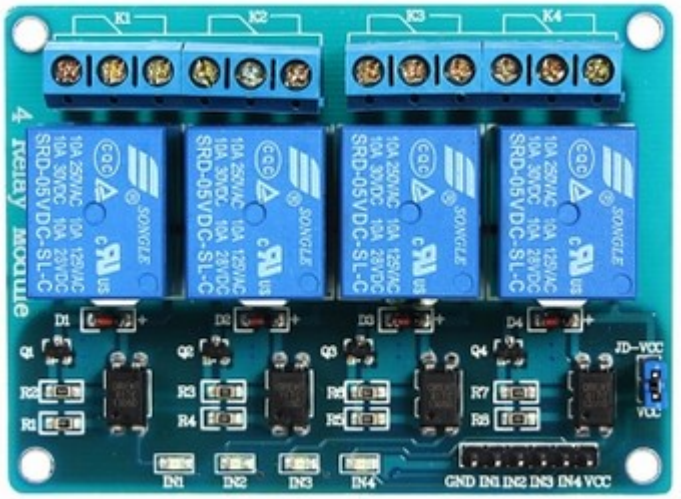
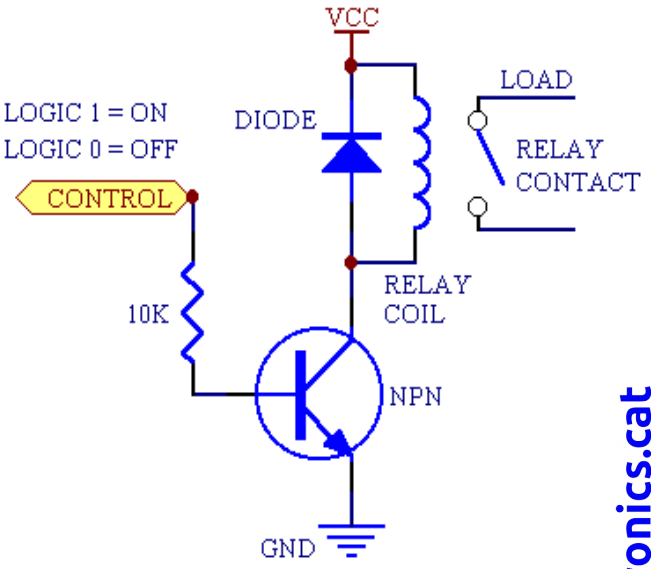


Figure 2: Relay on

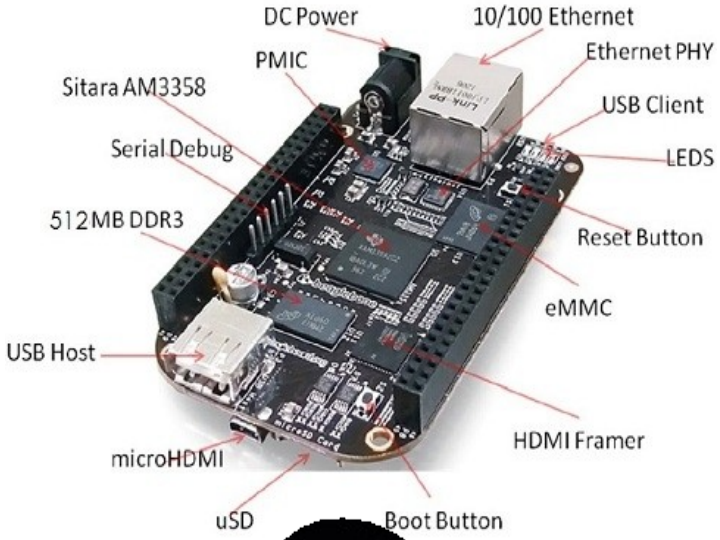


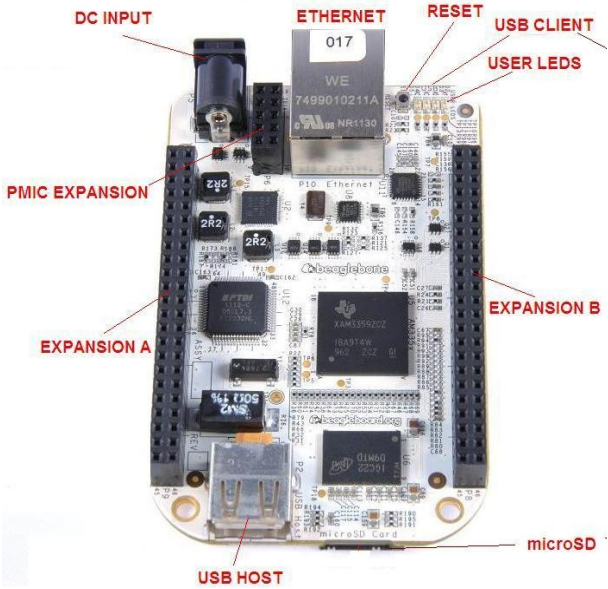


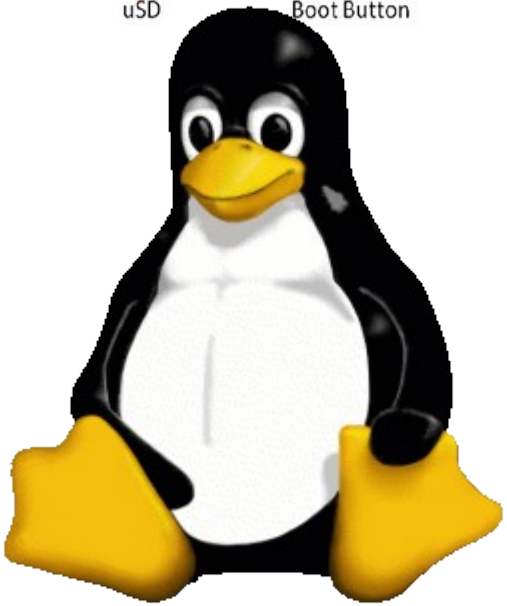


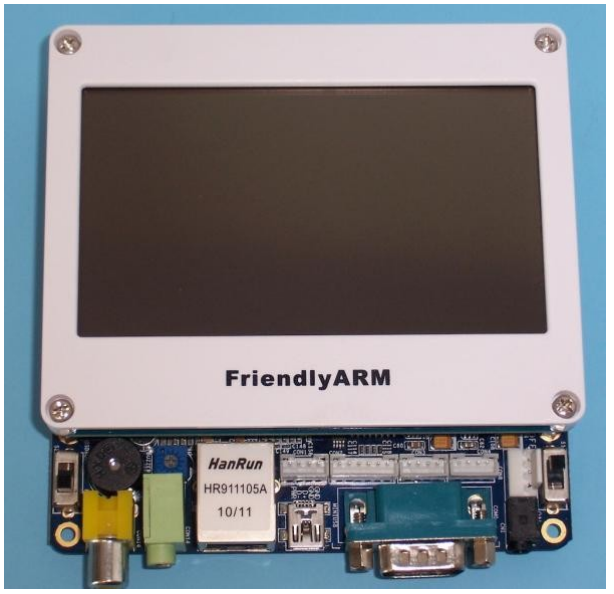
Arduino i Raspberry Pi

Processadors de 32 bits









Arduino i Raspberry Pi

Família d'Arduinos i Teensy

Arduino Uno

Arduino Leonardo

Arduino Due

Arduino Yún

Arduino Tre

Arduino Micro

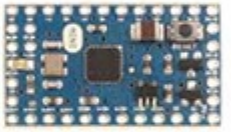
Arduino Robot

Arduino Esplora

Arduino Mega ADK

Arduino Ethernet

Arduino Mega 2560

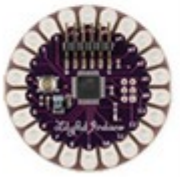


Arduino Mini

LilyPad Arduino USB

LilyPad Arduino Simple

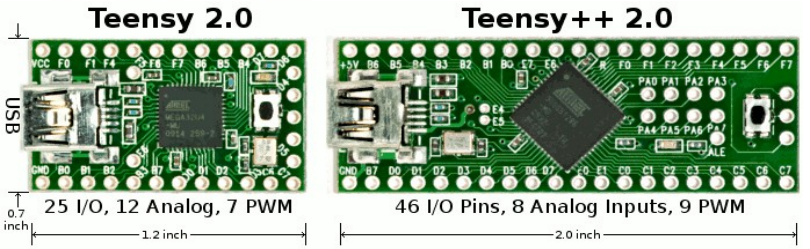
LilyPad Arduino SimpleSnap



LilyPad Arduino

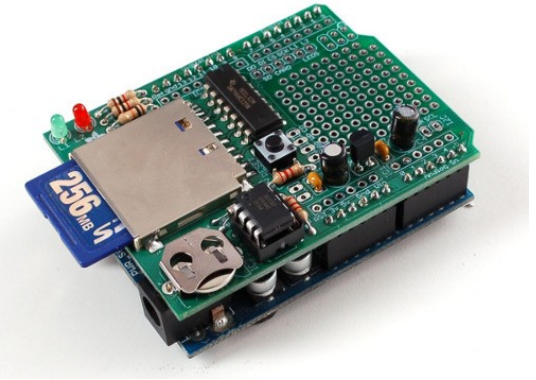
Arduino Nano

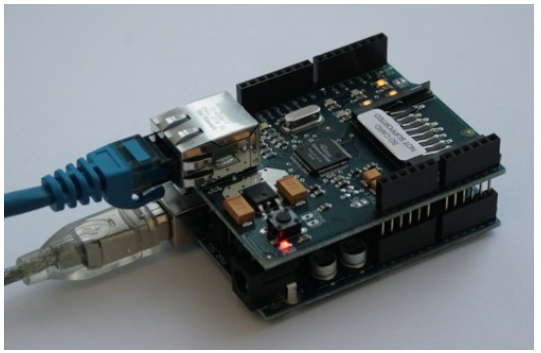
Arduino Pro Mini

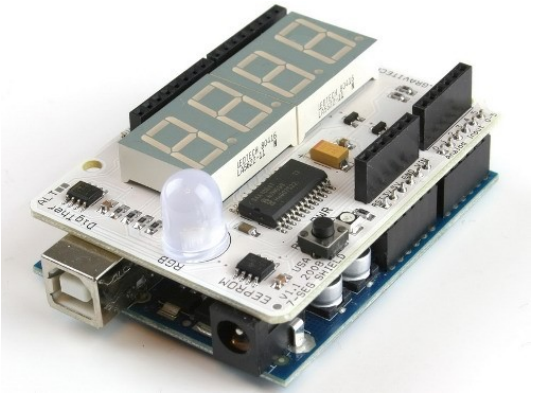


Arduino i Raspberry Pi

Plaques complementàries (shield / hat)





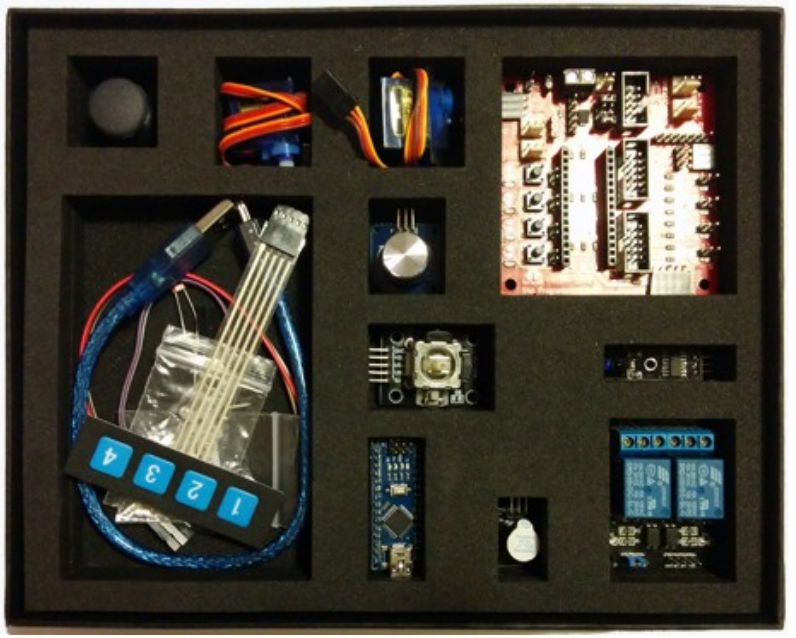


La majoria de plaques complementàries venen amb biblioteques i arxius de capçalera que acceleren el procés de funcionament.

http://arduino.cc/en/pmwiki.php?n=Main/ArduinoShields

Arduino i Raspberry Pi

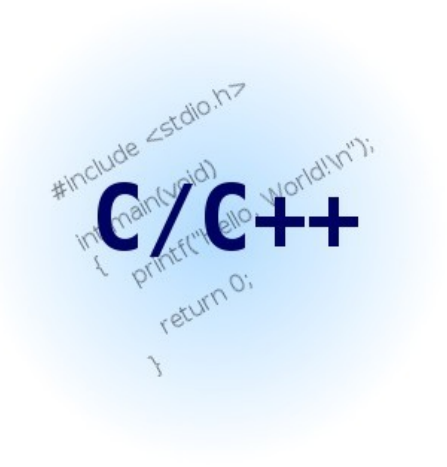
Make It !



http://www.makeit.cat

Arduino i Raspberry Pi

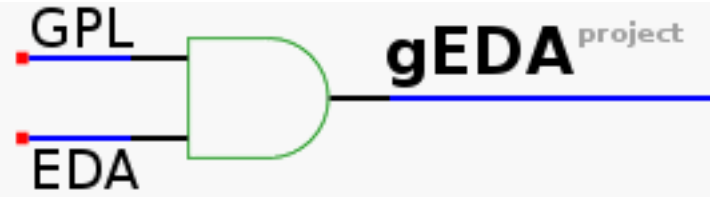
Alguns llenguatges de programació



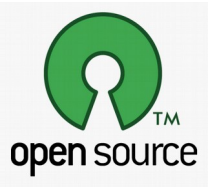
Arduino i Raspberry Pi

El perquè d'emprar el maquinari lliure

- Preus baixos (www.banggood.com)
- Promoció STEM (Science, Technology, Engineering and Maths)
- Disseny accessible
  - KiCad, gEDA



  - Circuits impresos (www.pcbway.com)
- Munió de projectes de codi obert



Arduino i Raspberry Pi

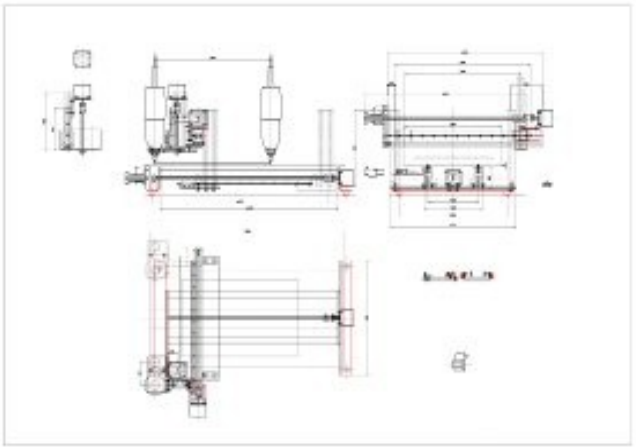
Exemple: Trepant / fresadora - qtCnc

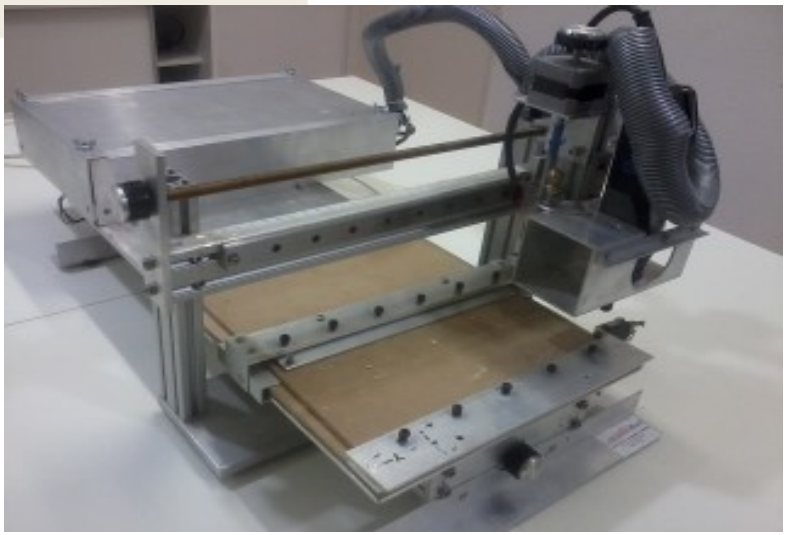
- Programari allotjat a sourceforge.net :
(http://sourceforge.net/projects/qtcnc/files/)

Home

Name	Modified	Size	Downloads
Desktop Software	2011-12-21		
FirmwareAtmega	2011-12-21		

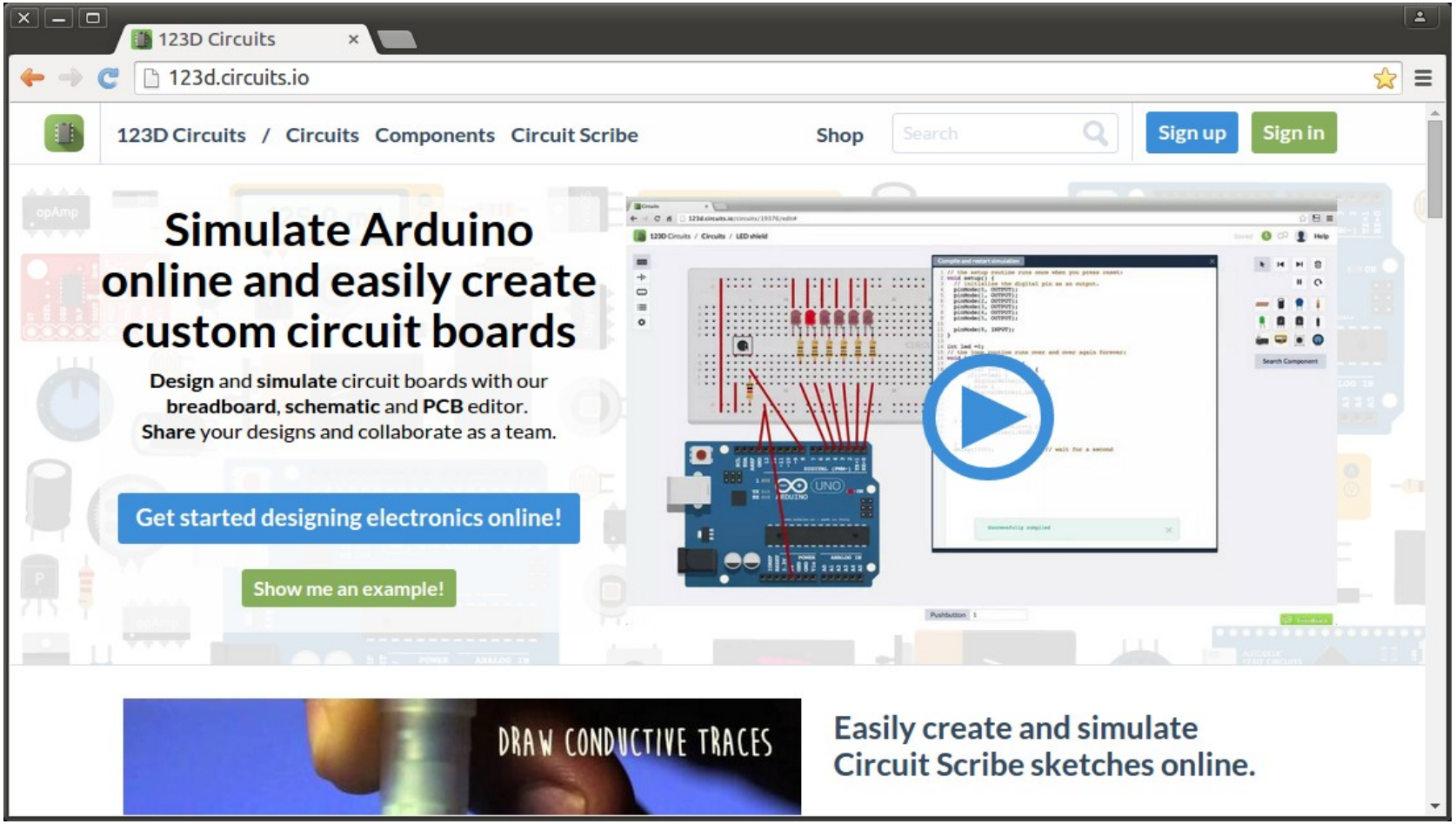
Totals: 2 Items





Arduino i Raspberry Pi

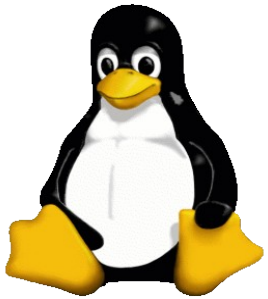
Eines per a simular



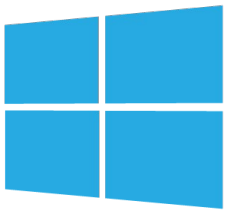
http://123d.circuits.io/

Arduino i Raspberry Pi

Sistemes operatius



Els sistemes basats en GNU/Linux permeten fer metadistribucions



Els sistemes propietaris no permeten fer metadistribucions

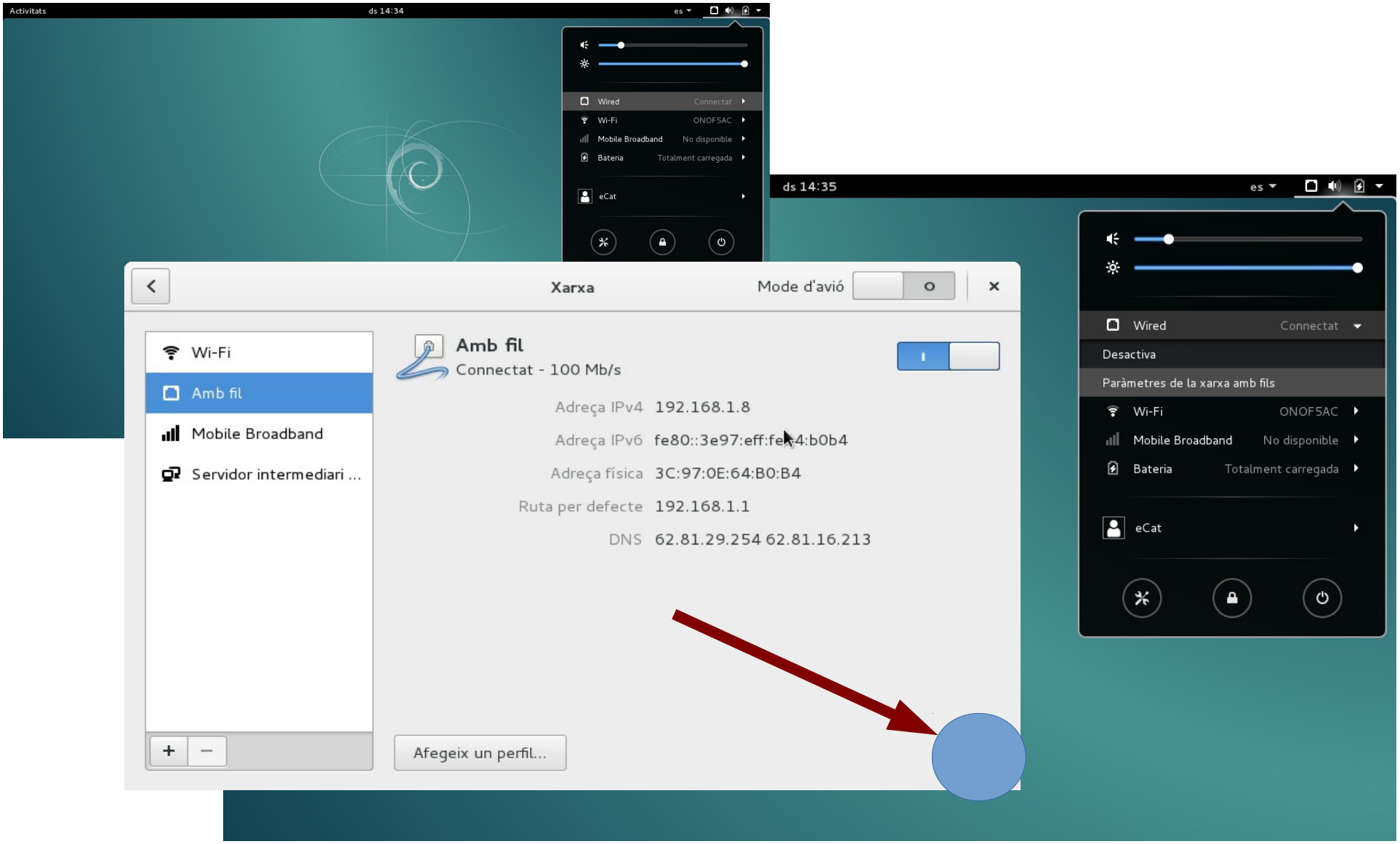
Arduino i Raspberry Pi

Metadistribució basada en Debian

- Els alumnes poden tenir una còpia funcional sense cap mena de restricció legal
- Escriptoris : Gnome3 / Gnome clàssic / LXDE
- Uuaris :
  - Primari o root (#). Contrasenya : clot
  - Usuari ecat ($). Contrasenya : clot

Arduino i Raspberry Pi

Assignació d'IP



Arduino i Raspberry Pi

Reconeixement de les plaques de comunicació

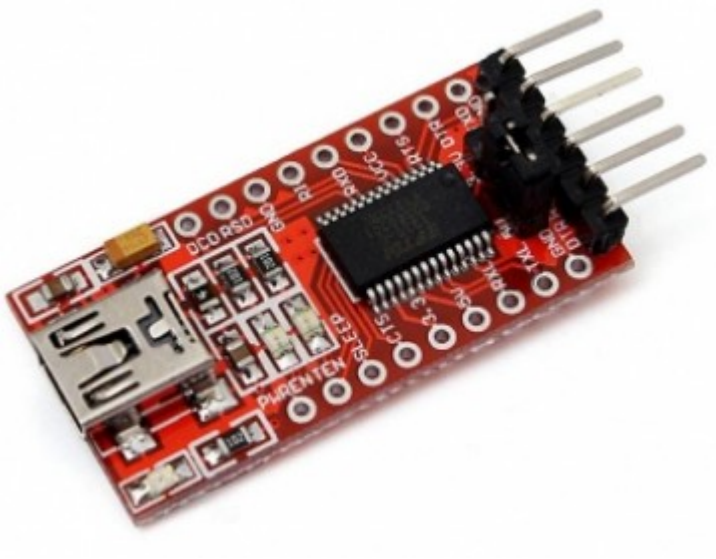
ecat@ecatian:~$ lsusb

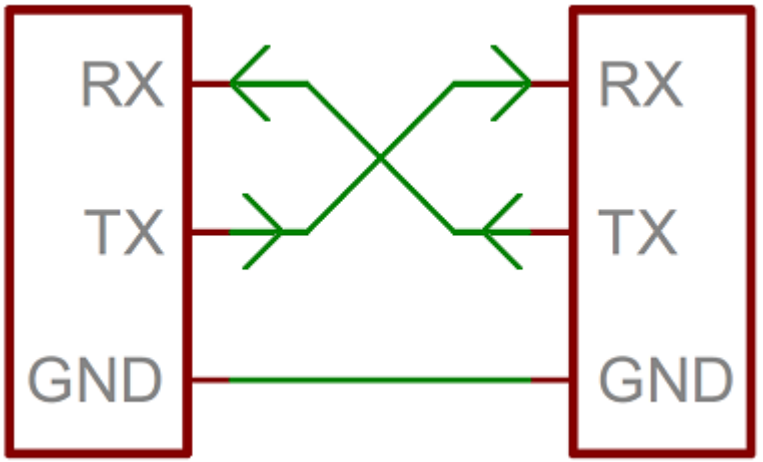
```
ecat@ecatian:~$ lsusb
Bus 004 Device 002: ID 8087:0024 Intel Corp. Integrated Rate Matching Hub
Bus 004 Device 001: ID 1d6b:0002 Linux Foundation 2.0 root hub
Bus 003 Device 005: ID 5986:0299 Acer, Inc
Bus 003 Device 004: ID 0461:4d81 Primax Electronics, Ltd Dell N889 Optical Mouse
Bus 003 Device 003: ID 0bdb:1926 Ericsson Business Mobile Networks BV
Bus 003 Device 002: ID 8087:0024 Intel Corp. Integrated Rate Matching Hub
Bus 003 Device 001: ID 1d6b:0002 Linux Foundation 2.0 root hub
Bus 002 Device 002: ID 0781:5581 SanDisk Corp.
Bus 002 Device 001: ID 1d6b:0003 Linux Foundation 3.0 root hub
Bus 001 Device 005: ID 0403:6001 Future Technology Devices International, Ltd FT232 USB-Serial (UART) IC
Bus 001 Device 004: ID 0403:6001 Future Technology Devices International, Ltd FT232 USB-Serial (UART) IC
Bus 001 Device 003: ID 1a40:0101 Terminus Technology Inc. 4-Port HUB
Bus 001 Device 001: ID 1d6b:0002 Linux Foundation 2.0 root hub
ecat@ecatian:~$ ls /dev/ttyUSB*
/dev/ttyUSB0  /dev/ttyUSB1
ecat@ecatian:~$ ls /dev/ttyUSB* -ls
0 crw-rw---- 1 root dialout 188, 0 jun 27 14:53 /dev/ttyUSB0
0 crw-rw---- 1 root dialout 188, 1 jun 27 14:53 /dev/ttyUSB1
ecat@ecatian:~$
```

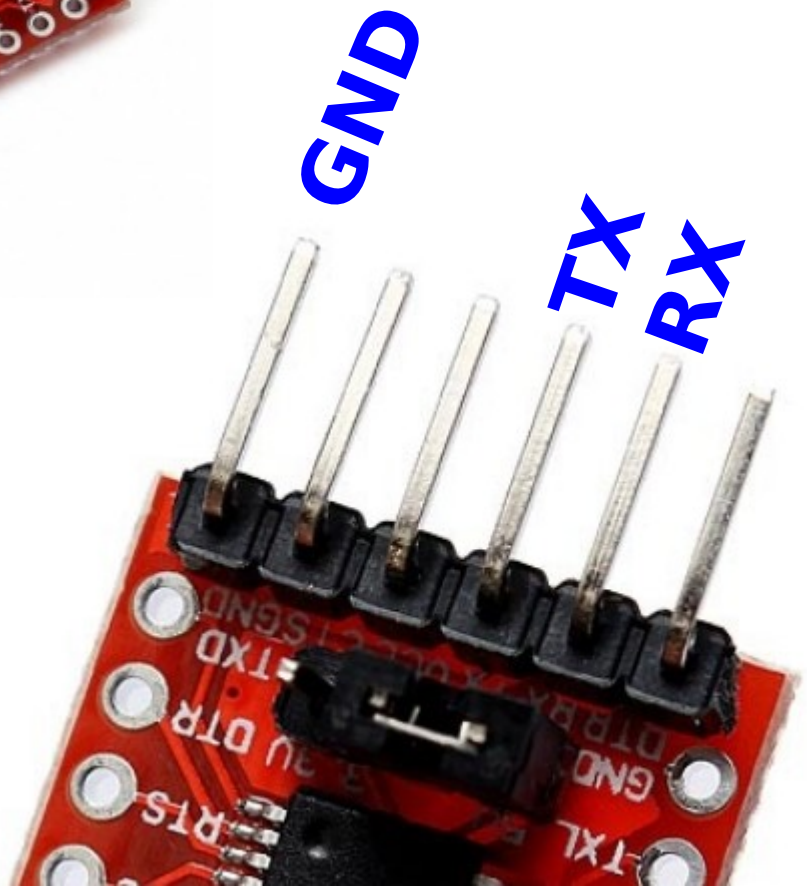
ecat@ecatian:~$ ls /dev/ttyUSB* -ls

Arduino i Raspberry Pi

Plaques de comunicació

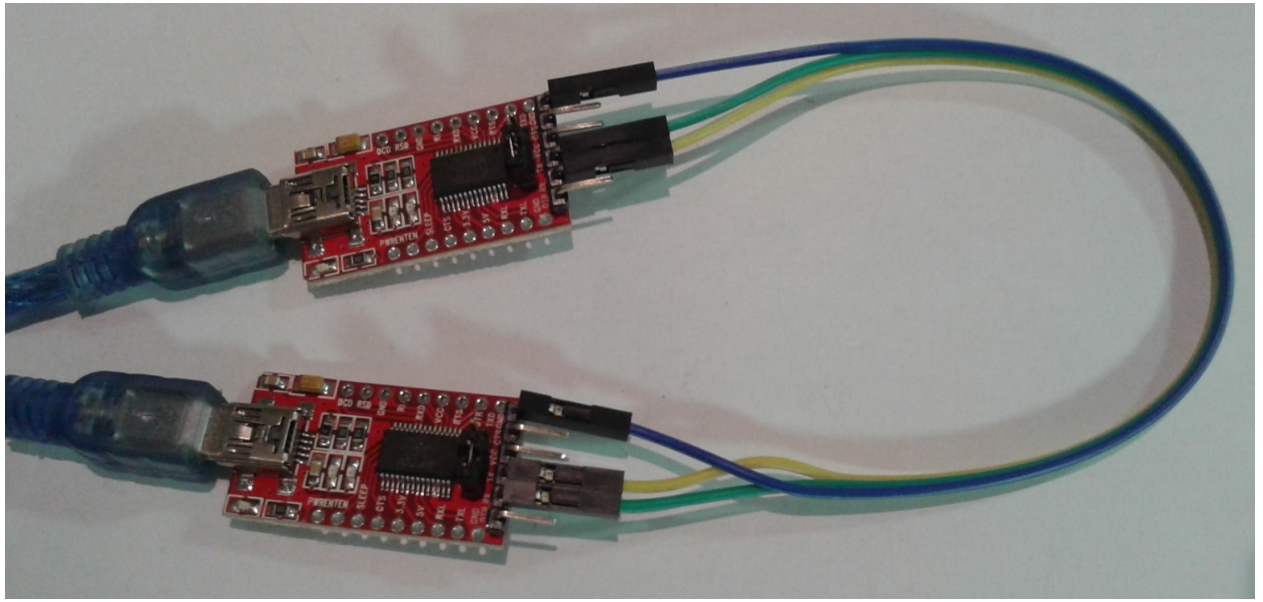


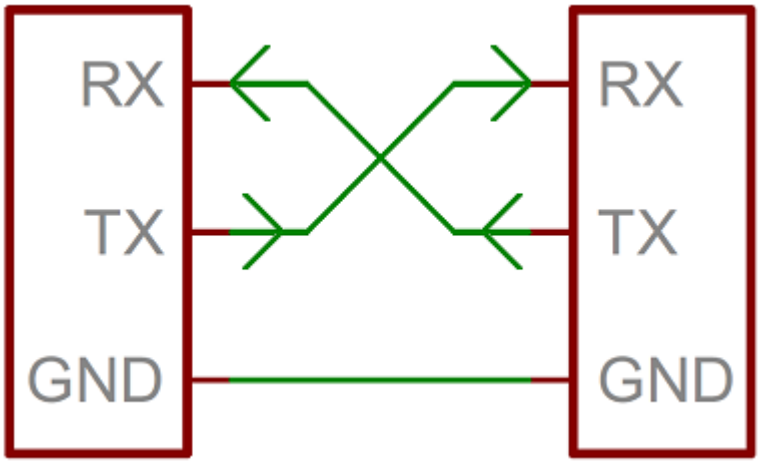


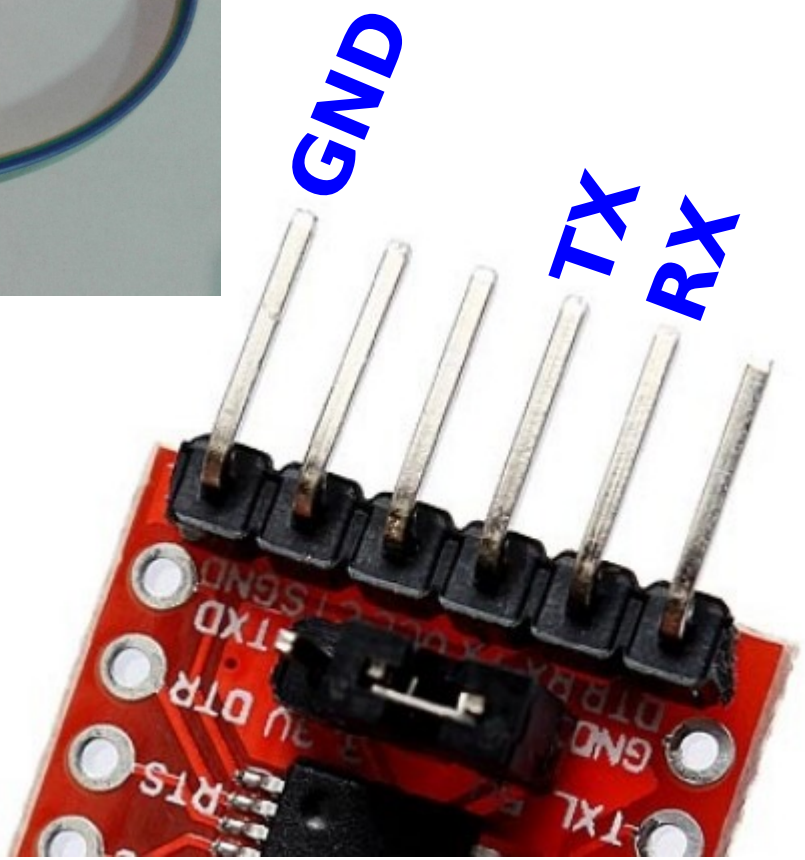


Arduino i Raspberry Pi

Plaques de comunicació

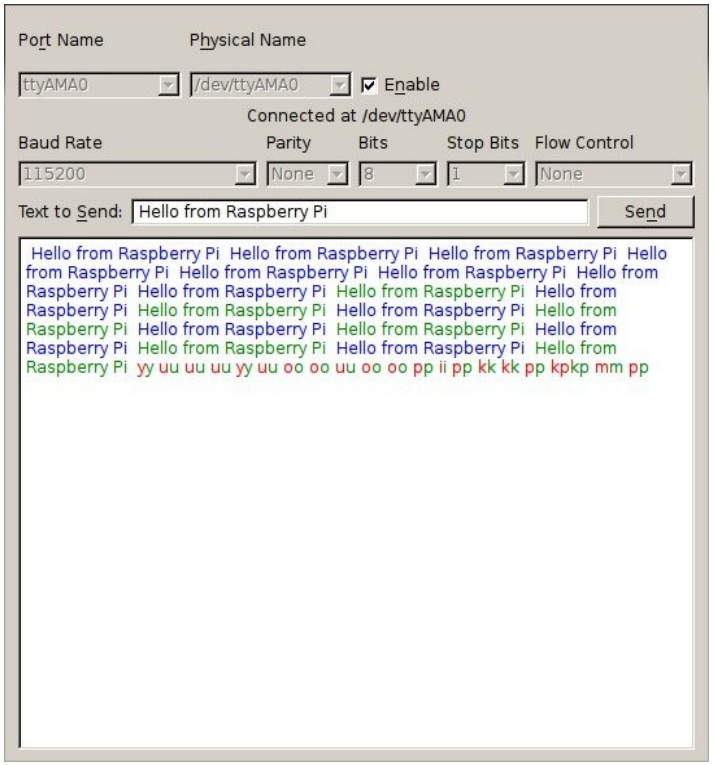






Arduino i Raspberry Pi

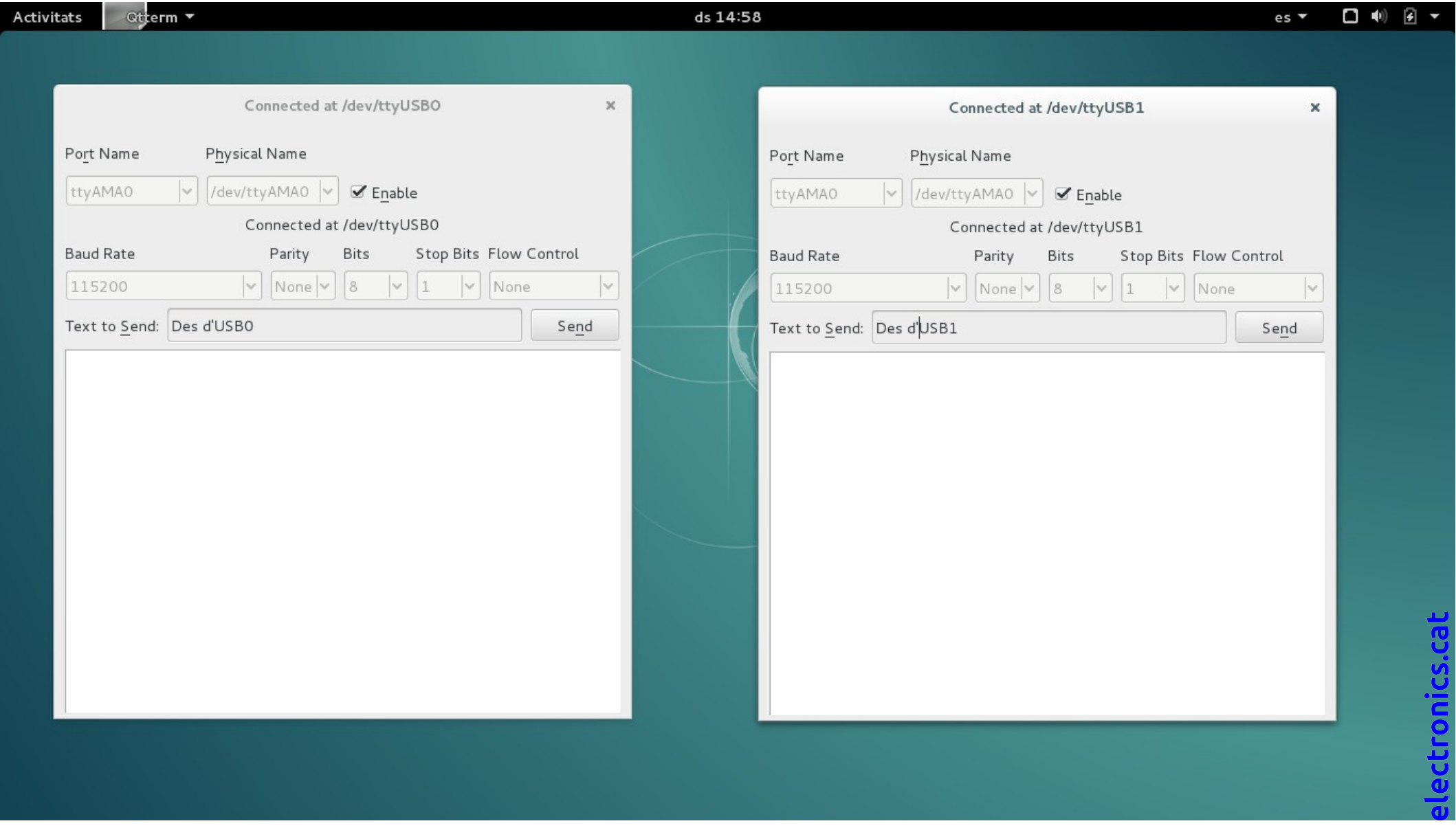
qtTerm



http://code.google.com/p/qtterm/

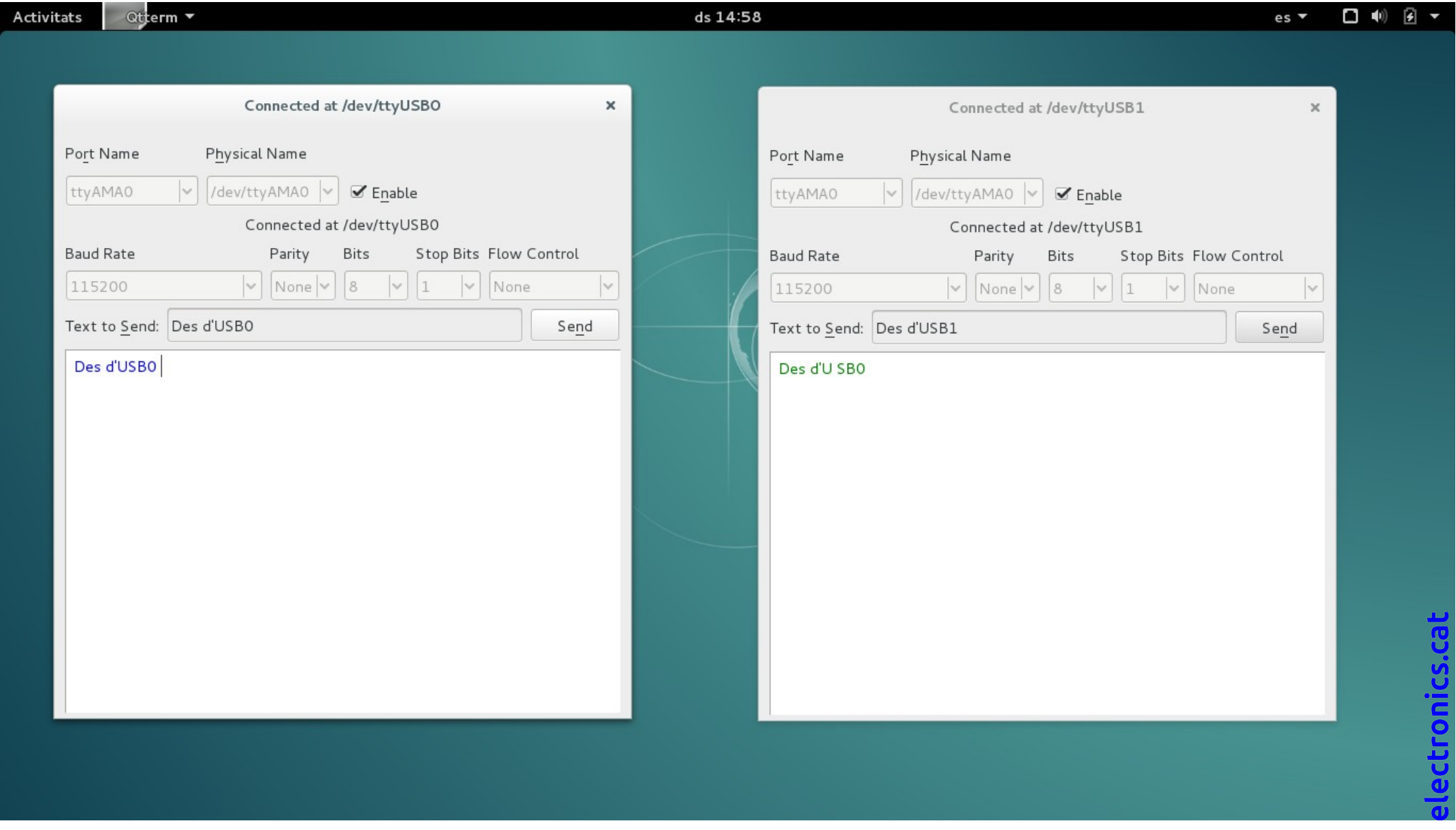
Arduino i Raspberry Pi

Ús del qtTerm amb les plaques de comunicació



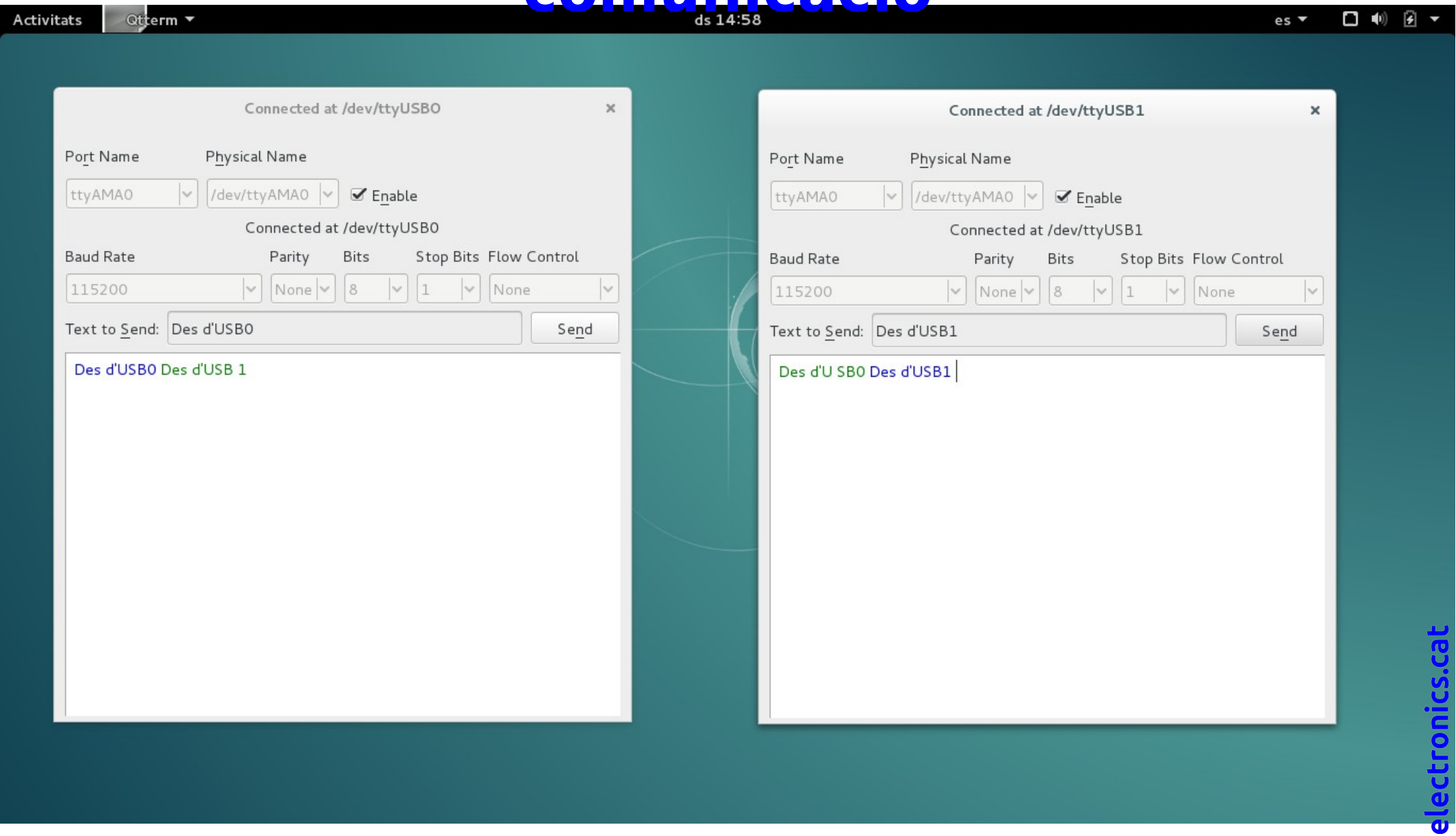
Arduino i Raspberry Pi

Ús del qtTerm amb les plaques de comunicació



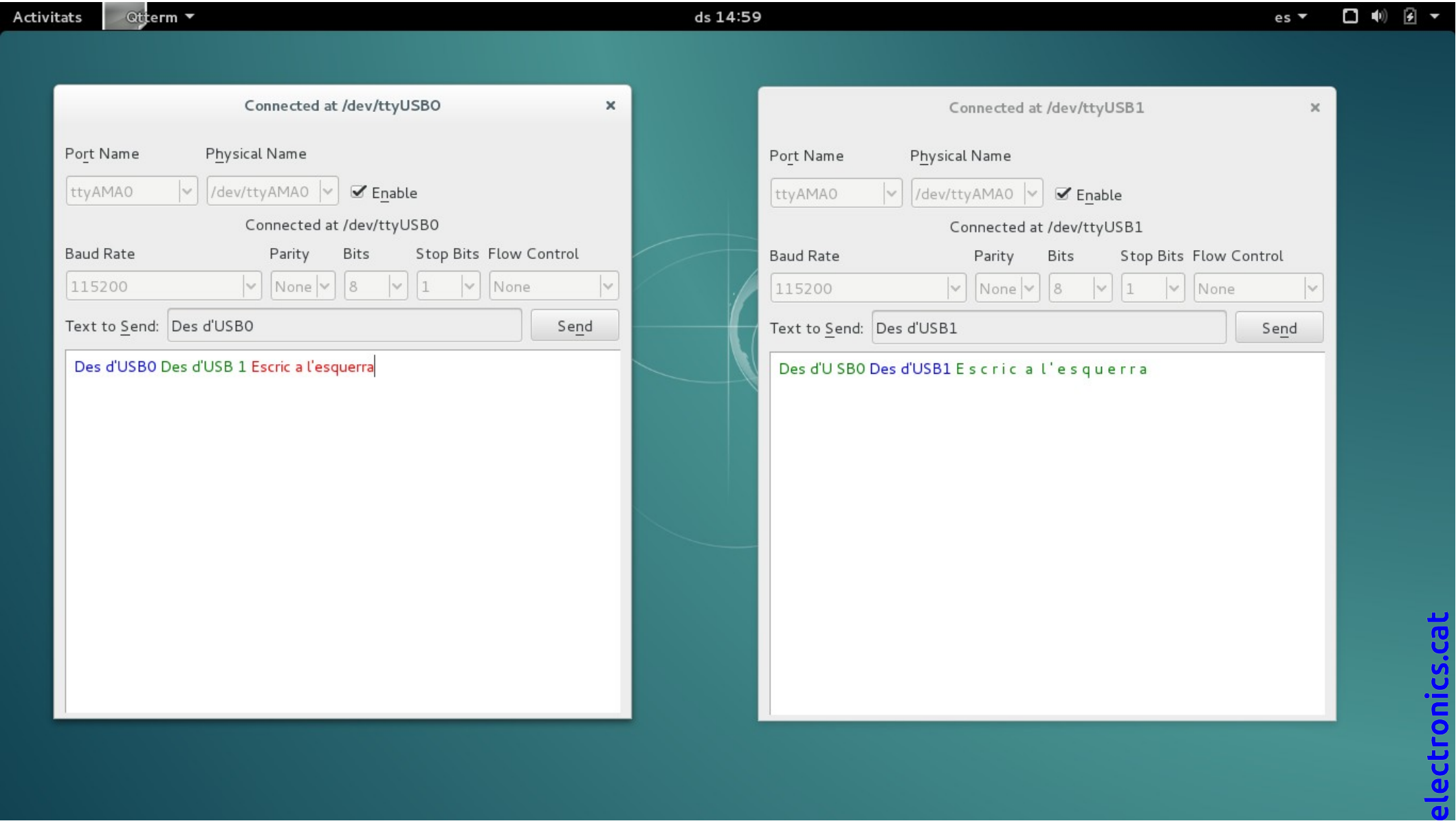
Arduino i Raspberry Pi

Ús del qtTerm amb les plaques de comunicació



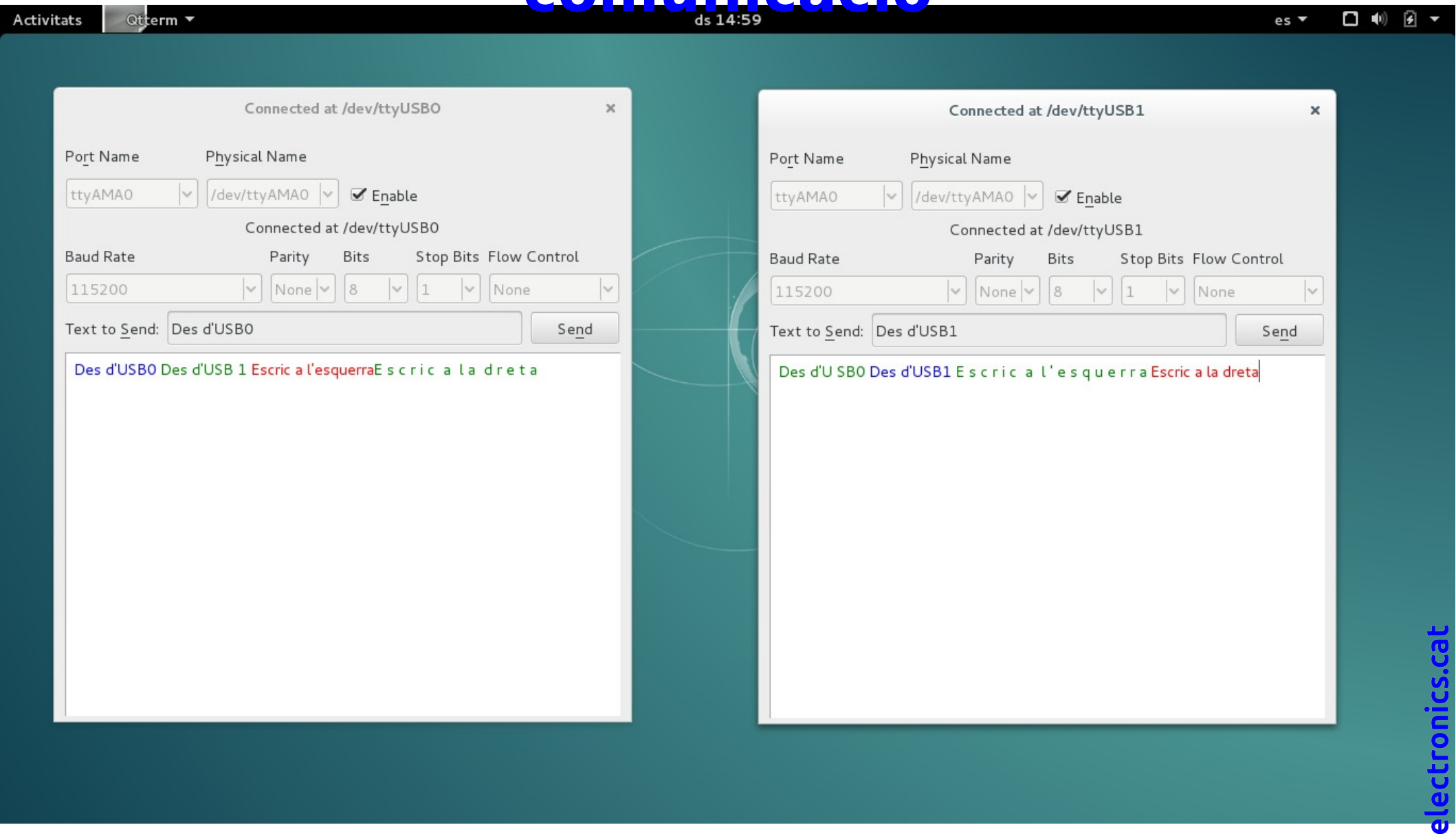
Arduino i Raspberry Pi

Ús del qtTerm amb les plaques de comunicació



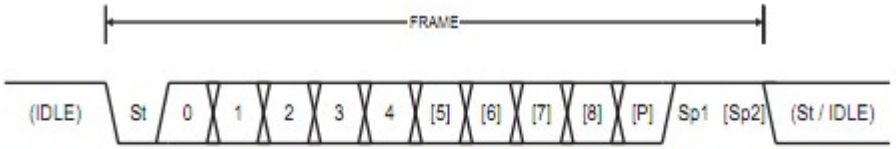
Arduino i Raspberry Pi

Ús del qtTerm amb les plaques de comunicació



Arduino i Raspberry Pi

Senyal de comunicació sèrie



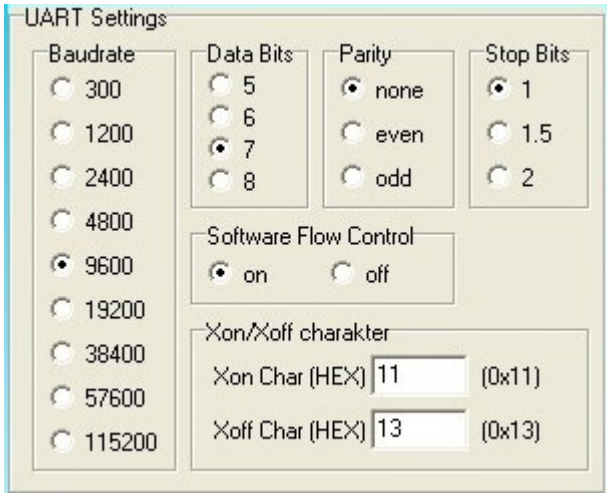
St Start bit, always low.

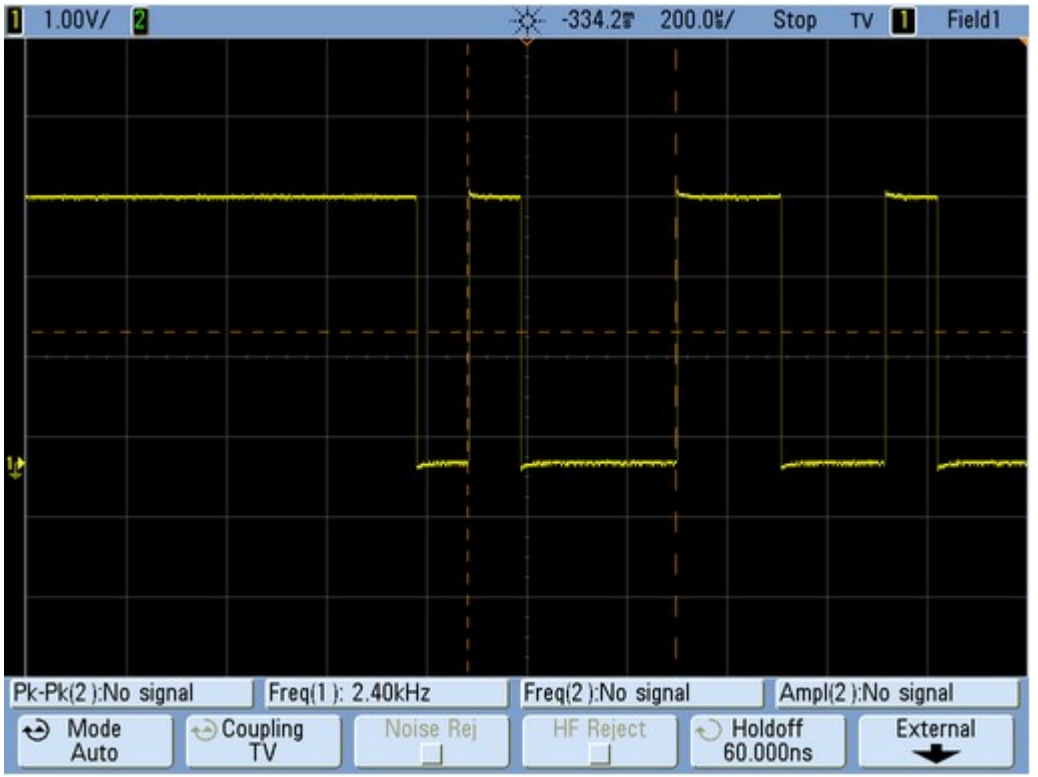
(n) Data bits (0 to 8).

P Parity bit. Can be odd or even.

Sp Stop bit, always high.

IDLE No transfers on the communication line (RxDn or TxDn). An IDLE line must be high.

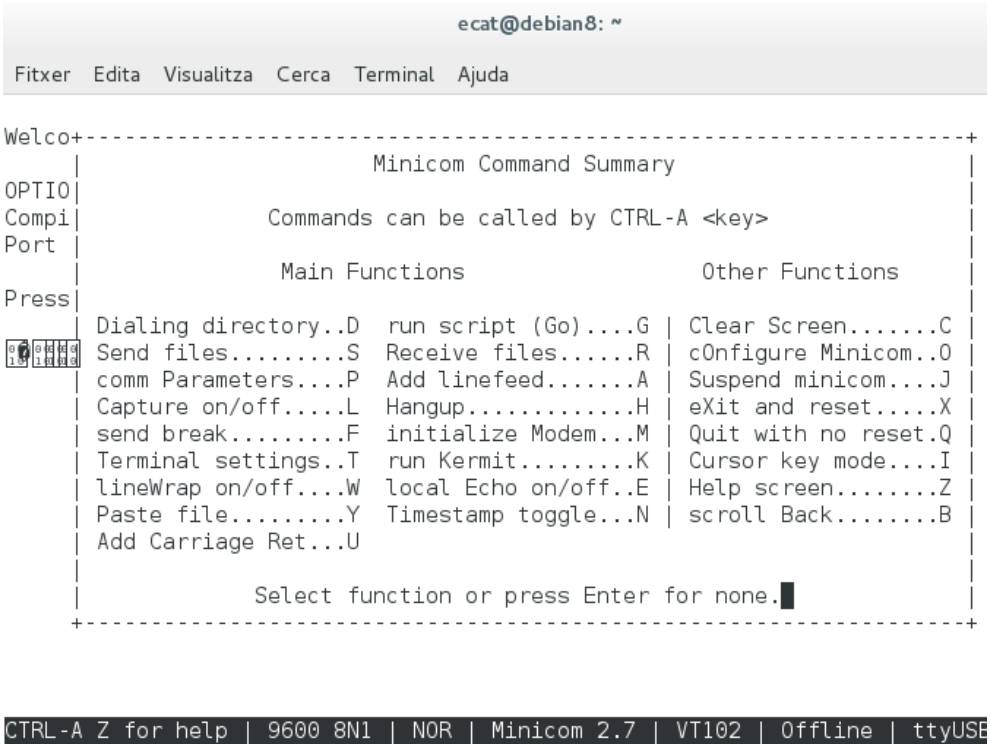


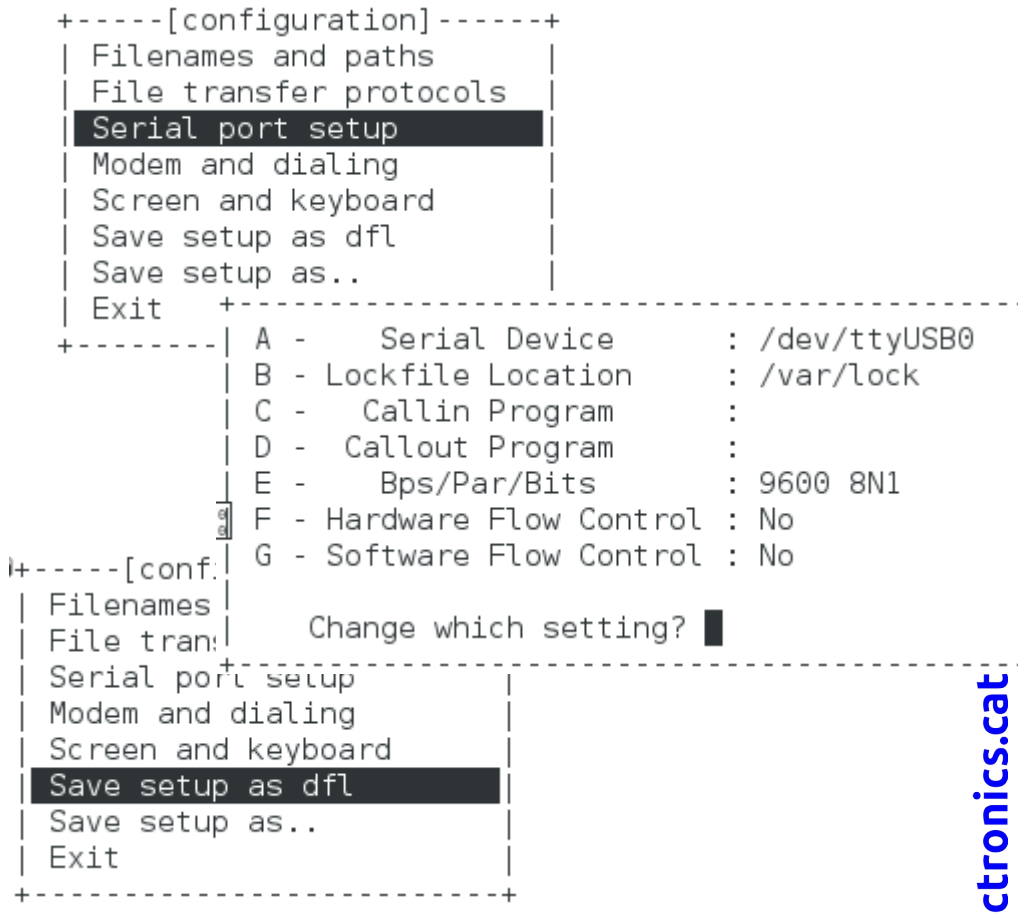


Arduino i Raspberry Pi

Comunicació amb minicom

```
ecat@ecatian:~$ minicom -b 9600 -o -D /dev/ttyUSB1
```

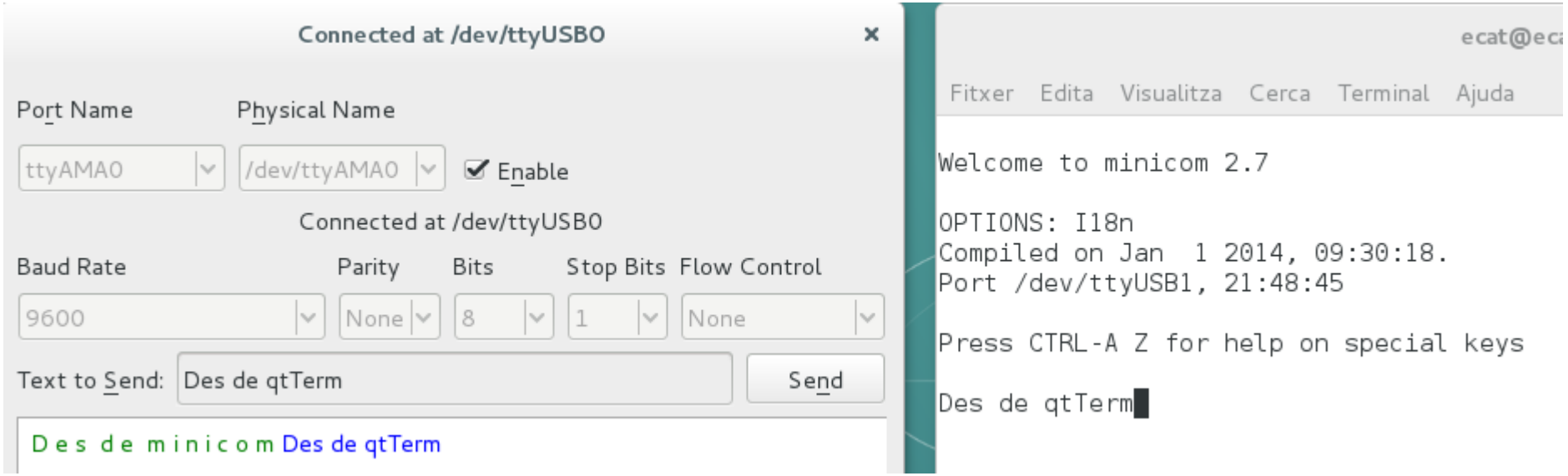




Deseu com a «per defecte» al finalitzar la configuració sense «Hardware Flow Control»

Arduino i Raspberry Pi

Comunicació qtTerm amb minicom

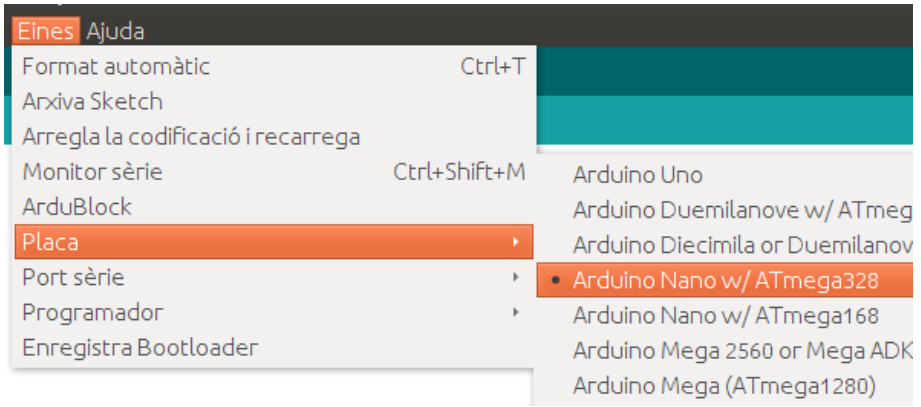


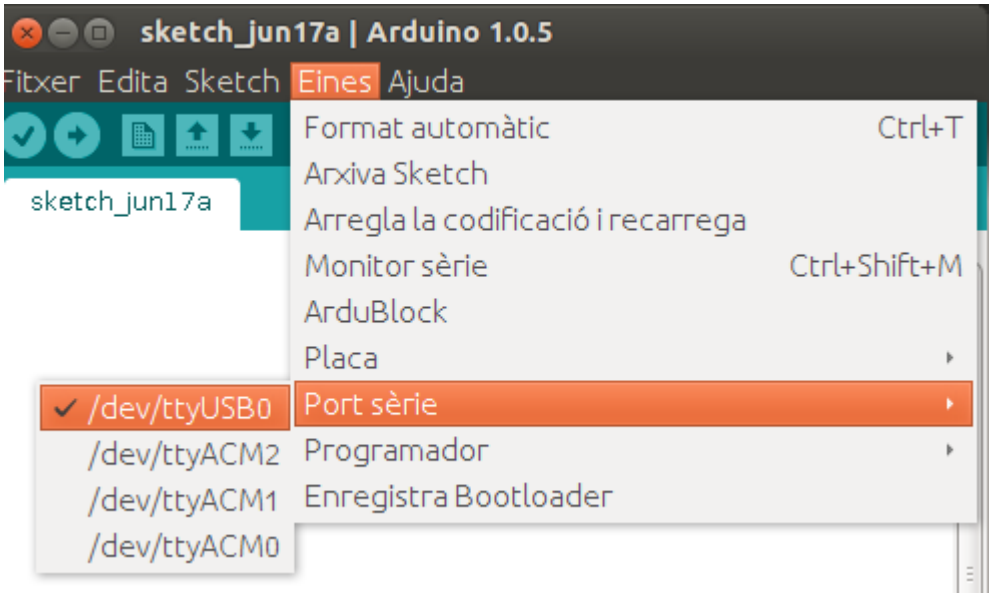
qtTerm està configurat a /dev/ttyUSB0 a 9600-N-8-1

```
ecat@ecatian:~$ minicom -b 9600 -o -D /dev/ttyUSB1
```

Arduino i Raspberry Pi

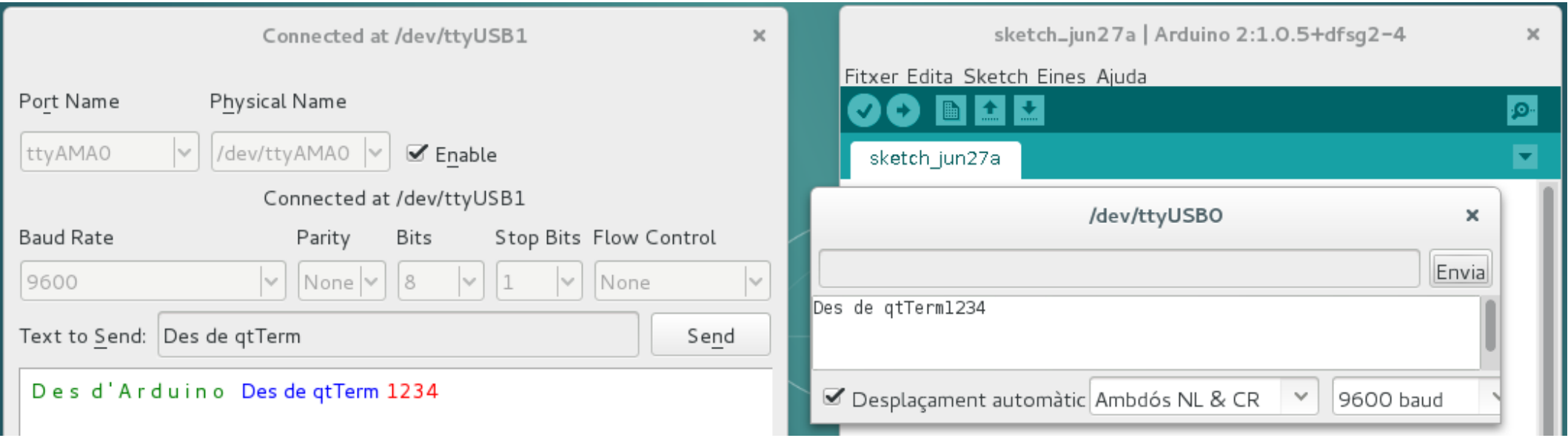
Comunicació qtTerm amb IDE d'Arduino





Arduino i Raspberry Pi

Comunicació qtTerm amb IDE d'Arduino



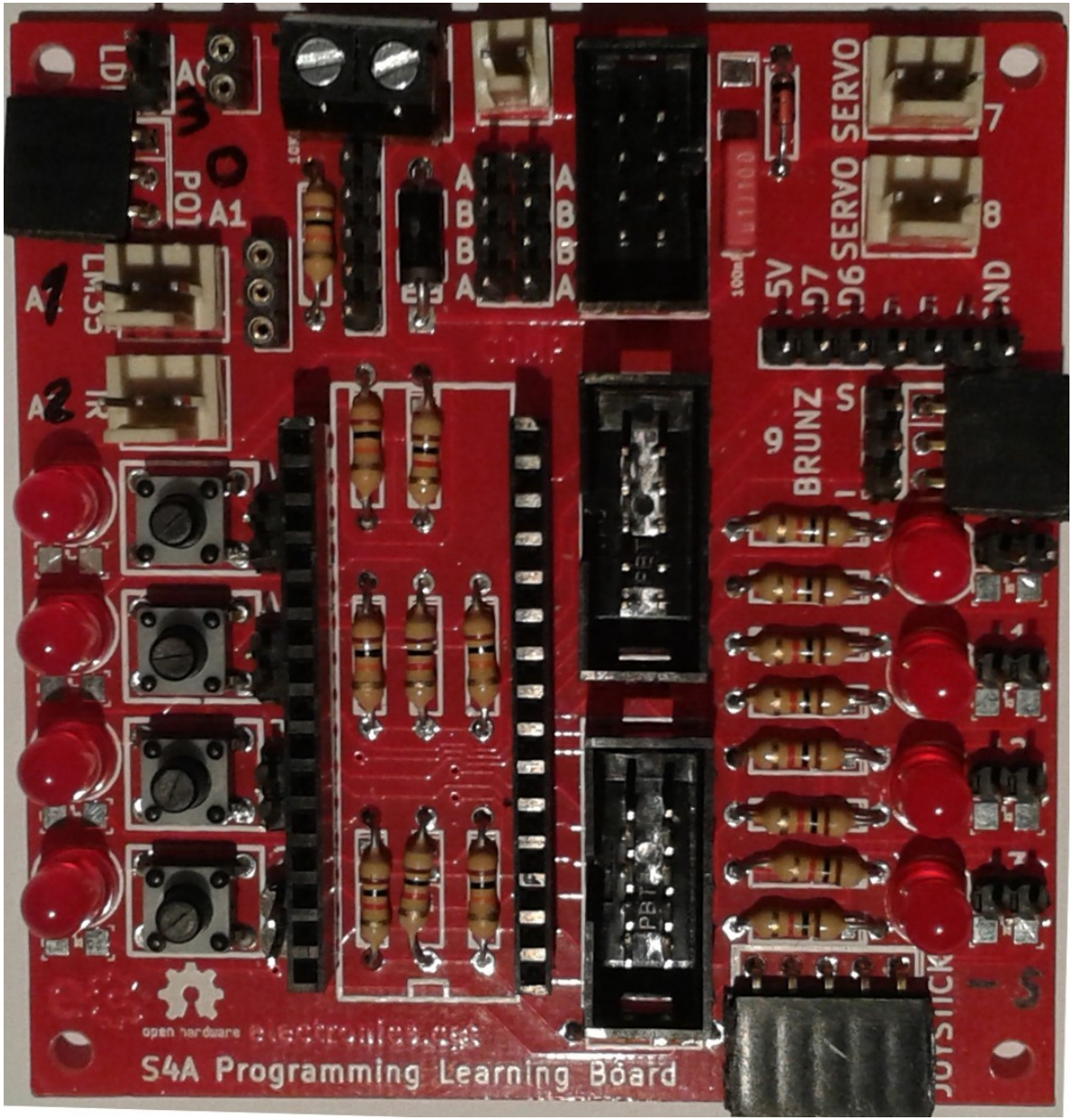
qtTerm està configurat a /dev/ttyUSB1 a 9600-N-8-1

IDE d'Arduino està configurat a /dev/ttyUSB0 a 9600

El monitor sèrie de l'IDE d'Arduino és a Eines/Monitor sèrie

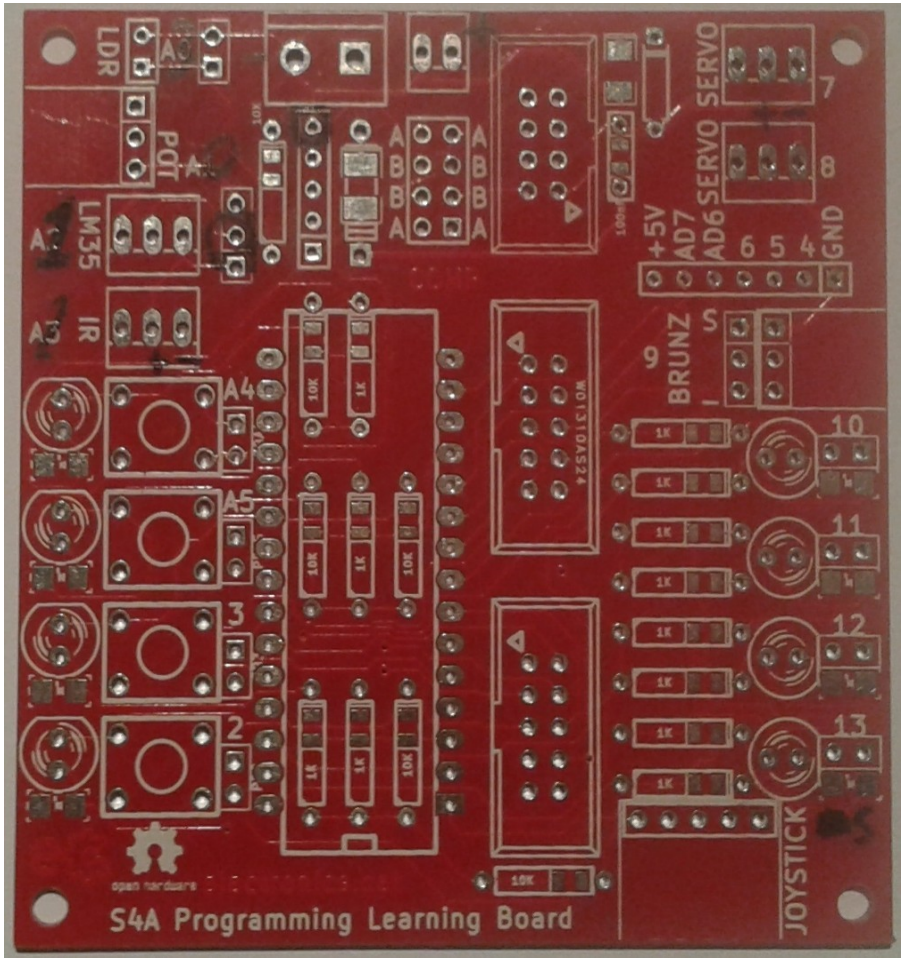
Arduino i Raspberry Pi

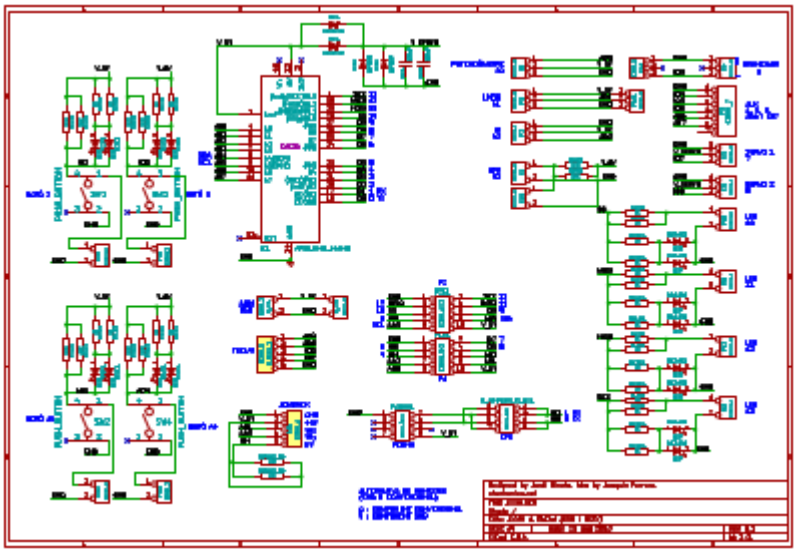
La placa S4A Programming Learning Board

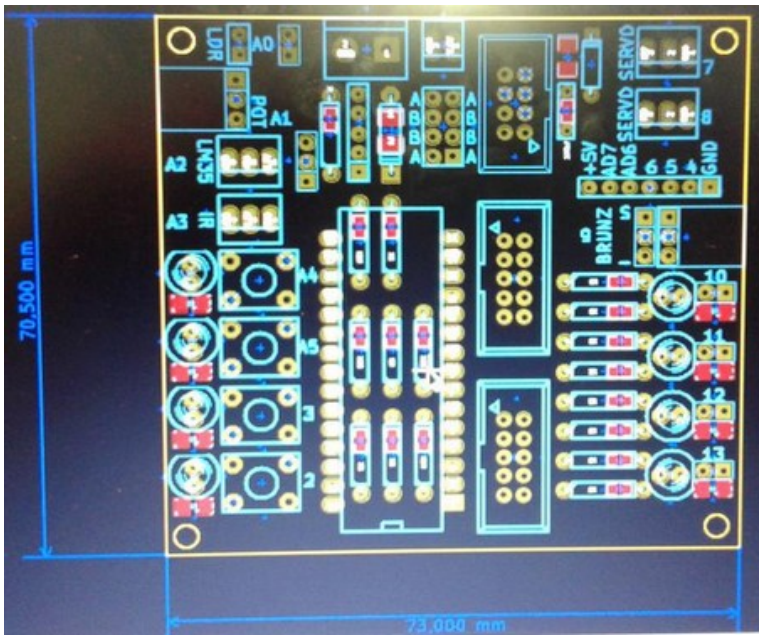


Arduino i Raspberry Pi

La placa S4A Programming Learning Board



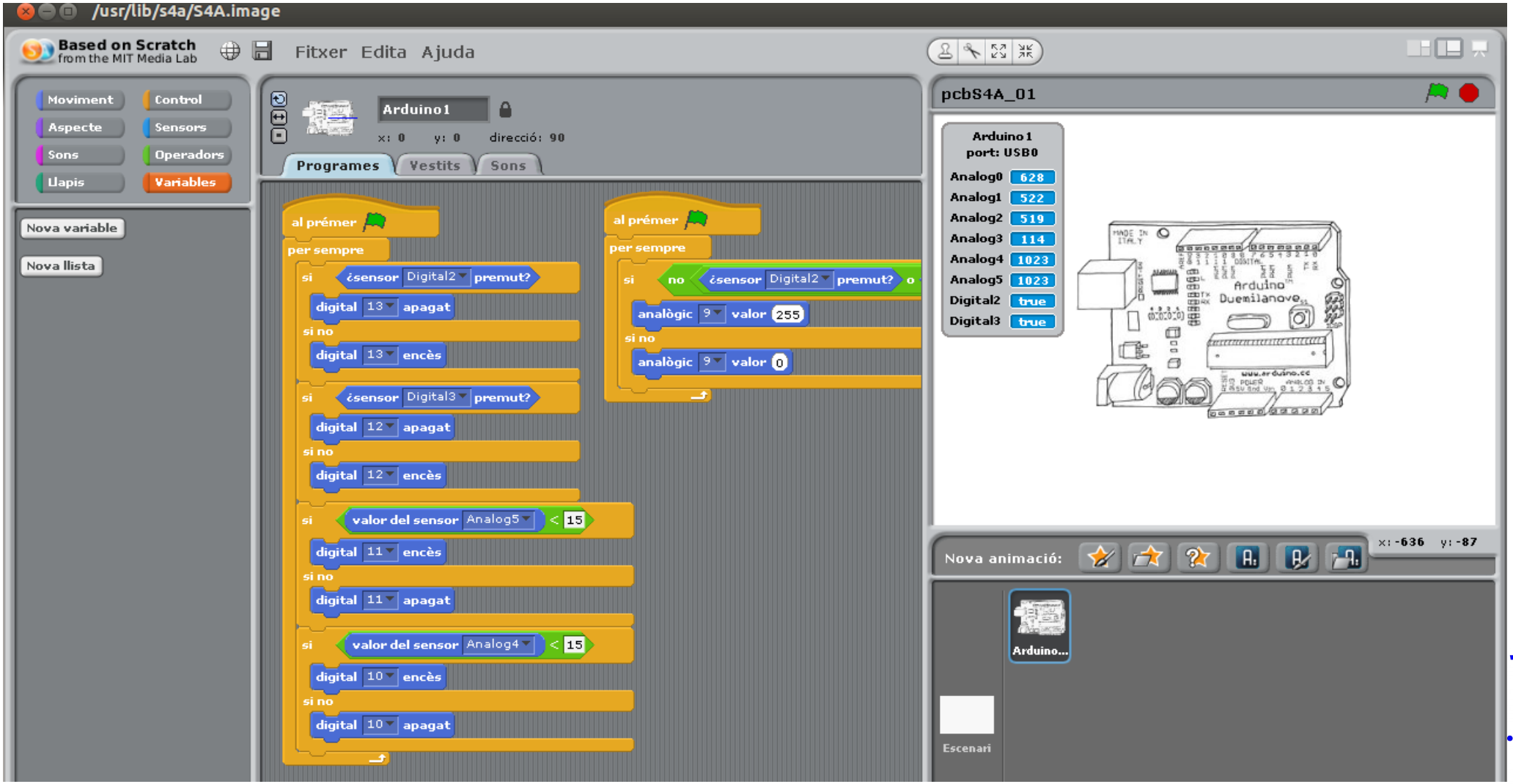




Placa desenvolupada amb l'entorn de disseny integrat de programari lliure KiCad

Arduino i Raspberry Pi

Ús d'S4A



www.s4a.cat

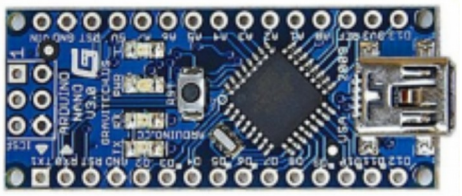
Arduino i Raspberry Pi

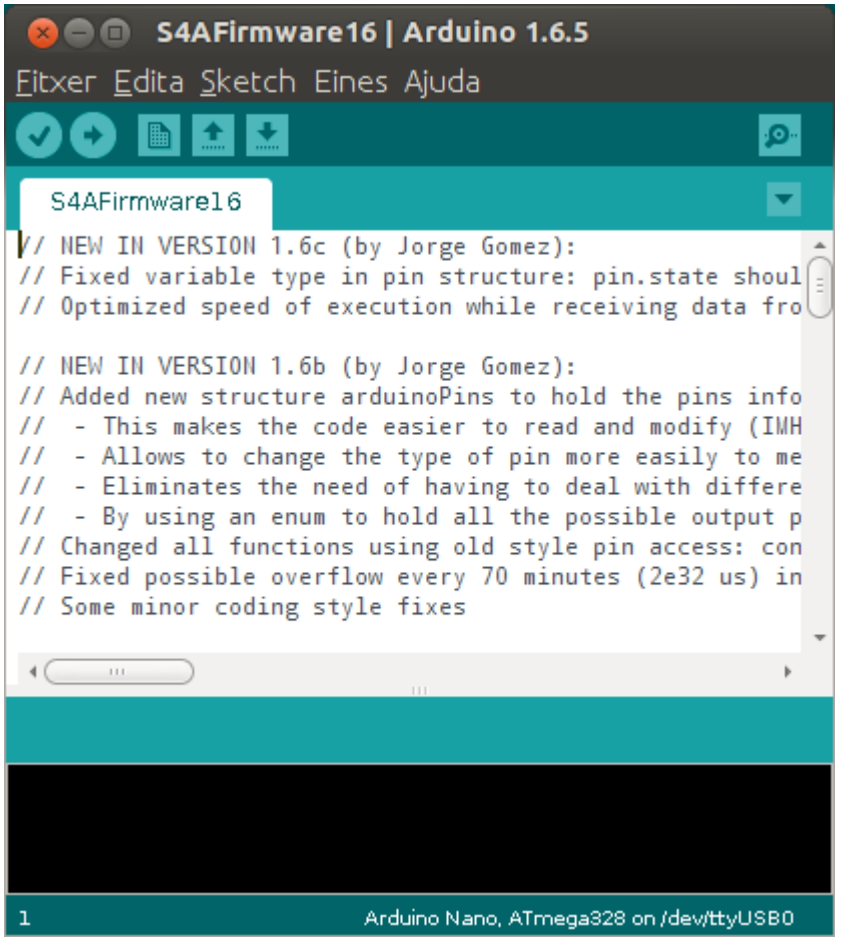
Ús d'S4A

El microprogramari és el programari del maquinari

Català	*Anglès*
Programari	**Software**
Maquinari	**Hardware**
Microprogramari	**Firmware**

Arduino Nano

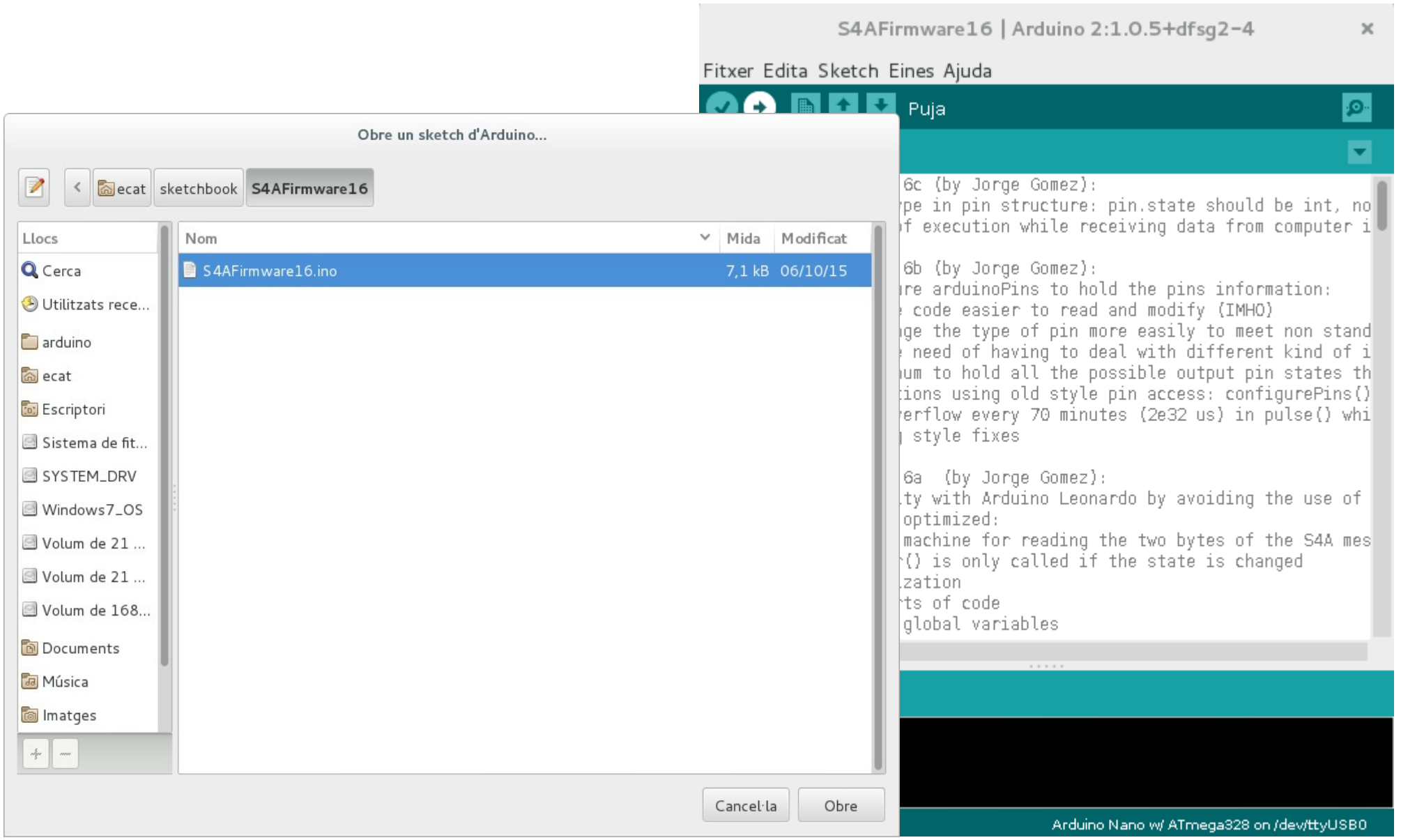




Microprogramari per l'Arduino per funcionar amb l'S4A :
http://vps34736.ovh.net/S4A/S4AFirmware16.ino

Arduino i Raspberry Pi

Ús d'S4A



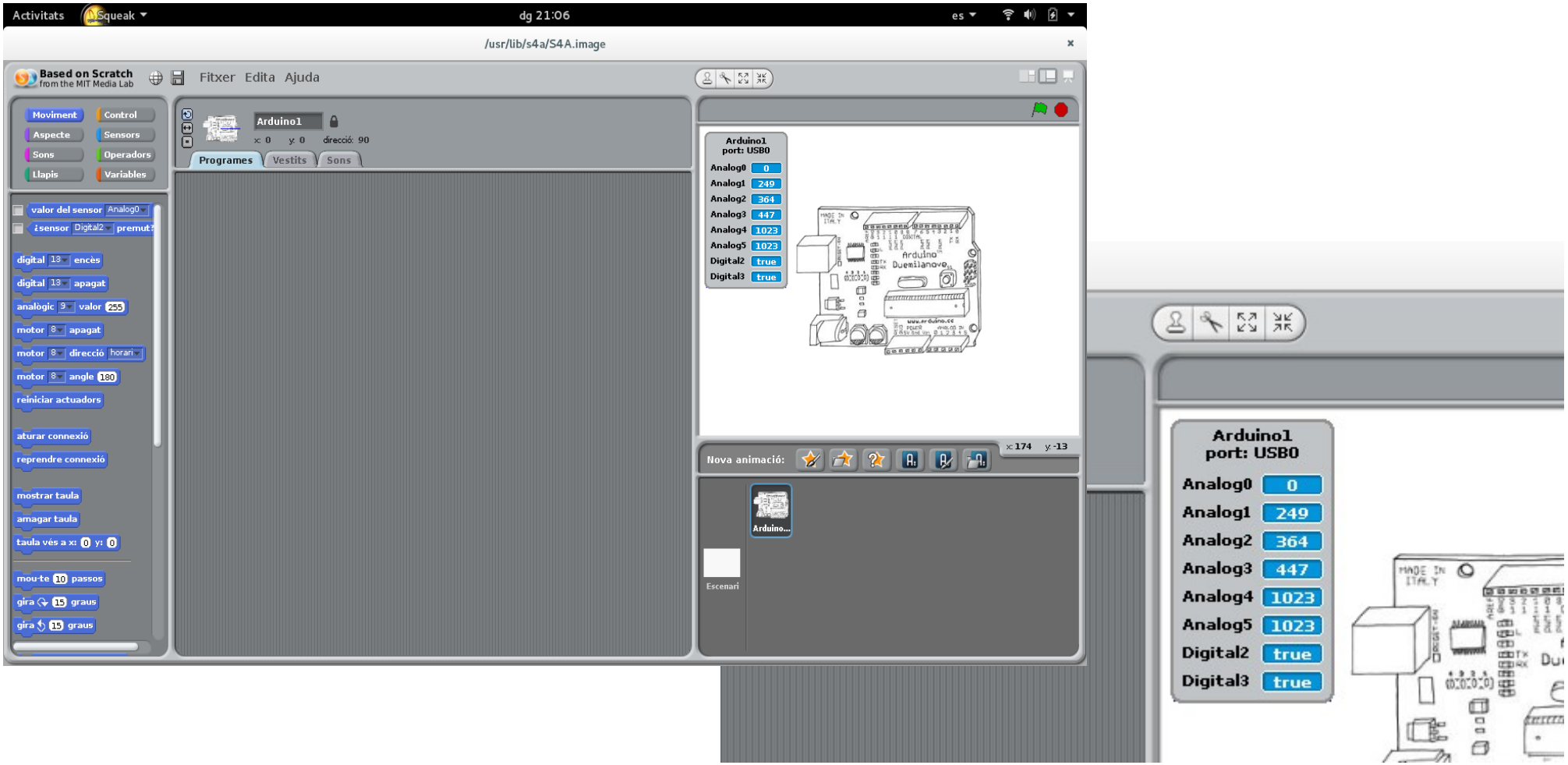
Arduino i Raspberry Pi

Ús d'S4A

Connecteu la placa S4A PLB al vostre ordinador i premeu la supertecla (botó amb la icona d'una finestra a l'esquerra de la barra espaiadora) i després escriviu S4A i ho seleccioneu amb el ratolí.

Arduino i Raspberry Pi

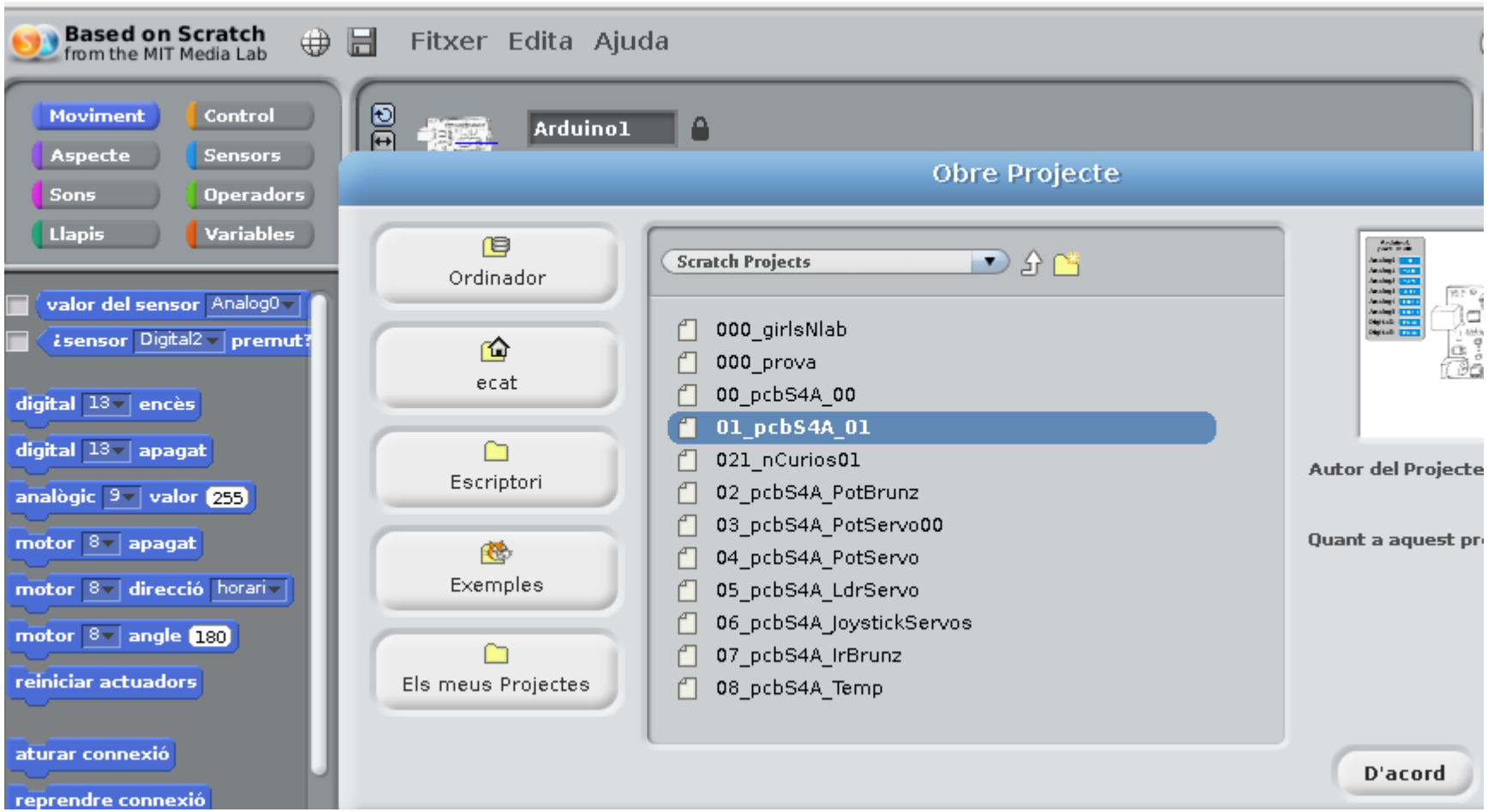
Ús d'S4A



Un cop es detecta la placa, apareixen nombres que es van movent al panell d'entrades analògiques i digitals.

Arduino i Raspberry Pi

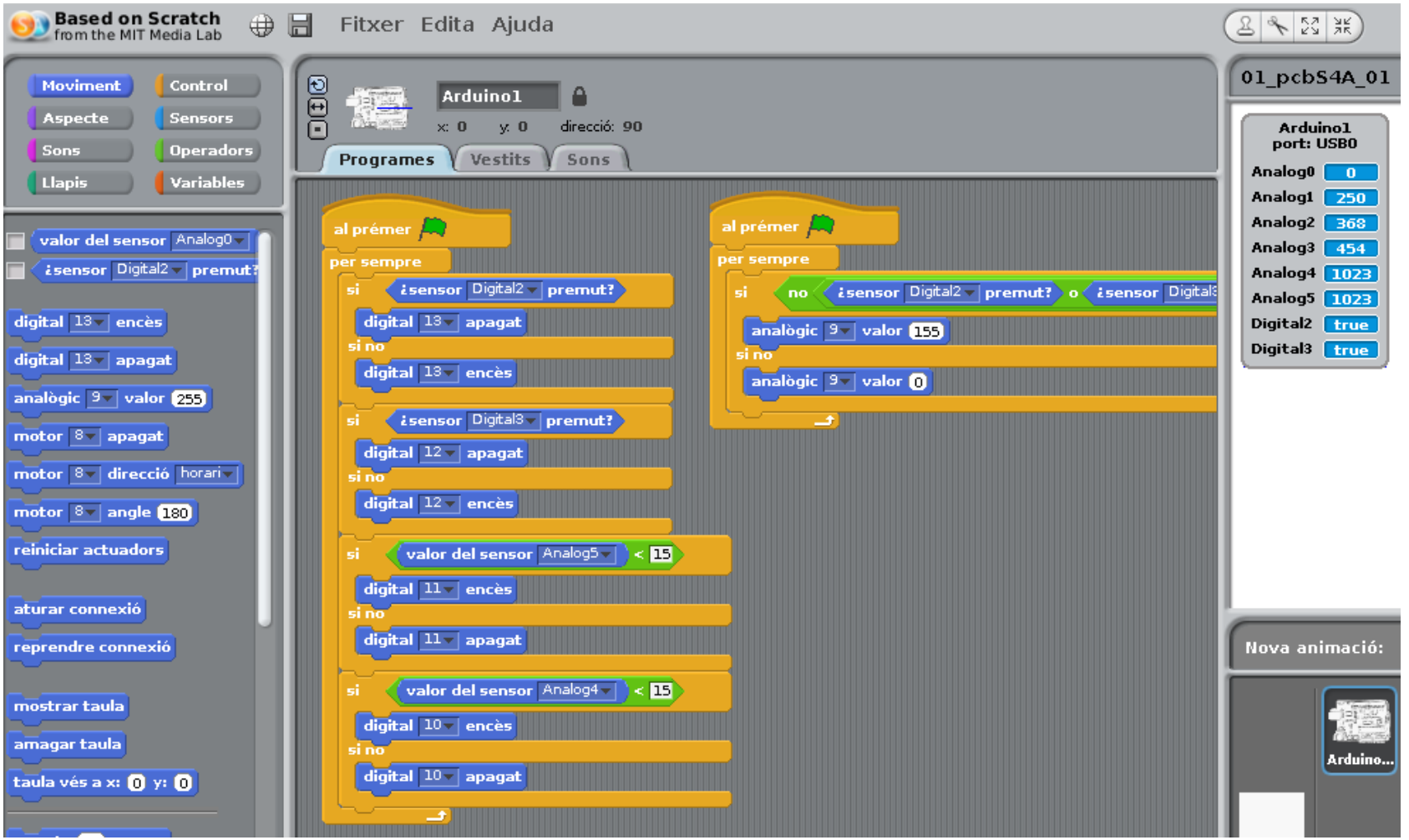
Ús d'S4A



Obriu l'arxiu 01_pcbS4A_01

Arduino i Raspberry Pi

Ús d'S4A

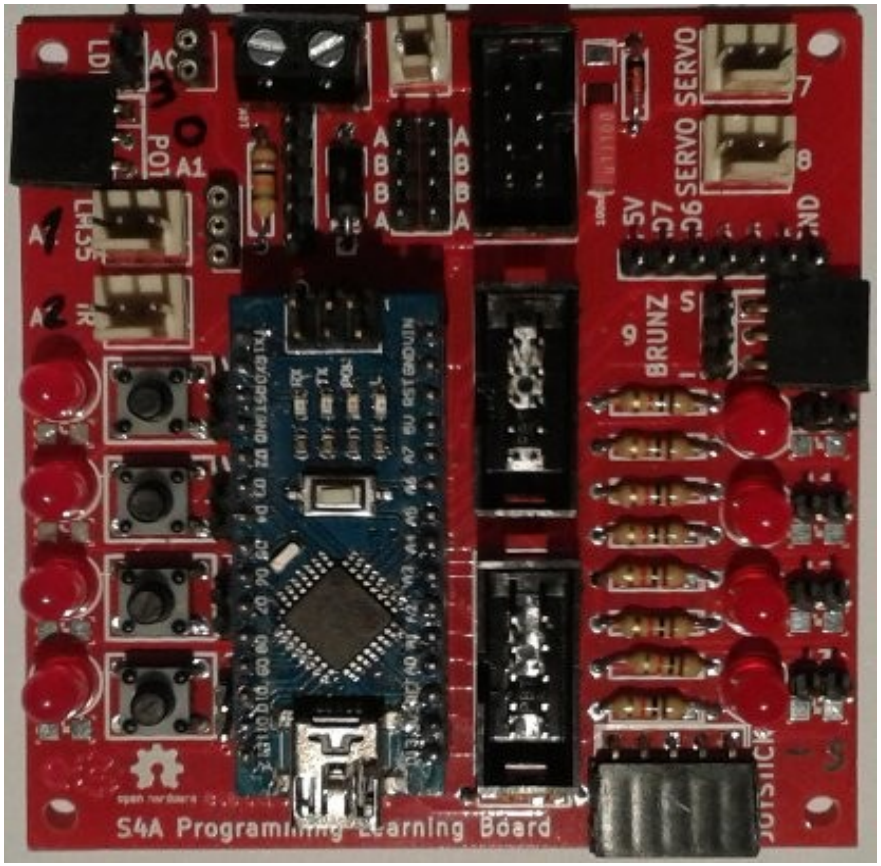


Us apareixerà un programa com aquest

Arduino i Raspberry Pi

Ús d'S4A

A5
A4
3
2

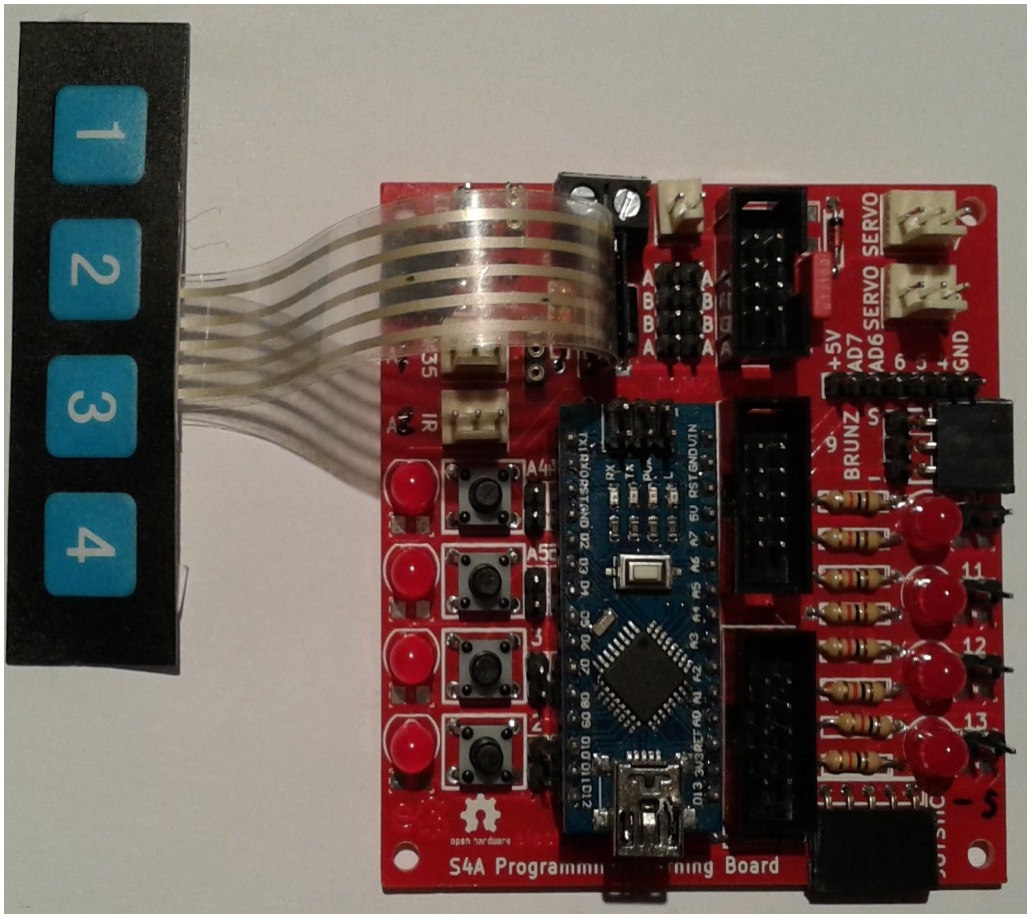


10
11
12
13

Premeu la bandera verda de l'S4A
I després premeu els botons de la placa

Arduino i Raspberry Pi

Ús d'S4A

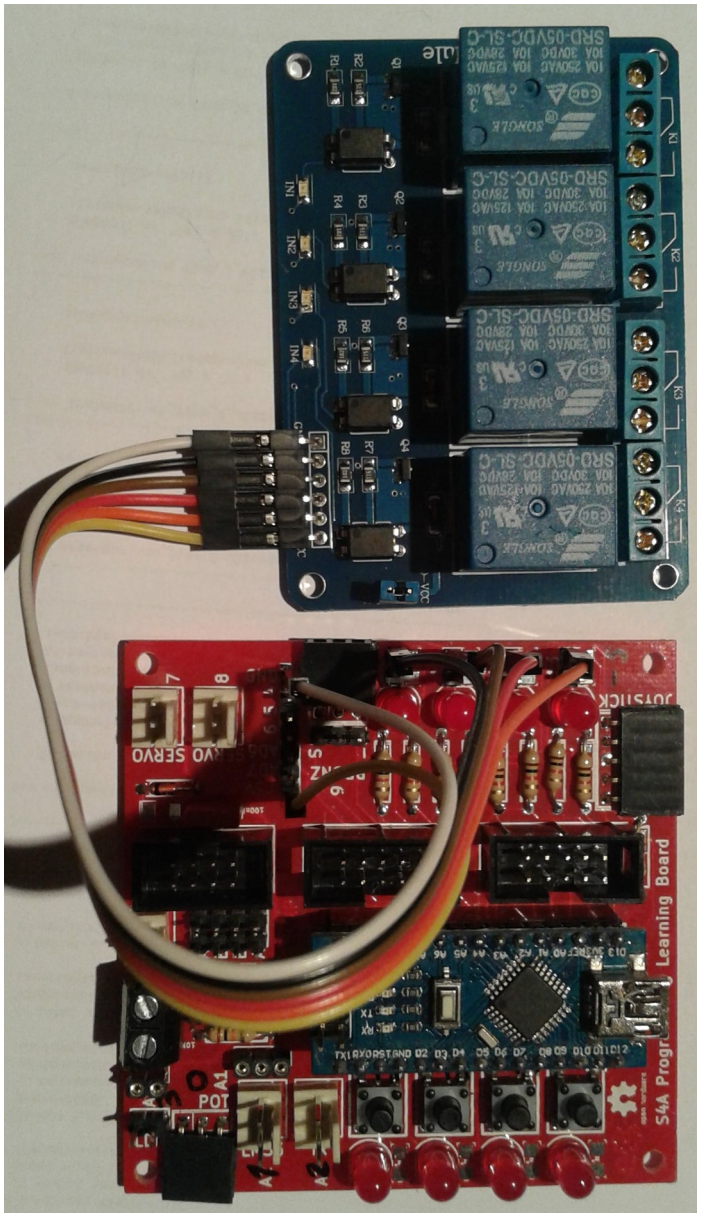


Connecteu el teclat de membrana. Torneu
A prémer la bandera verda de l'S4A
i després premeu els botons del nou teclat.

Potser haureu de canviar el número 15 per un altre de superior.

Arduino i Raspberry Pi

Ús d'S4A



Arduino i Raspberry Pi

Com funciona un relé

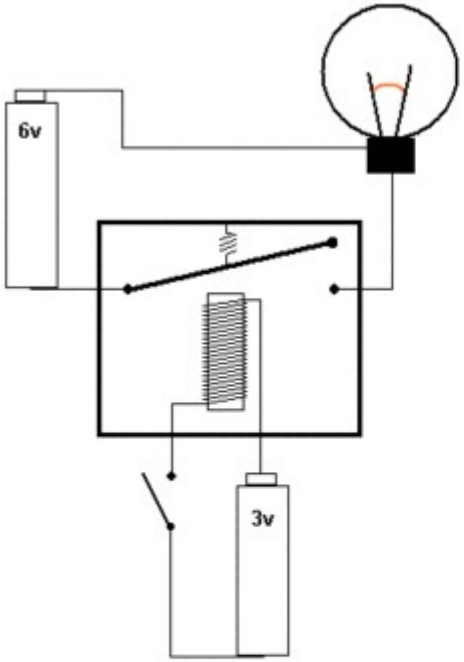


Figure 1: Relay off

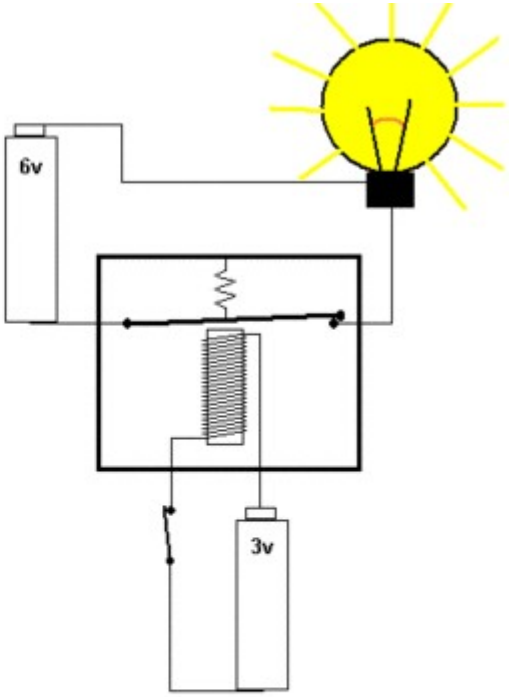
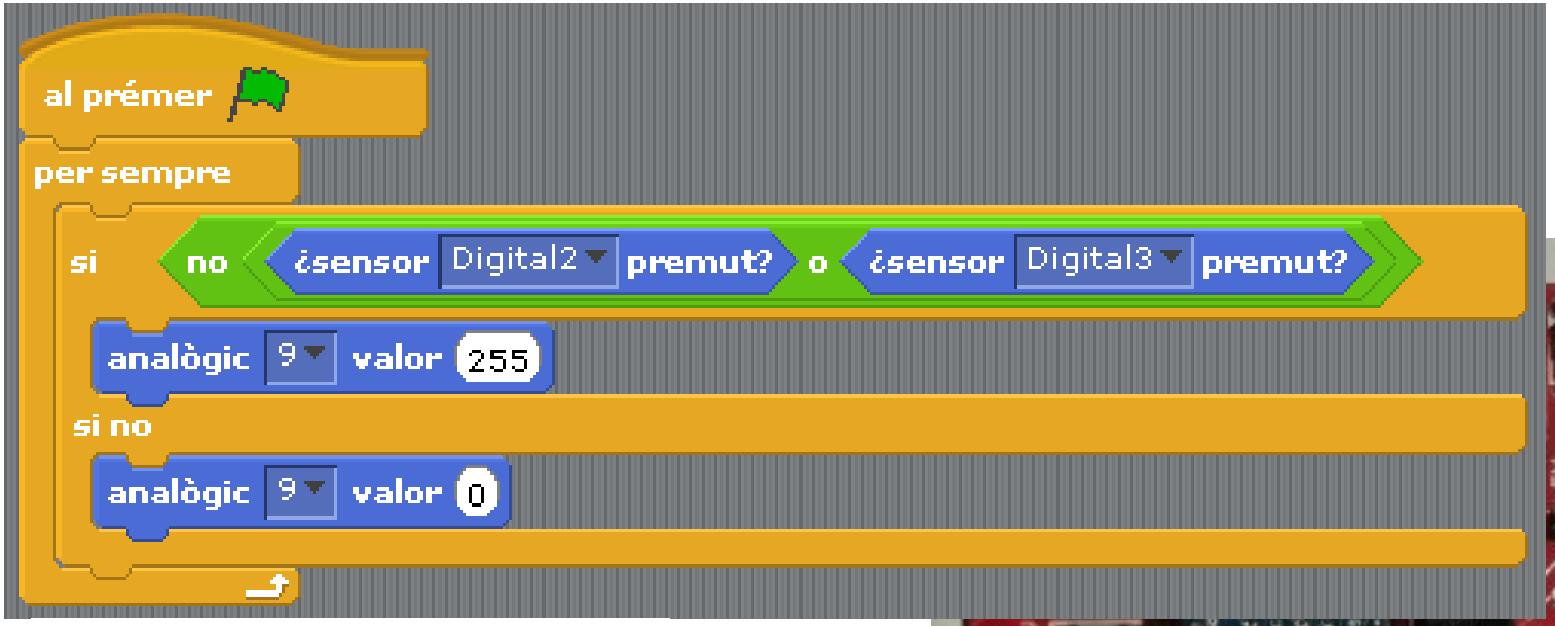
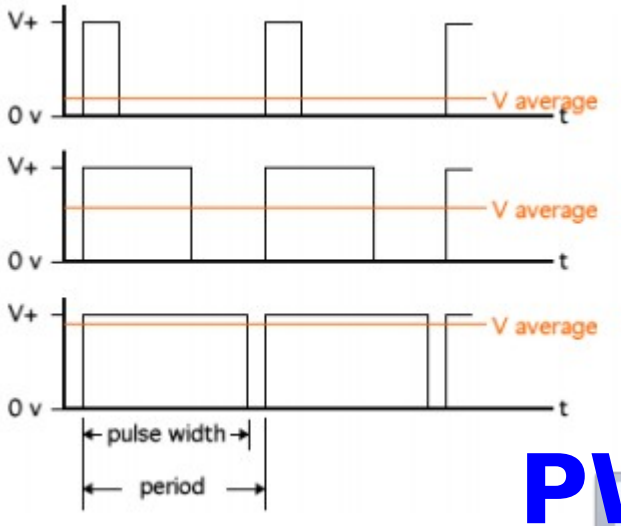


Figure 2: Relay on

Arduino i Raspberry Pi

Ús d'S4A - El brunzidor





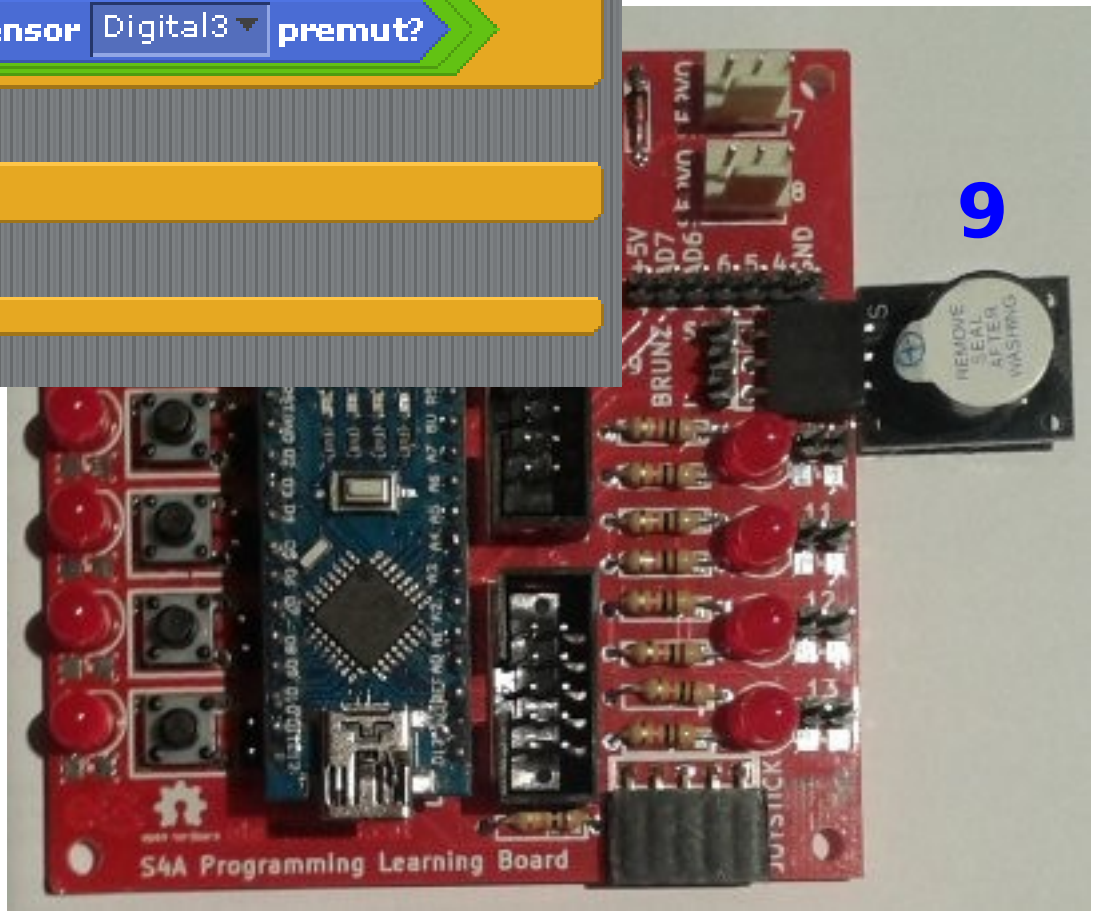
A4

A5

3

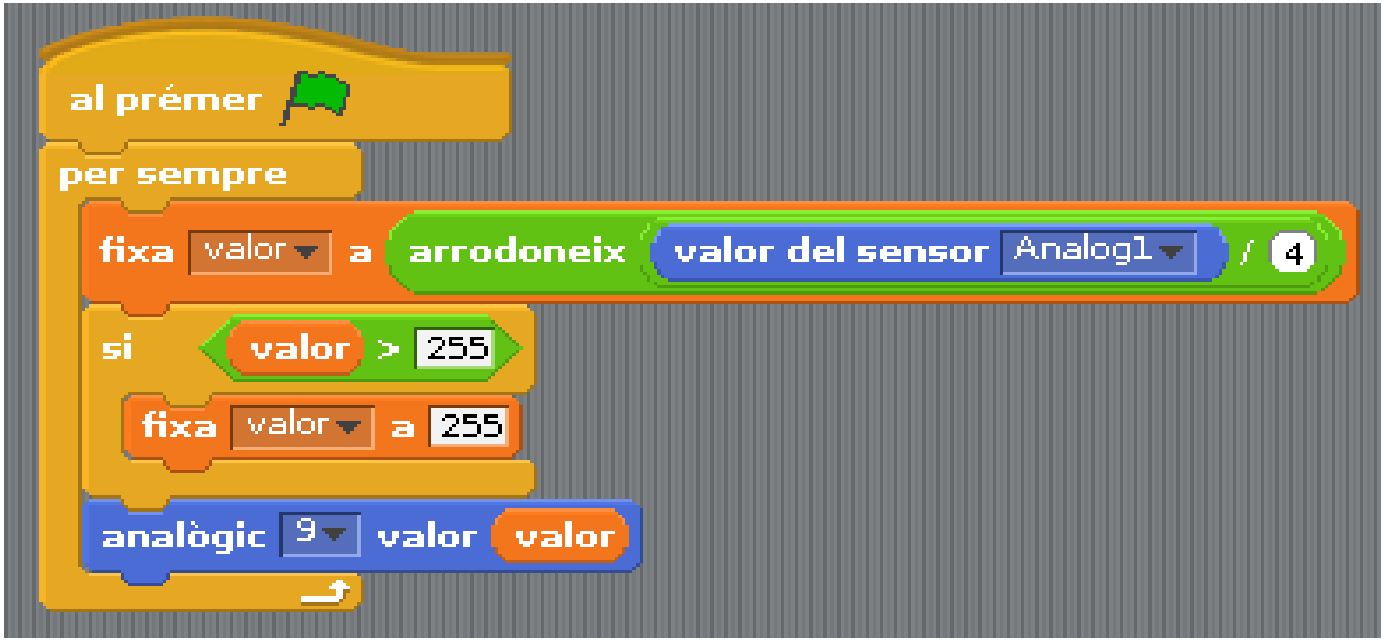
2

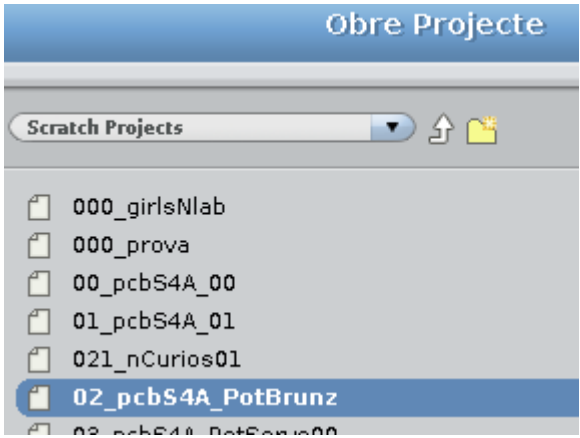
PWM



Arduino i Raspberry Pi

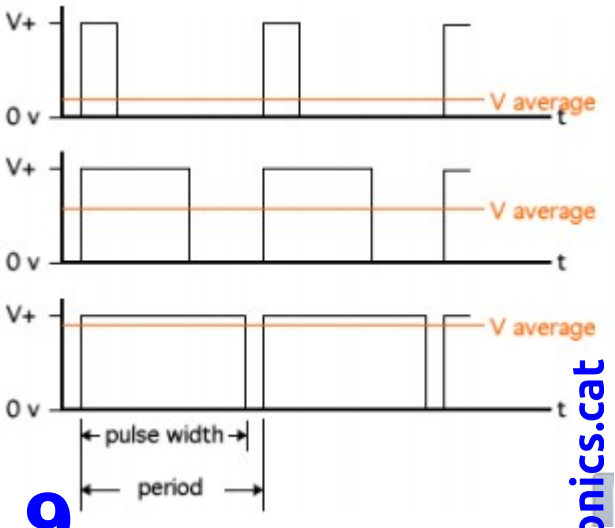
Ús d'S4A – Potenciòmetre i brunzidor





Verifiqueu que està seleccionat Analog1 i no Analog0

A1



9

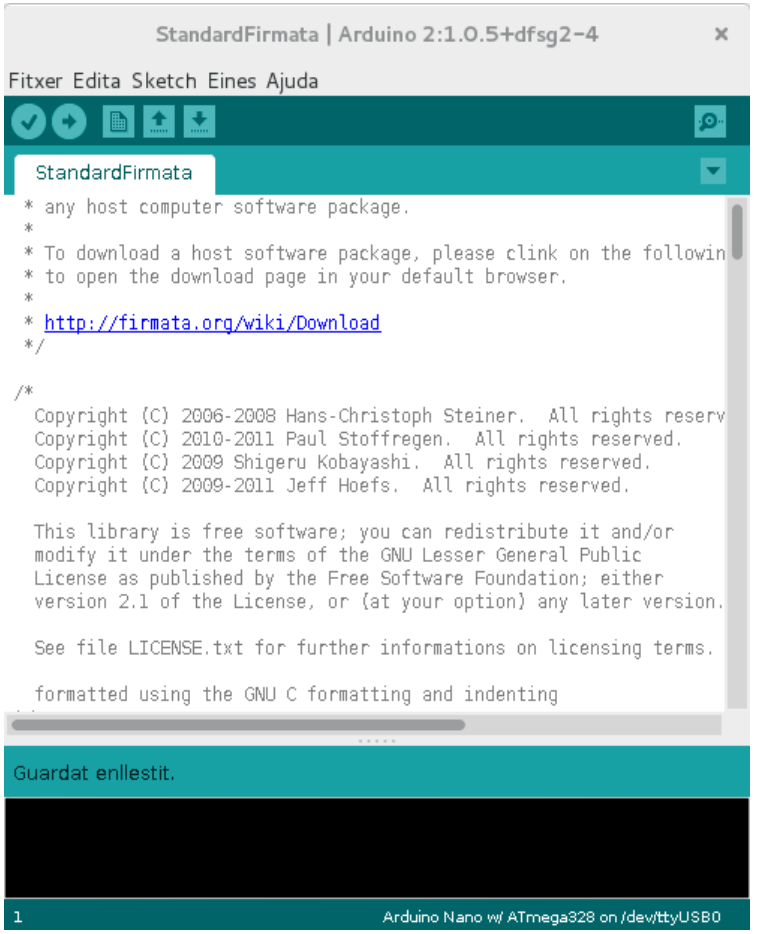
Arduino i Raspberry Pi

Ús d'Snap for Arduino

Per a l'Snap for Arduino i l'Scratch 2.0 offline
el microprogramari
és el Firmata estàndar

Català	*Anglès*
Programari	**Software**
Maquinari	**Hardware**
Microprogramari	**Firmware**

Arduino Nano



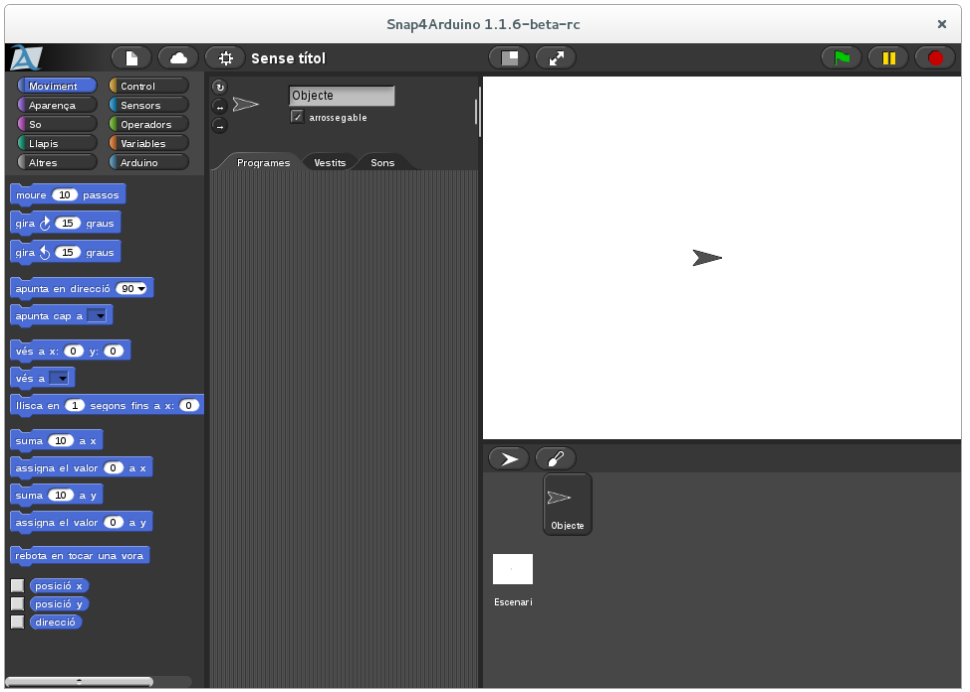
Microprogramari per l'Arduino per funcionar amb l'Snap for Arduino i l'Scratch 2 Offline:
http://binefa.cat/php/training/s4a/StandardFirmata.tar.gz

Arduino i Raspberry Pi

Ús d'Snap for Arduino

Feu la crida a Snap for Arduino des del terminal:

```
                                        ecat@debian8: ~/Snap4Arduino

 Fitxer   Edita   Visualitza   Cerca   Terminal   Ajuda
ecat@debian8:~$ cd /home/ecat/Snap4Arduino
ecat@debian8:~/Snap4Arduino$ ./Snap4Arduino
```



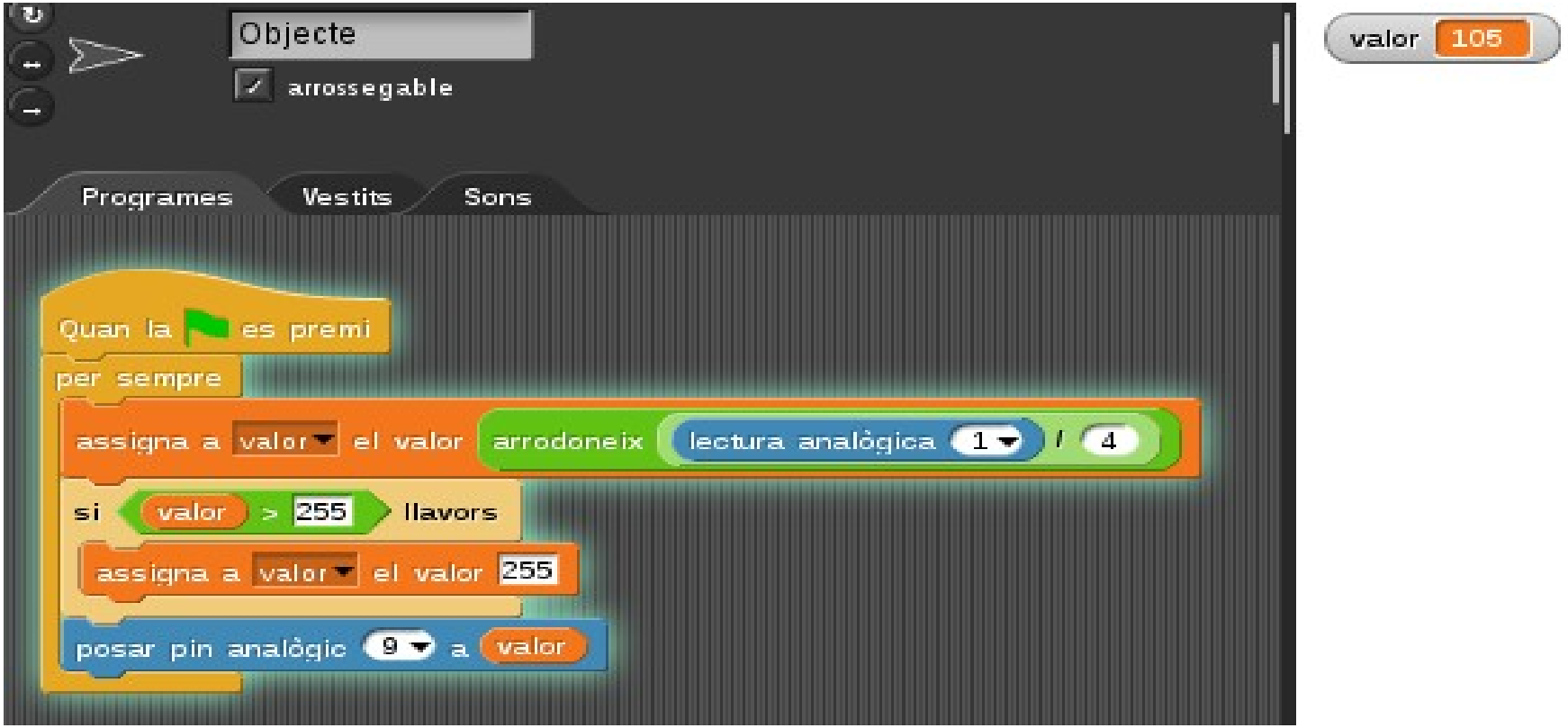
Arduino i Raspberry Pi

Ús d'Snap for Arduino

Assegureu-vos d'haver programat l'Arduino amb el programari del protocol Firmata estàndar.
Quan connecteu l'Arduino seleccioneu el port /dev/ttyUSB0.

Arduino i Raspberry Pi

Ús d'Snap for Arduino



La sortida PWM la interpreta com a sortida analògica

Arduino i Raspberry Pi

Ús d'Snap for Arduino

Exercici

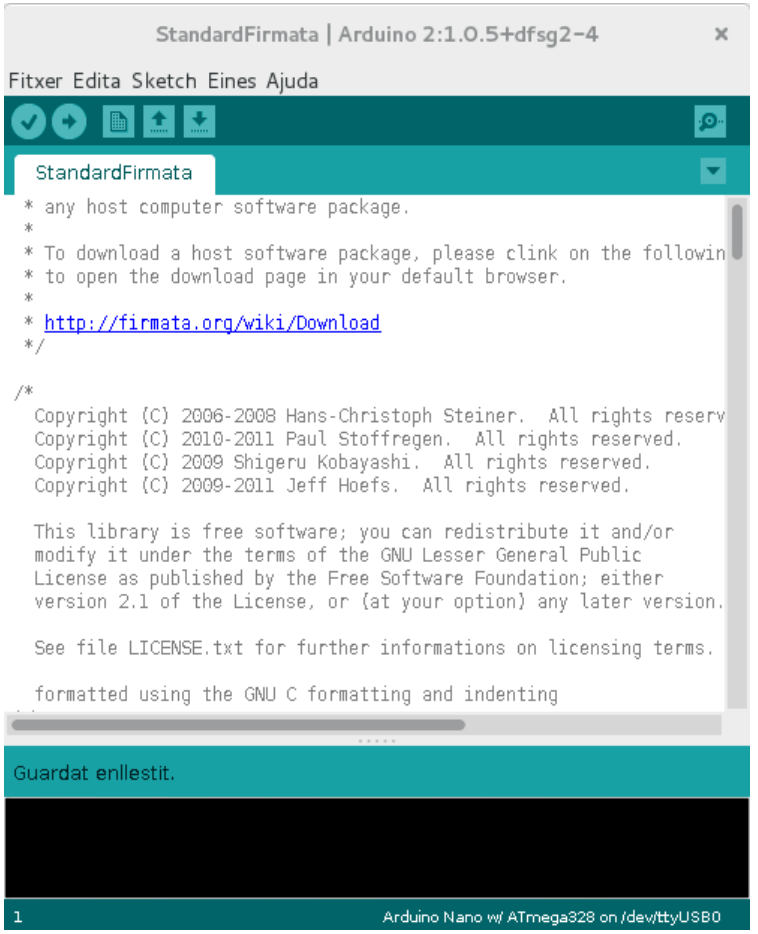
Implementeu a l'Snap for Arduino el control dels 4 relés des dels quatre botons del teclat de membrana i feu que soni el brunzidor quan es premen alhora els botons connectats a les entrades digital 2 i 3.

Arduino i Raspberry Pi

Ús d'Scratch 2.0 offline

Per a l'Snap for Arduino i l'Scratch 2.0 offline
el microprogramari
és el Firmata estàndar

Català	*Anglès*
Programari	**Software**
Maquinari	**Hardware**
Microprogramari	**Firmware**



Arduino Nano

Per tant, si ja l'heu programat per a l'Snap for Arduino **no cal** tornar-ho a **reprogramar**

Arduino i Raspberry Pi

Ús d'Scratch 2.0 offline

s2aio https://github.com/MrYsLab/s2aio/wiki

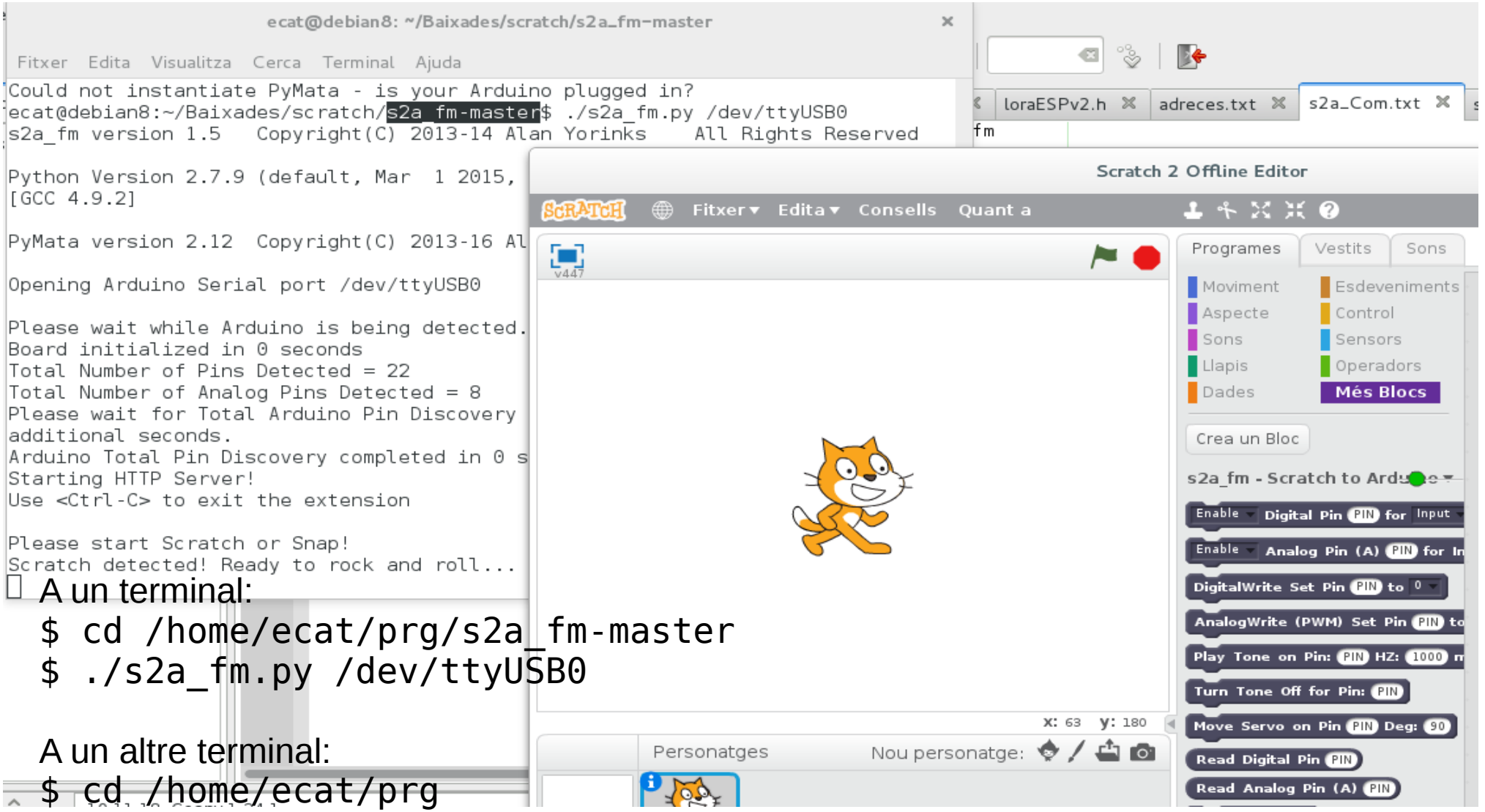
The Arduino Hardware Extension For Snap! and the Scratch 2.0 Offline Editor

s2a_fm

Previous version of ***s2aio*** https://github.com/MrYsLab/s2a_fm

Arduino i Raspberry Pi

Ús d'Scratch 2.0 offline



A un terminal:

```
$ cd /home/ecat/prg/s2a_fm-master
$ ./s2a_fm.py /dev/ttyUSB0
```

A un altre terminal:

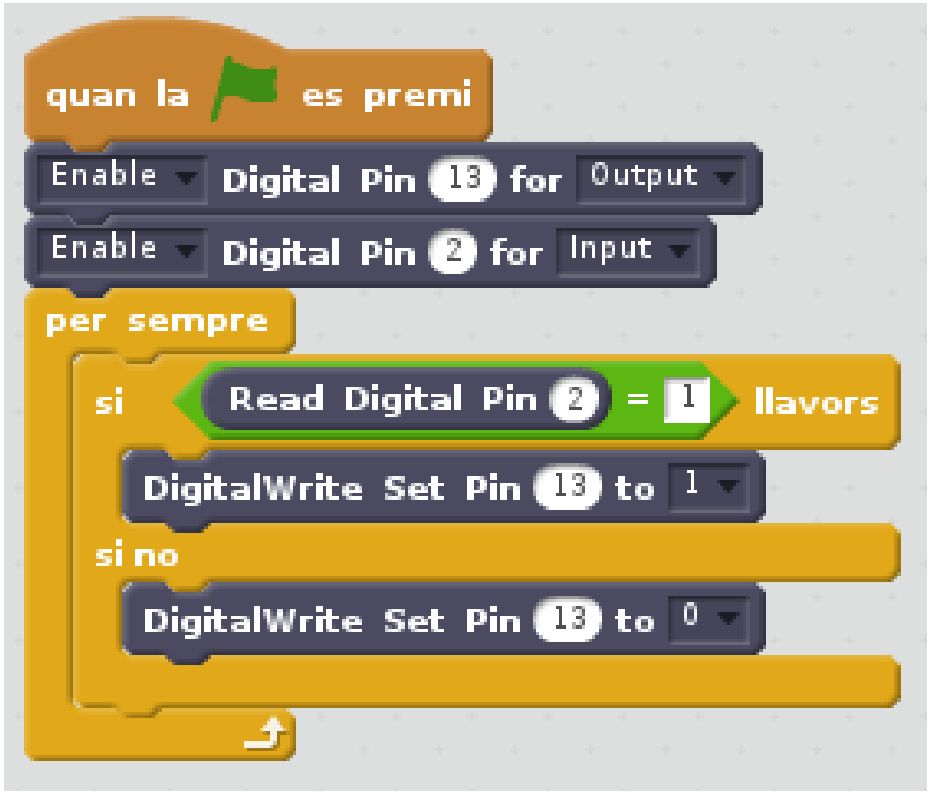
```
$ cd /home/ecat/prg
$ ./Scratch2
```

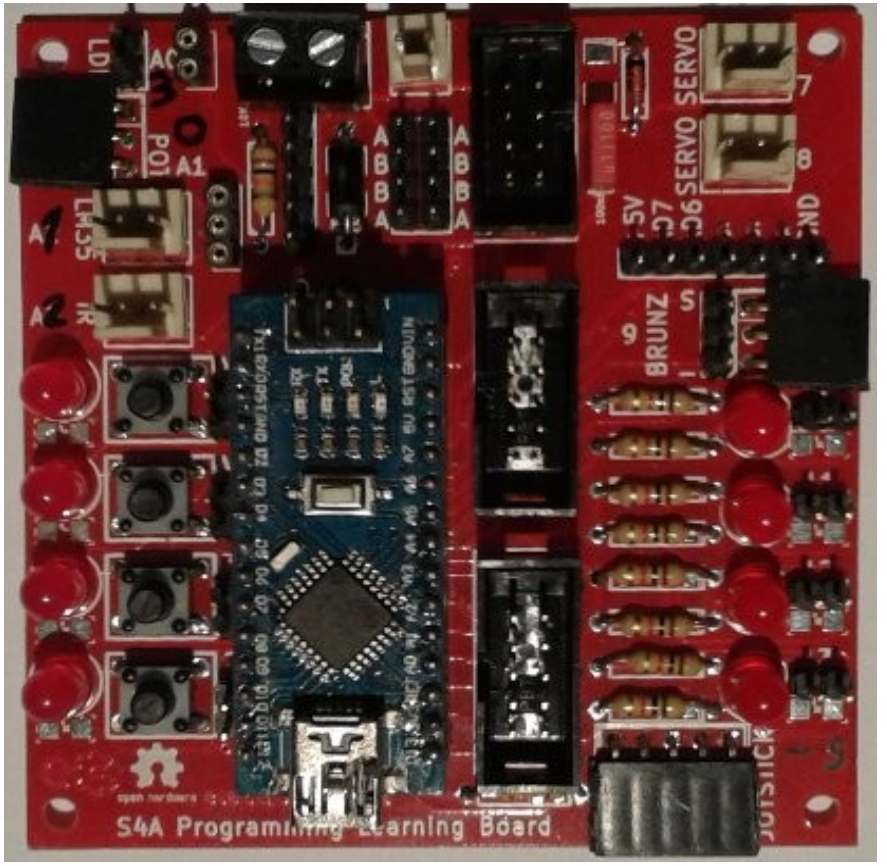
https://github.com/MrYsLab/s2a_fm

Arduino i Raspberry Pi

Ús d'Scratch 2.0 offline

sc2_prova00.sb2





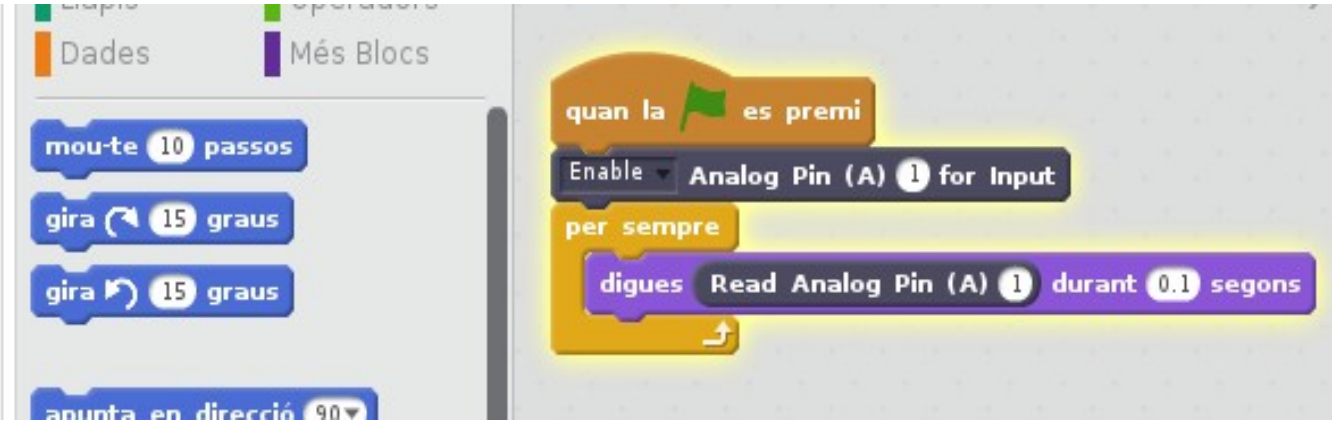
A diferència dels programes anteriors, cal configurar si les potes són entrades o sortides.

Per a fer un programa des de zero cal carregar l'extensió de maquinari s2a_fm.s2e
http://binefa.cat/php/training/s4a/codi.tar.gz

Arduino i Raspberry Pi

Ús d'Scratch 2.0 offline

Ús del potenciòmetre



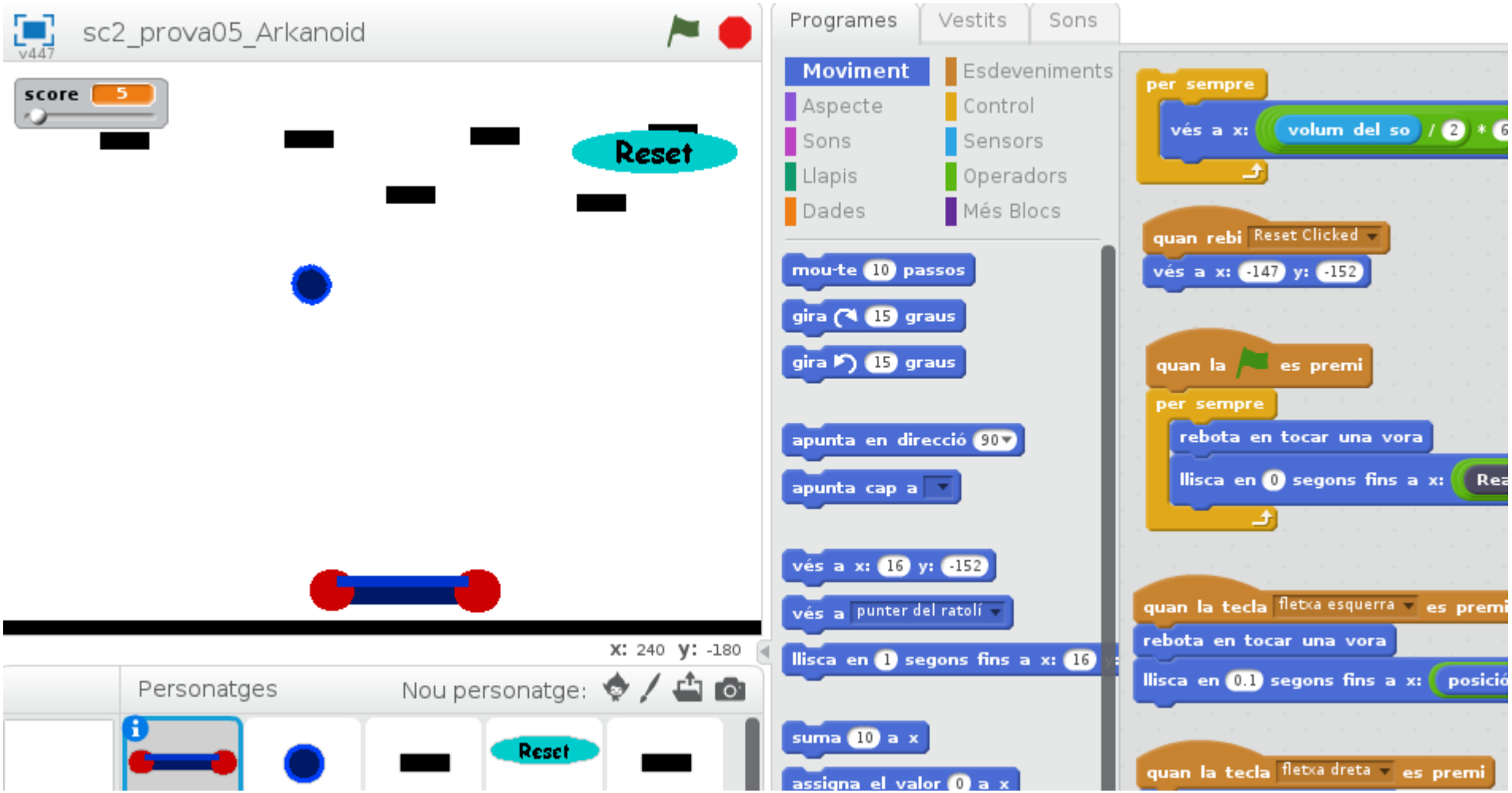
Obriu el programa sc2_prova04_potA1.sb2

http://binefa.cat/php/training/s4a/codi.tar.gz

Arduino i Raspberry Pi

Ús d'Scratch 2.0 offline

sc2_prova05_Arkanoid.sb2

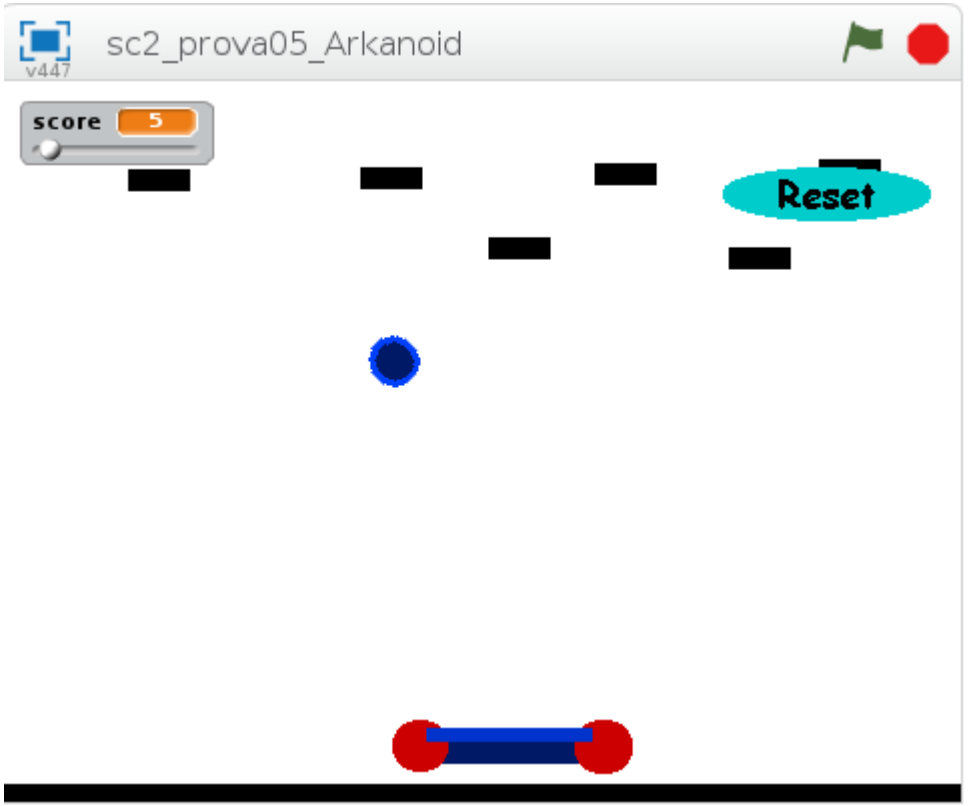


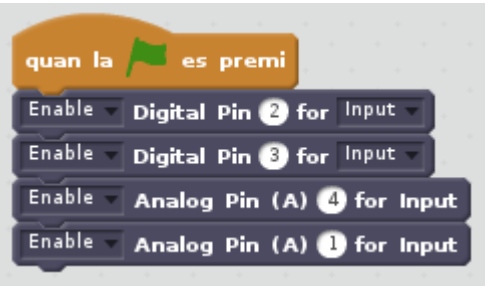
http://binefa.cat/php/training/s4a/codi.tar.gz

Arduino i Raspberry Pi

Ús d'Scratch 2.0 offline

sc2_prova05_Arkanoid.sb2





http://binefa.cat/php/training/s4a/codi.tar.gz

Arduino i Raspberry Pi

Ús d'Scratch 2.0 offline

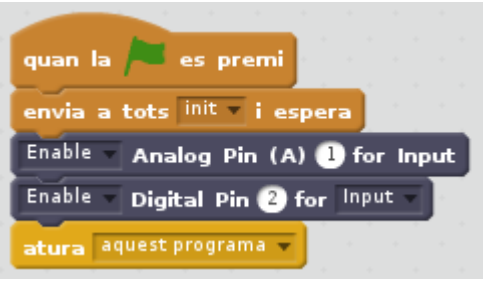
sc2_prova06_ScratchArkanoid.sb2

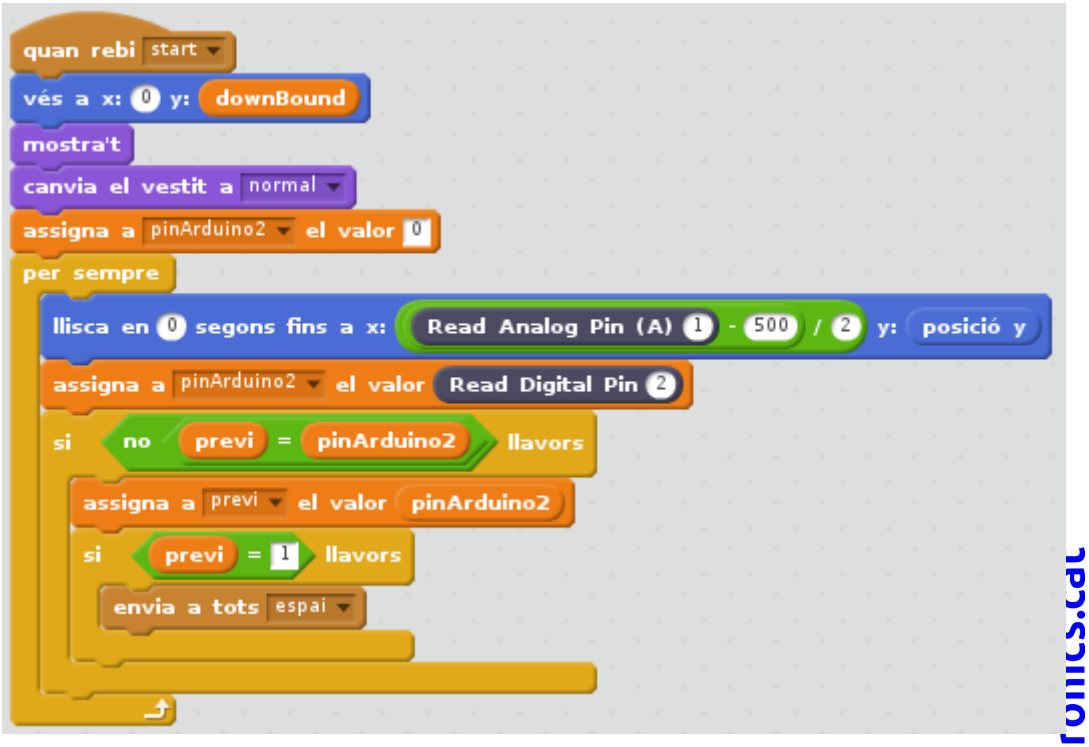
http://binefa.cat/php/training/s4a/codi.tar.gz

Arduino i Raspberry Pi

Ús d'Scratch 2.0 offline

sc2_prova07_SpaceInvaders1.4.sb2





Podeu activar el volum.

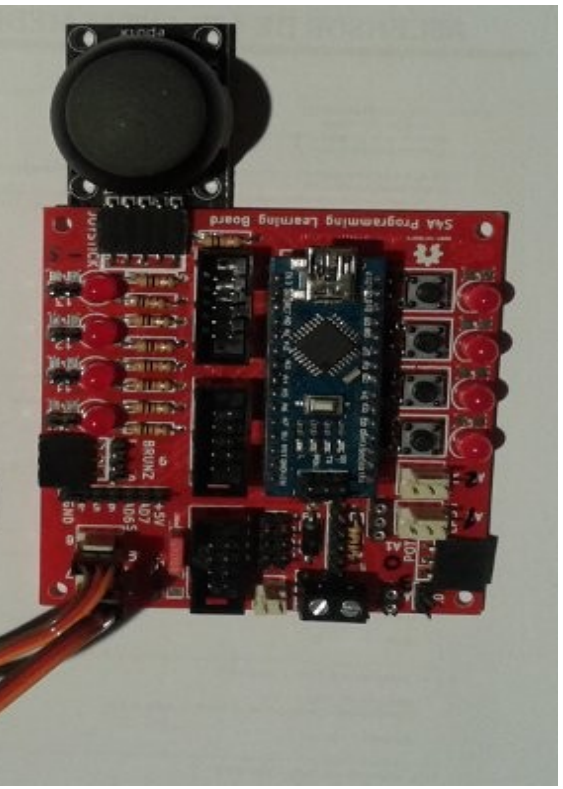
Es fa servir el potenciòmetre A1 per a moure la nau i el botó 2 per a disparar.

http://binefa.cat/php/training/s4a/codi.tar.gz

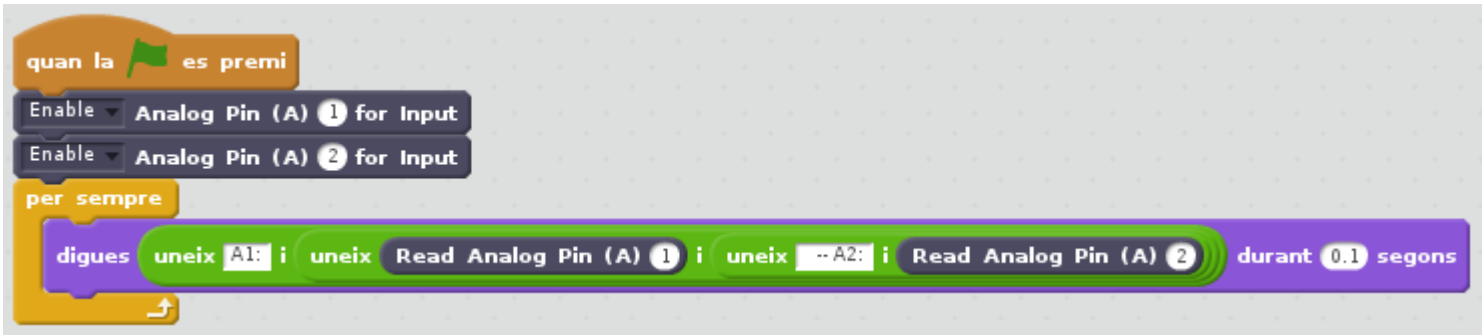
Arduino i Raspberry Pi

Ús d'Scratch 2.0 offline

Ús del joystick



sc2_prova08_JoystickA1A2.sb2

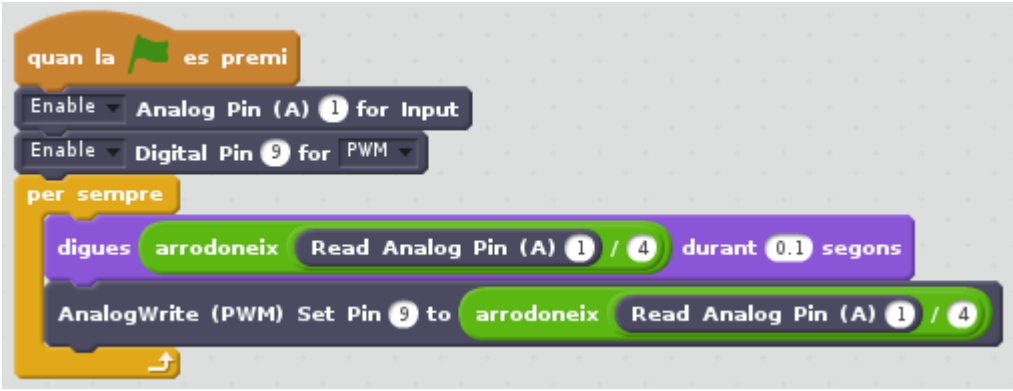


http://binefa.cat/php/training/s4a/codi.tar.gz

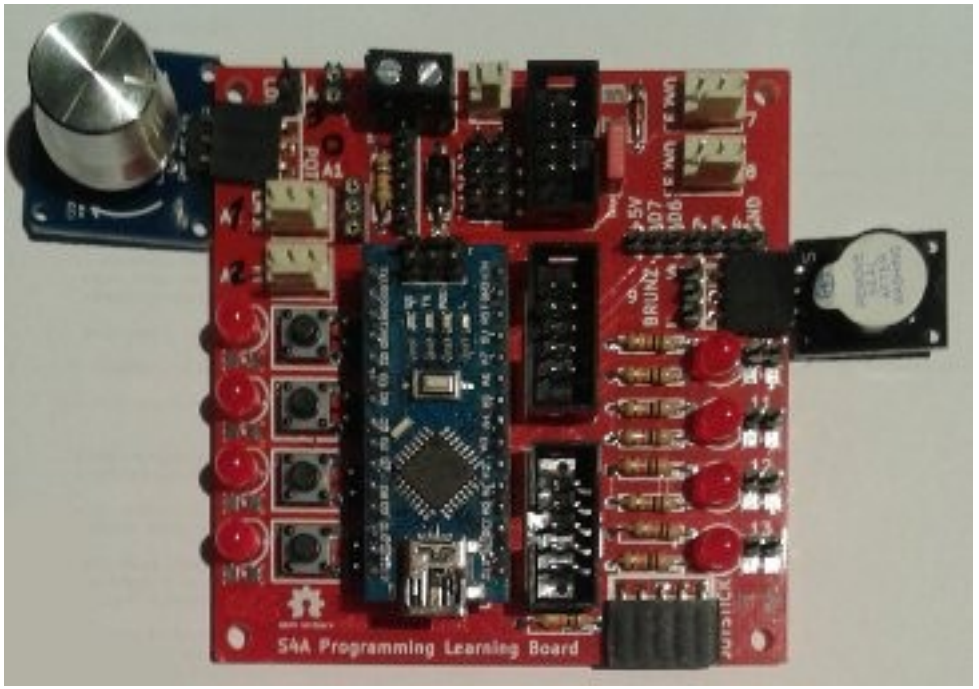
Arduino i Raspberry Pi

Ús d'Scratch 2.0 offline

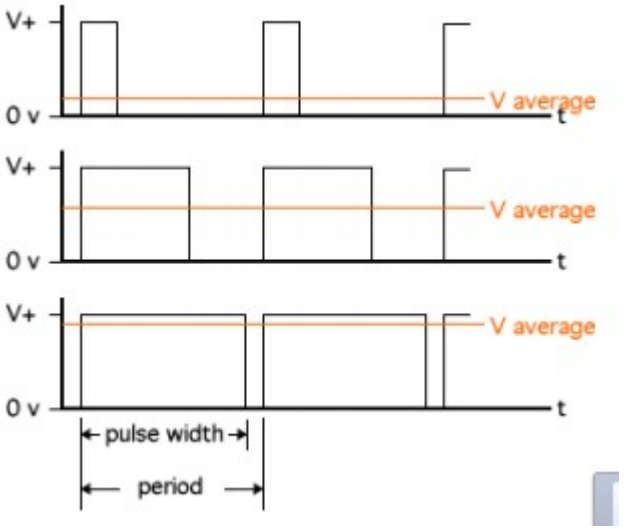
sc2_prova09_potA1brunz.sb2



A1



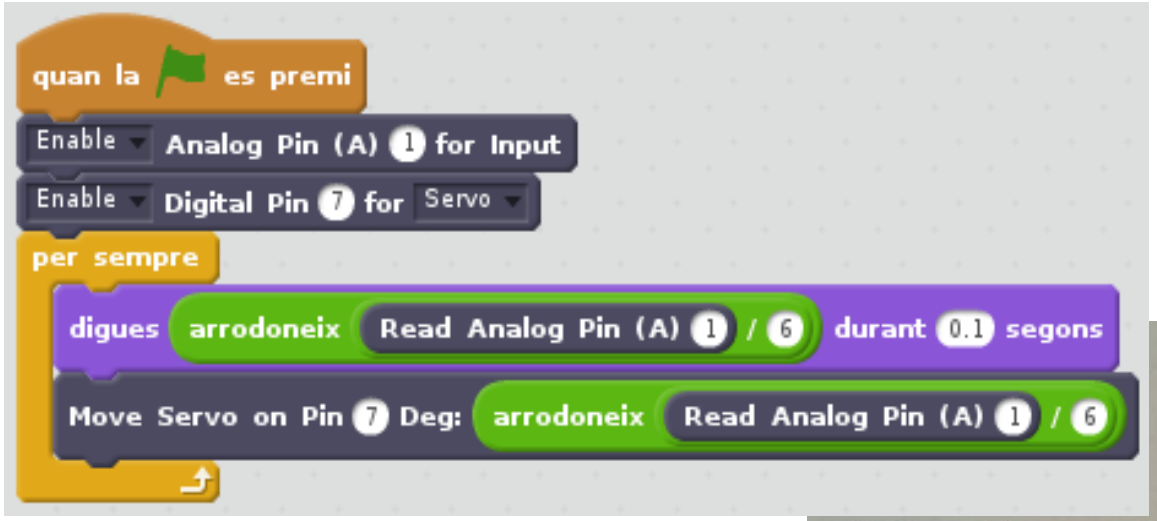
9



http://binefa.cat/php/training/s4a/codi.tar.gz

Arduino i Raspberry Pi

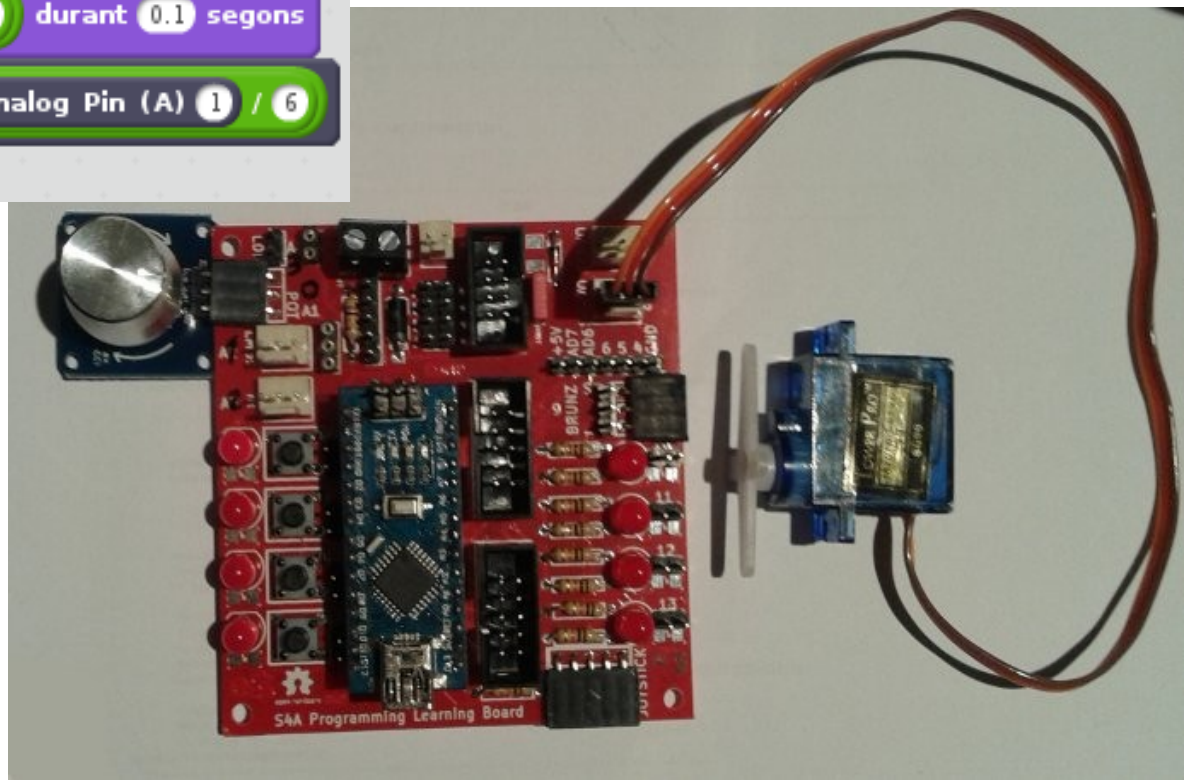
Ús d'Scratch 2.0 offline



sc2_prova10_potA1_servo7.sb2

Ús del servomotor (servo)

Abans de connectar el servo atureu
El programa en Python i l'Scratch.



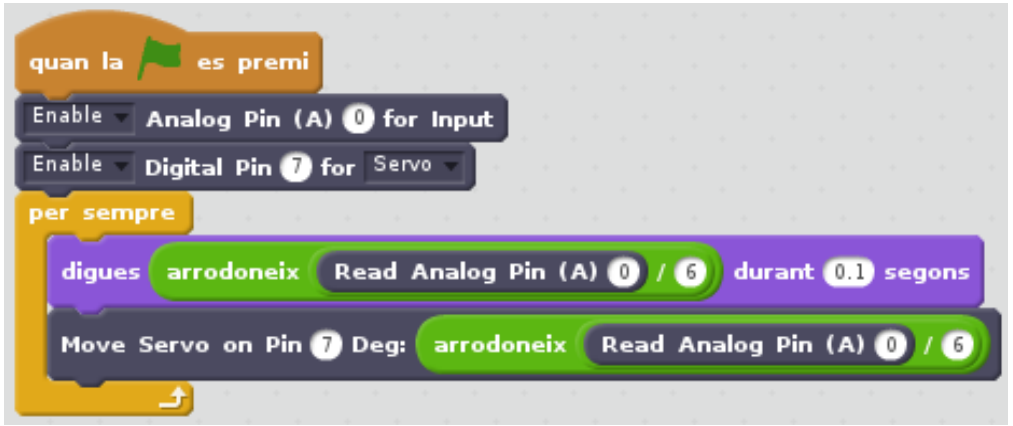
http://binefa.cat/php/training/s4a/codi.tar.gz

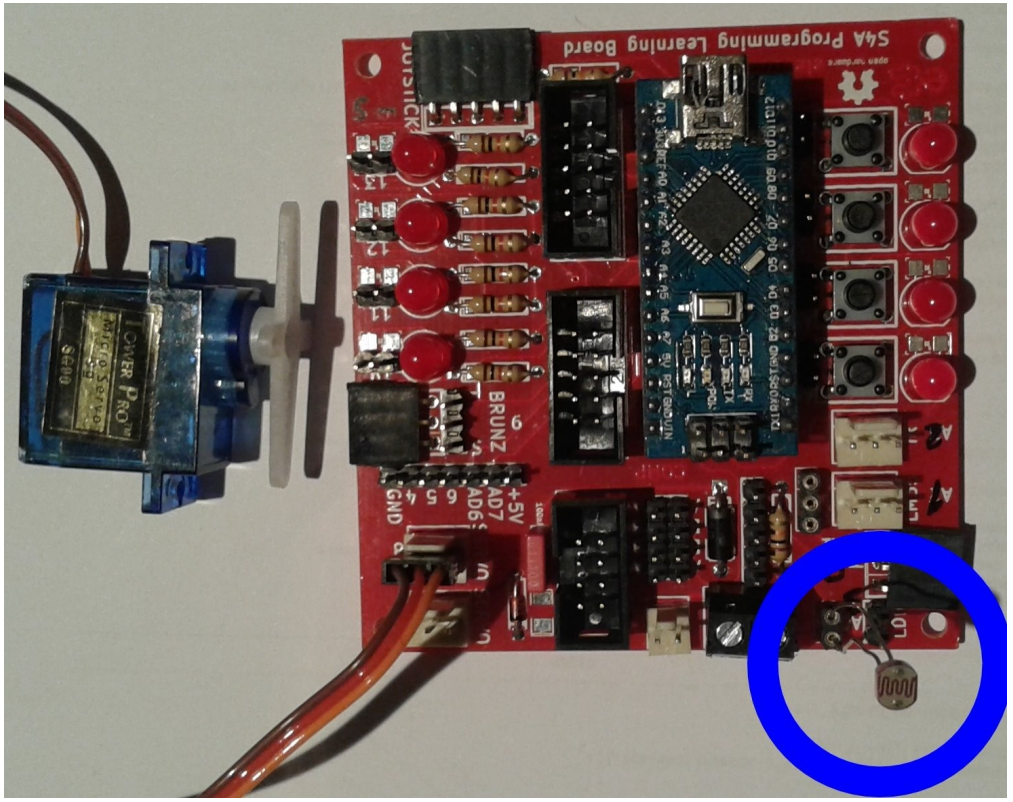
Arduino i Raspberry Pi

Ús d'Scratch 2.0 offline

Ús del fotoresistor (LDR)

sc2_prova11_ldrA0_servo7.sb2



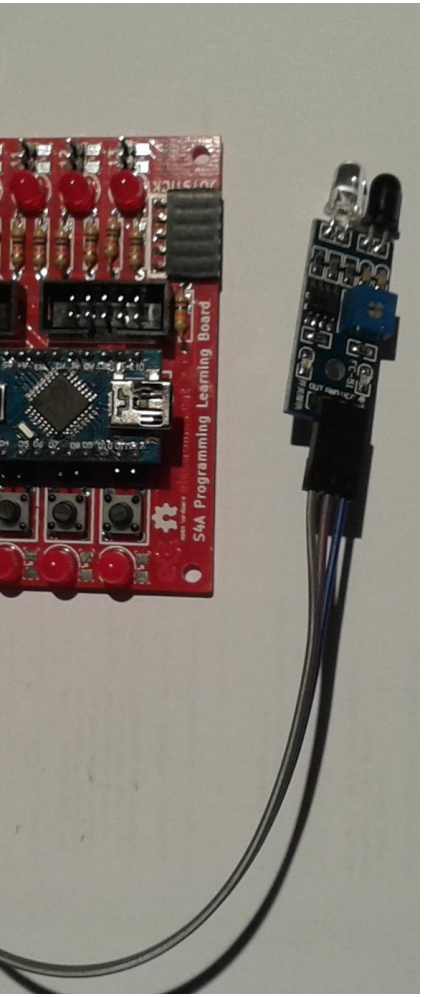


http://binefa.cat/php/training/s4a/codi.tar.gz

Arduino i Raspberry Pi

Ús d'Scratch 2.0 offline

sc2_prova12irRelay.sb2

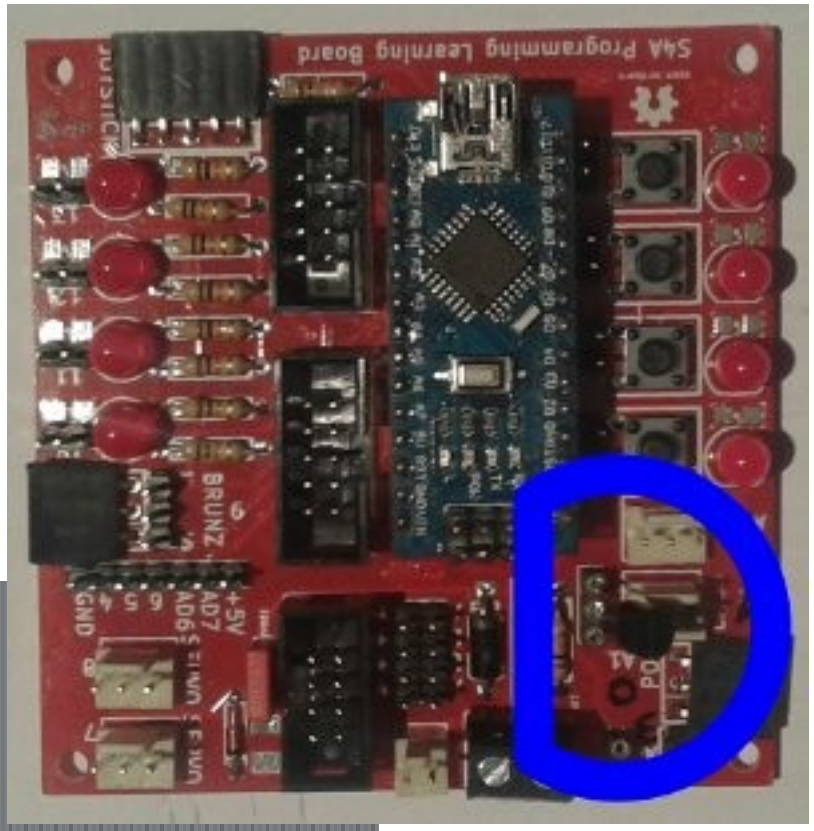


http://binefa.cat/php/training/s4a/codi.tar.gz

Arduino i Raspberry Pi

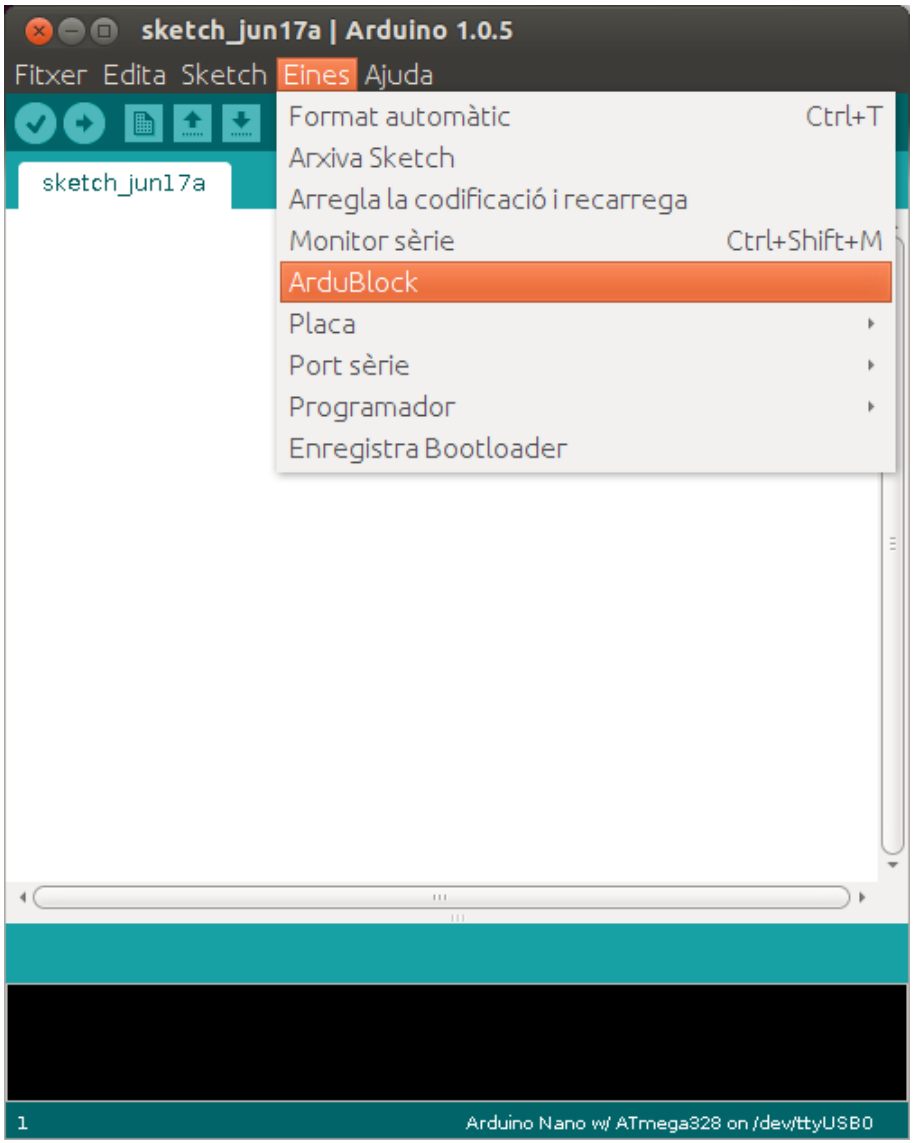
Ús d'Scratch 2.0 offline

Exercici: Implementeu aquest codi en Scratch 2.0



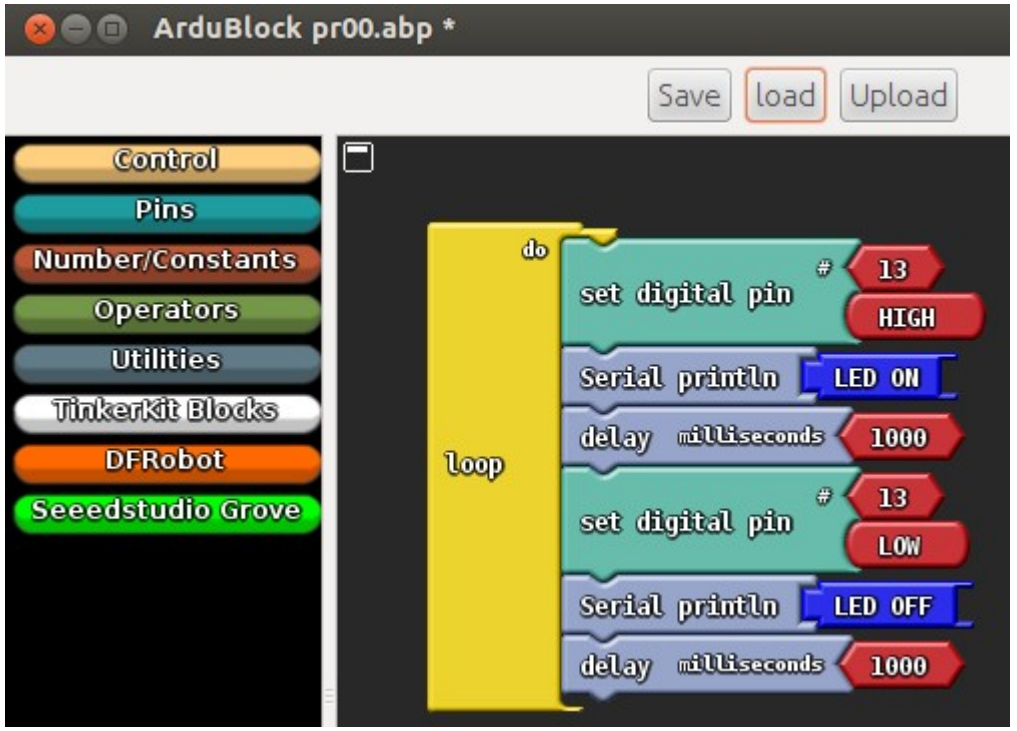
Arduino i Raspberry Pi

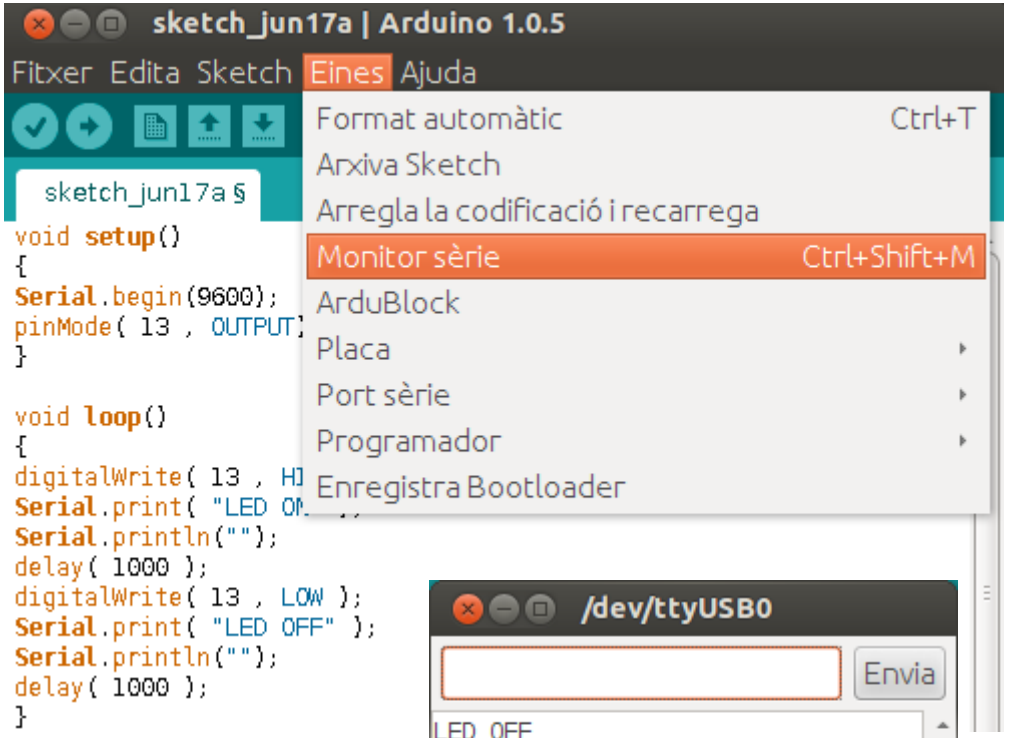
Ús d'ArduBlock

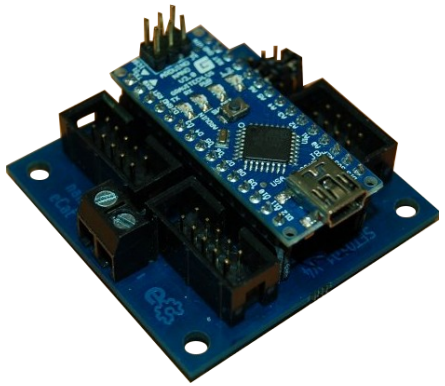


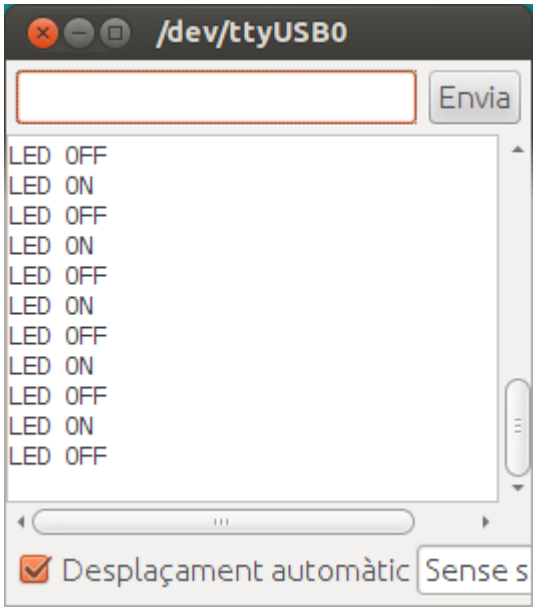
Arduino i Raspberry Pi

pr00.abp – Sortides digitals





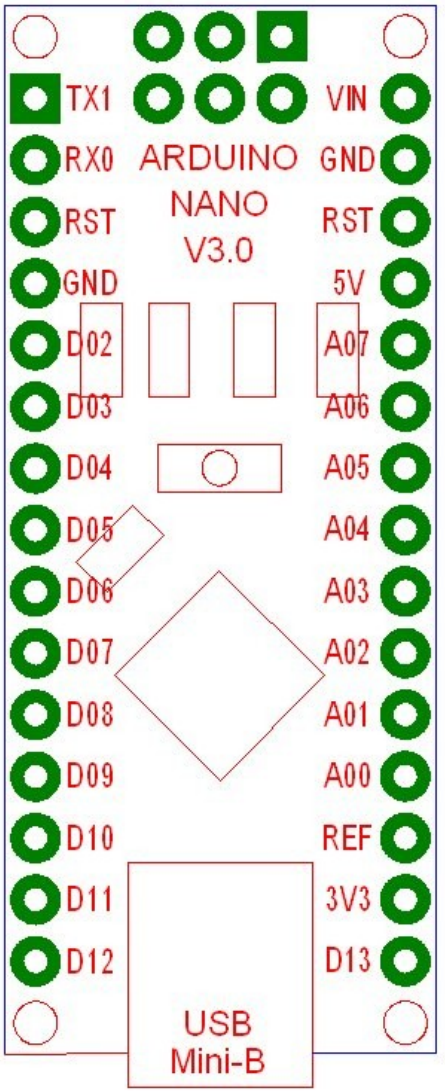




http://www.binefa.cat/php/arduino/ardublock/pr00.abp

Arduino i Raspberry Pi

Arduino Nano

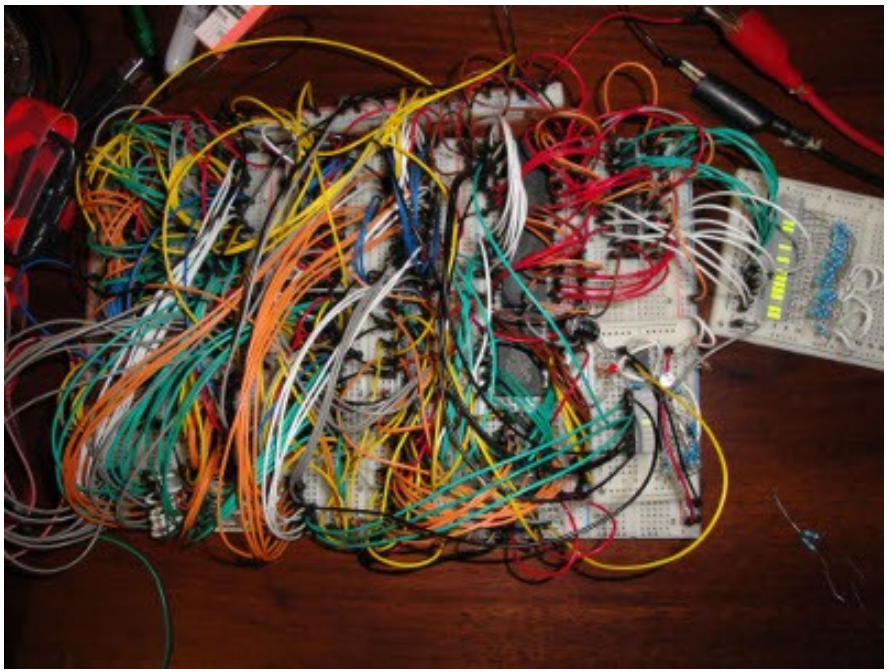


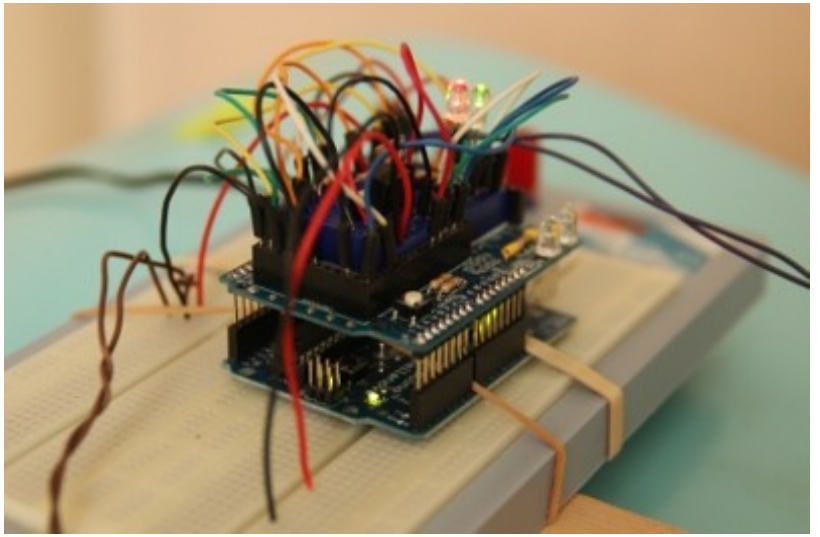
RS232:TX, DIGITAL 01 (01)
RS232:RX, DIGITAL 00 (02)
RESET (03)
GROUND (04)
INTERRUPT, DIGITAL 02 (05)
PWM, INTERRUPT, DIGITAL 03 (06)
I2C:SDA, DIGITAL 04 (07)
PWM, I2C:SCL, DIGITAL 05 (08)
PWM, DIGITAL 06 (09)
DIGITAL 07 (10)
DIGITAL 08 (11)
PWM, DIGITAL 09 (12)
PWM, SPI:SS, DIGITAL 10 (13)
PWM, SPI:MOSI, DIGITAL 11 (14)
SPI:MISO, DIGITAL 12 (15)

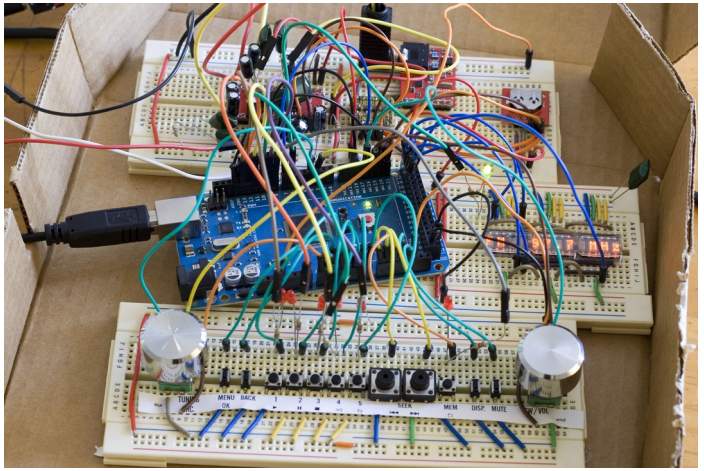
(30) SUPPLY VOLTAGE IN (7-12 VOLTS DC)
(29) GROUND
(28) RESET
(27) +5.0 VOLTS
(26) ANALOG 07
(25) ANALOG 06
(24) ANALOG 05
(23) ANALOG 04
(22) ANALOG 03
(21) ANALOG 02
(20) ANALOG 01
(19) ANALOG 00
(18) ANALOG REFERENCE VOLTAGE
(17) +3.3 VOLTS
(16) DIGITAL 13, LED, SPI:SCK

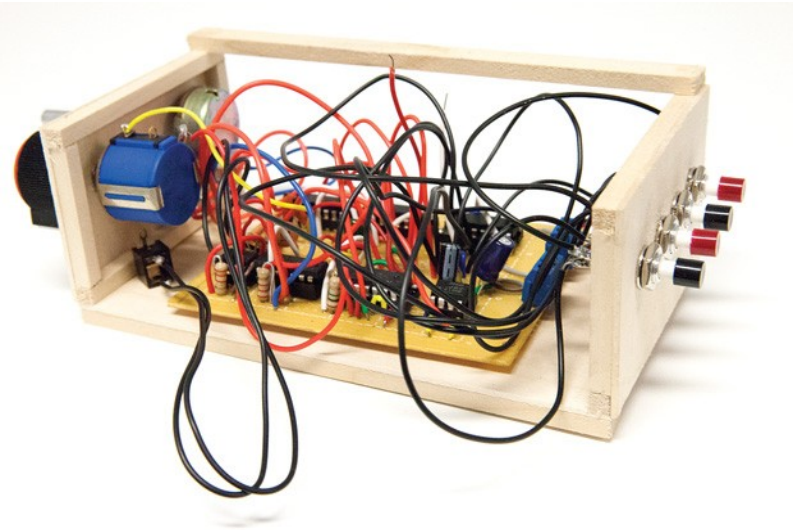
Arduino i Raspberry Pi

Inconvenients per a novells, ... i experts





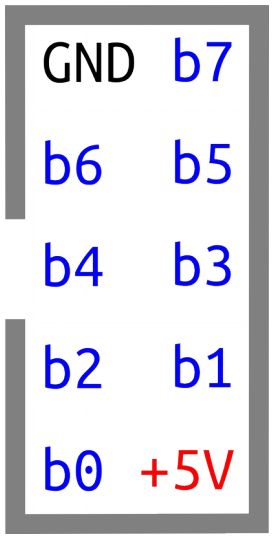


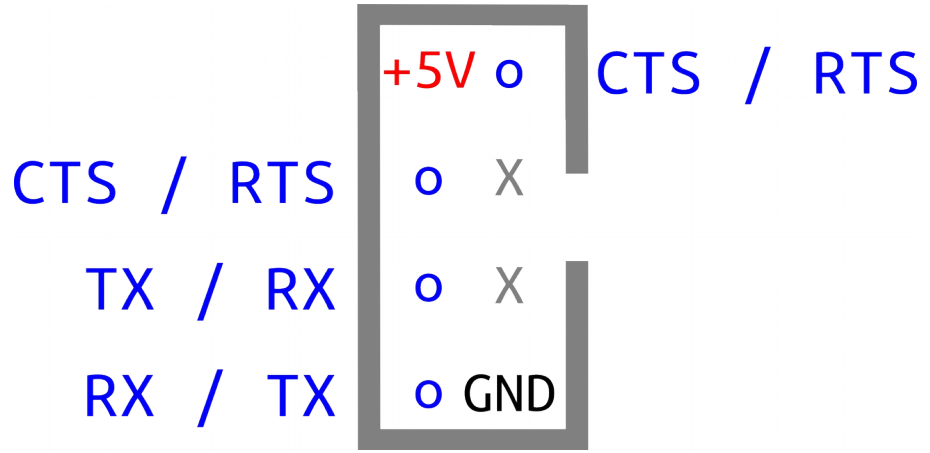


Arduino i Raspberry Pi

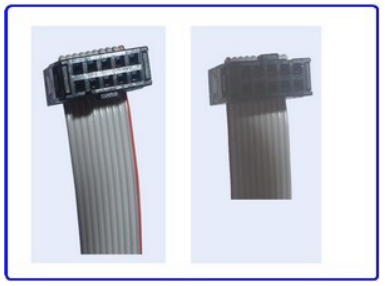
Maquinari orientat a alumne

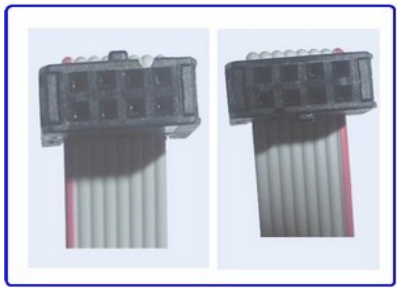
BUS : Sistema digital que transfereix dades entre dispositius electrònics





Cable pla
5x2 a 5x2
(0104A)



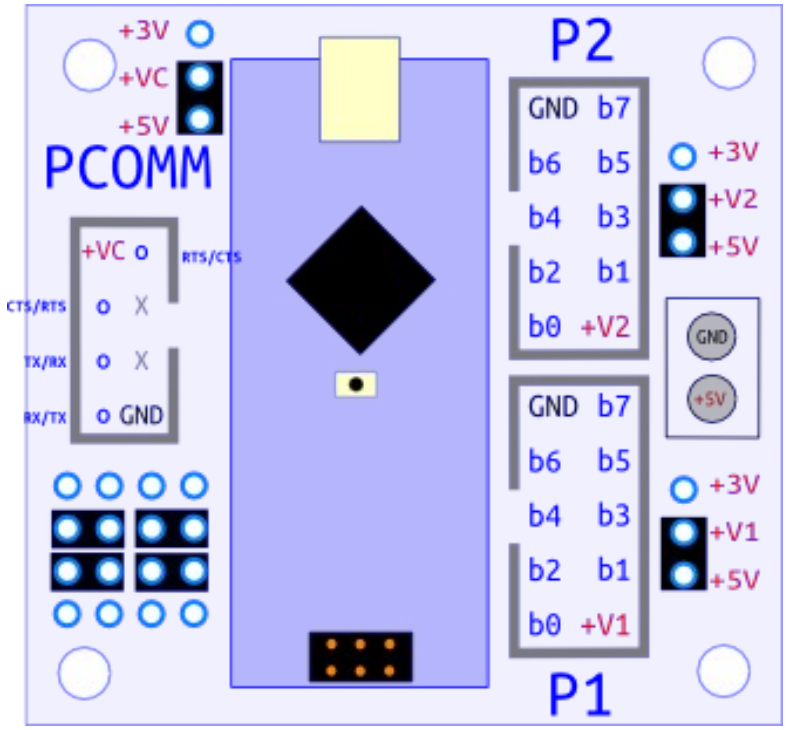


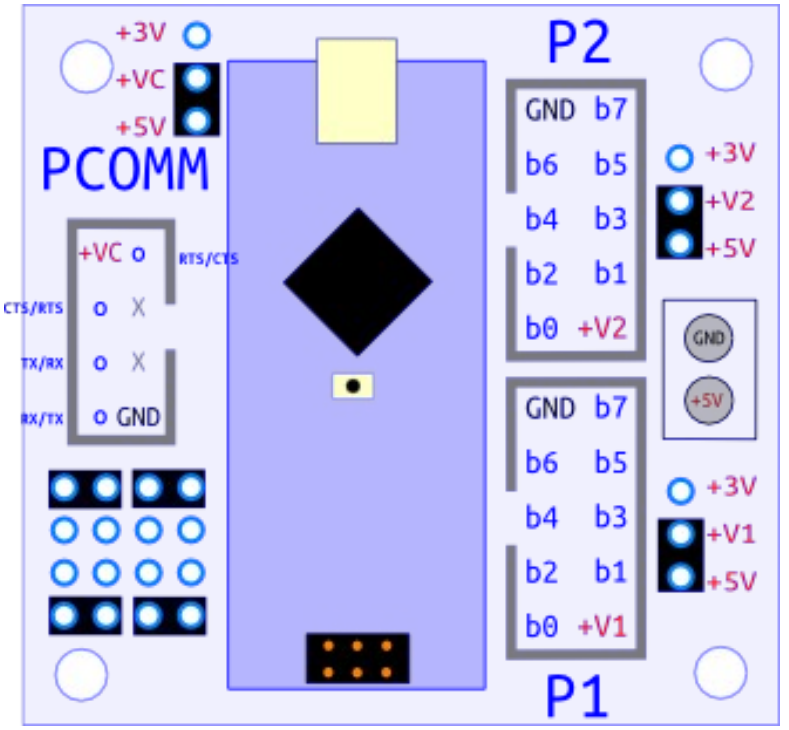
eCat System : Dos tipologies de BUS, dades (8 bits) i comunicacions

http://electronics.cat/php/common/index.php?lang=ca&page=044

Arduino i Raspberry Pi

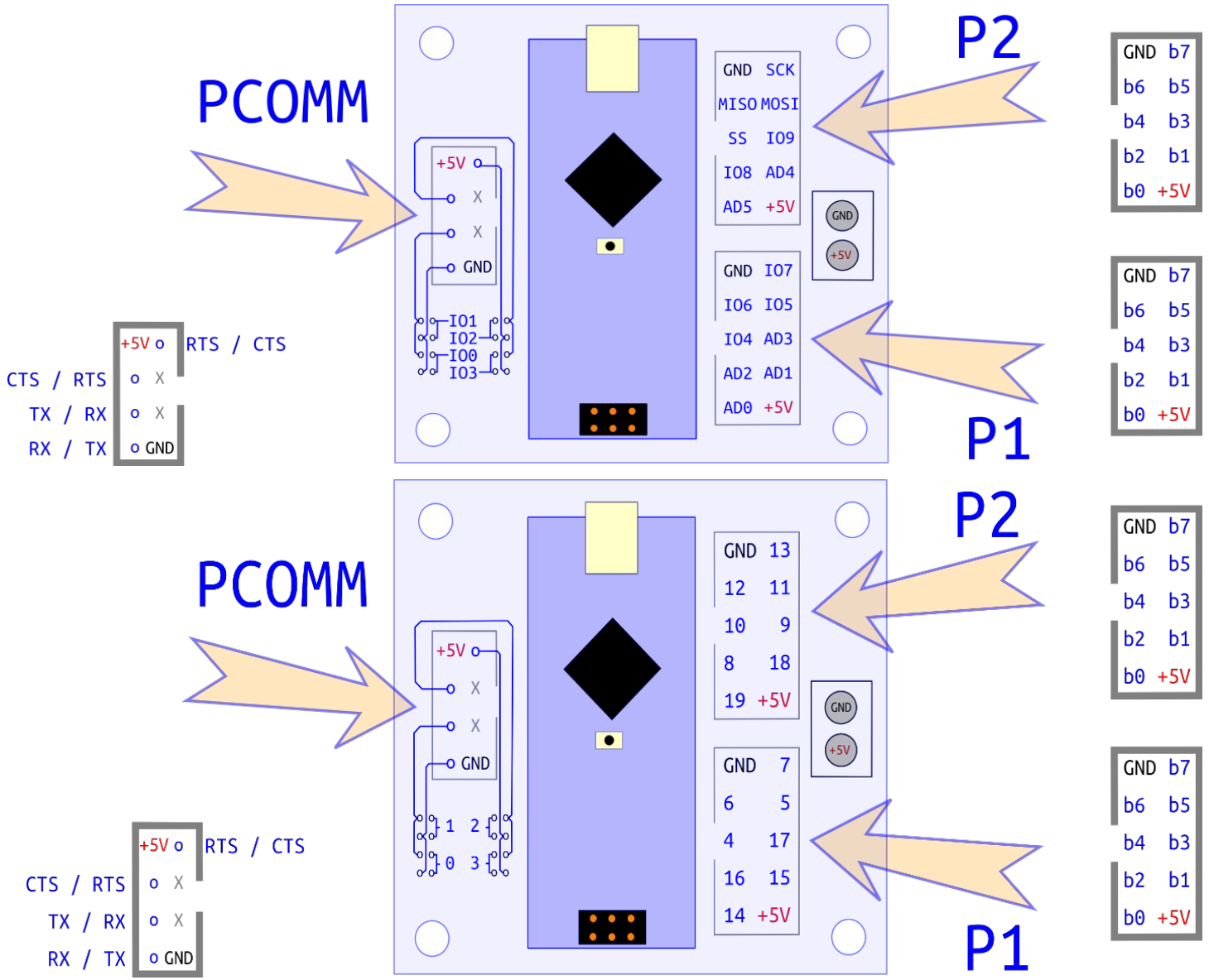
nano-eCat





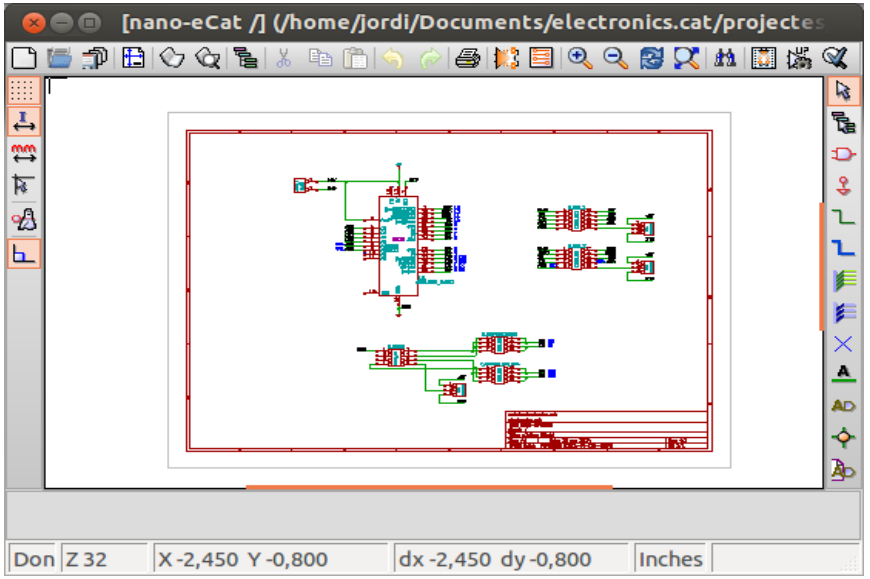
Arduino i Raspberry Pi

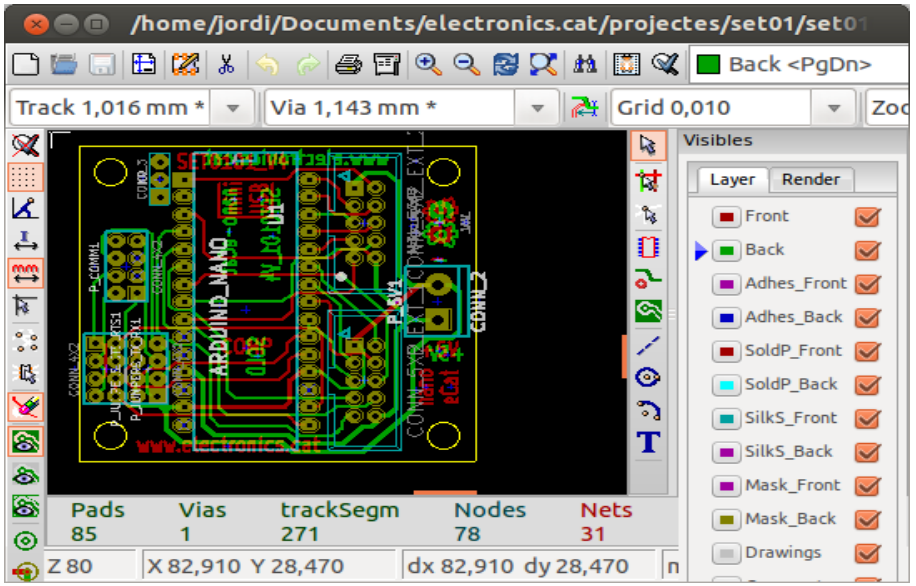
nano-eCat

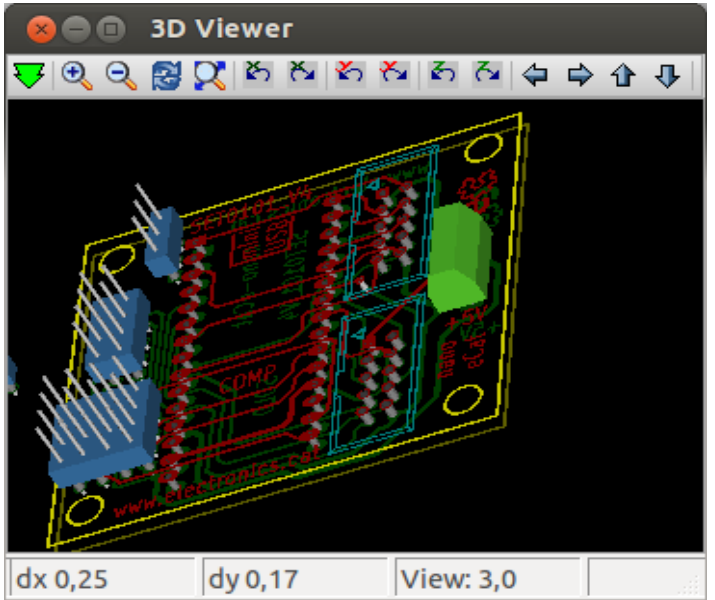


Arduino i Raspberry Pi

Maquinari lliure dissenyat amb KiCad

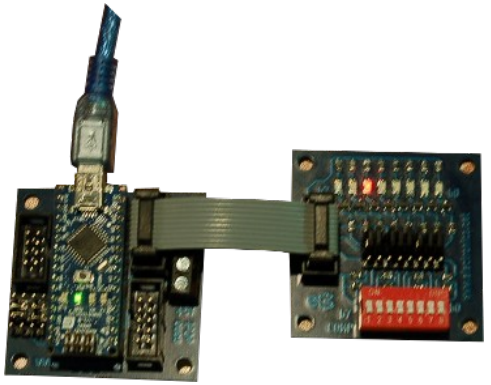


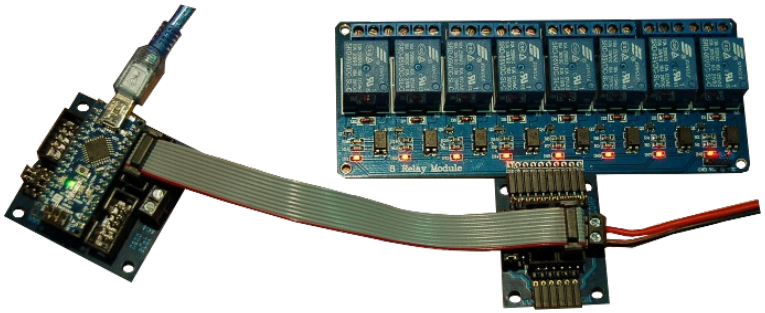


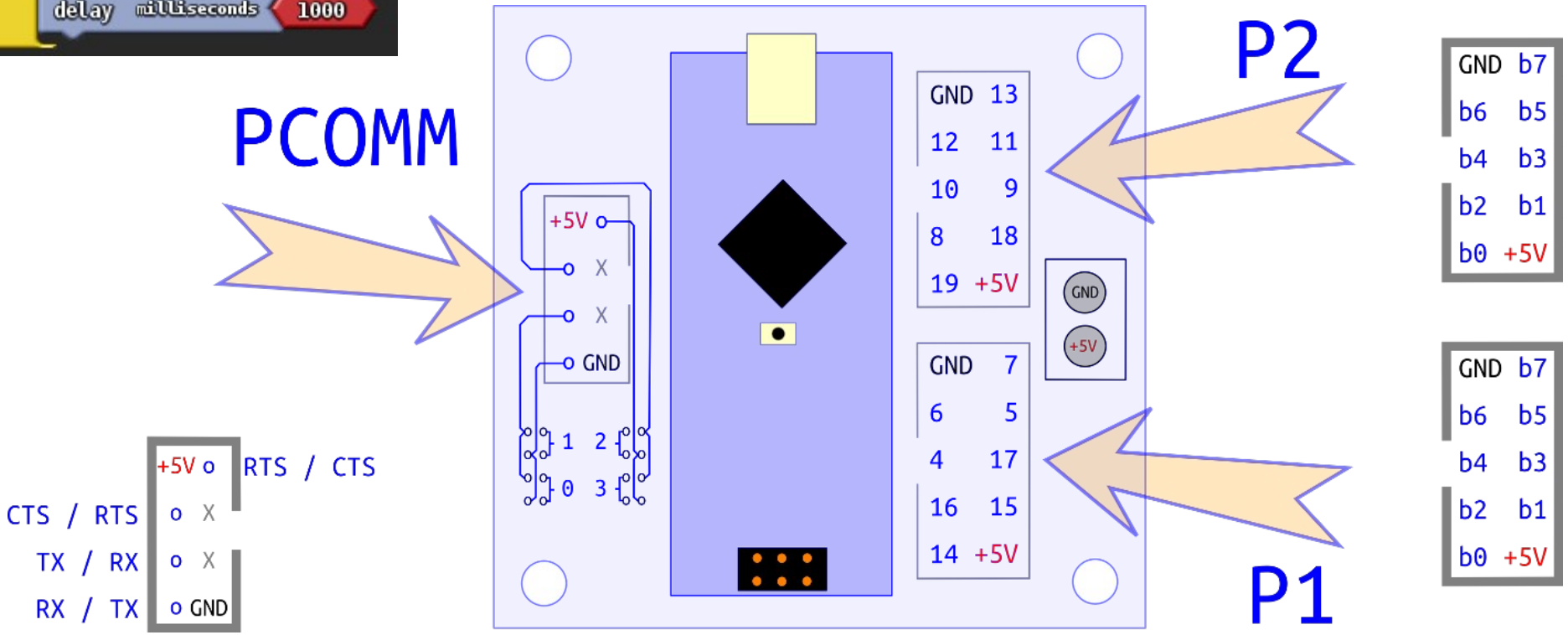


Arduino i Raspberry Pi

pr00.abp – Sortides digitals



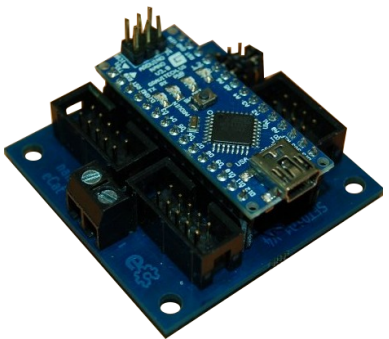




Arduino i Raspberry Pi

minicom -b 9600 -o -D /dev/ttyUSB0

```
jordi@eCat:~/Documents/electronics.cat/projectes/arduino/install/arduino-1.0.5$ minicom -b 9600 -o
-D /dev/ttyUSB1


Welcome to minicom 2.5

OPTIONS: I18n
Compiled on May  2 2011, 10:05:24.
Port /dev/ttyUSB1

Press CTRL-A Z for help on special keys

LED OFF
LED ON
LED OFF
LED ON
LED OFF
LED ON
LED OFF
LED ON
LED OFF
LED ON
LED OFF
```

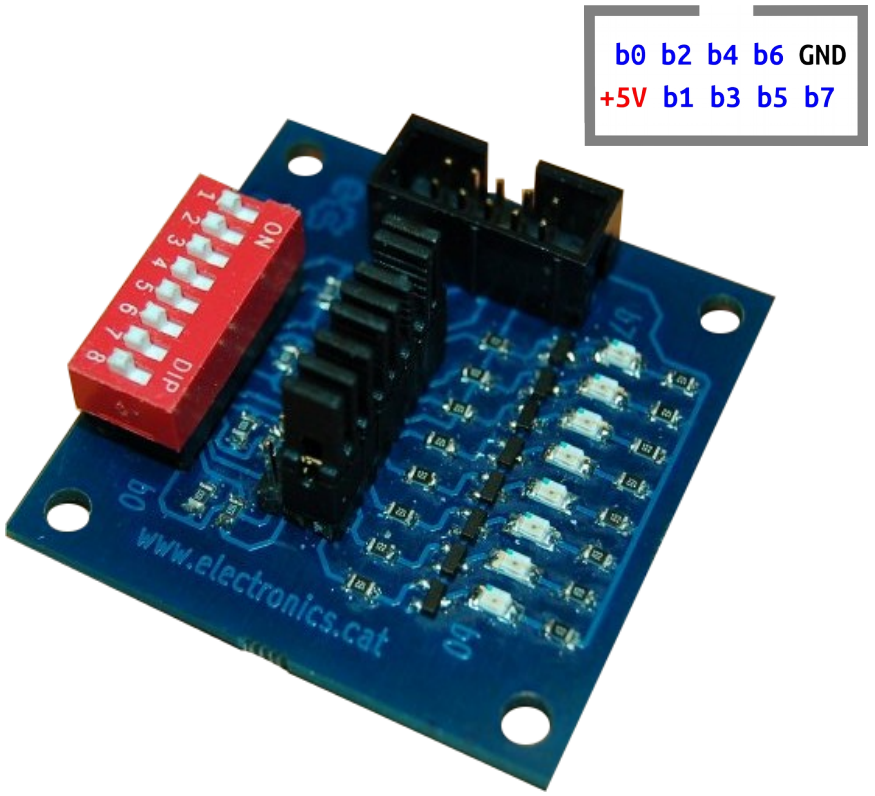


Arduino i Raspberry Pi

Placa de microruptors i leds

uSW – LEDs

01_04 v3



Placa configurable d'entrades / sortides.

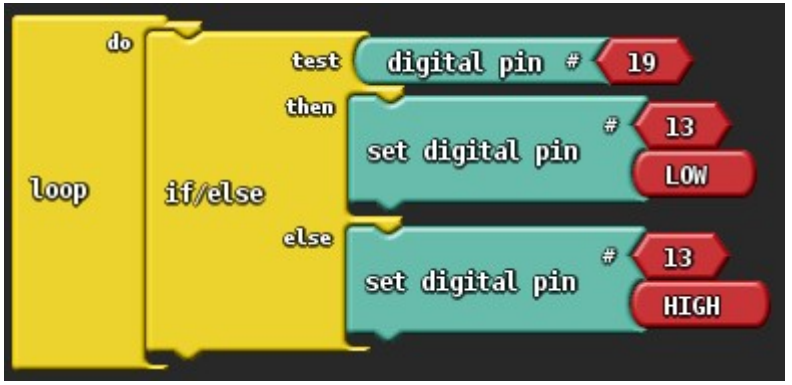
La configuració de cada bit es fa mitjançant un pont (jumper).

Les entrades es fan per microruptor (ON : zero lògic, OFF : u lògic).

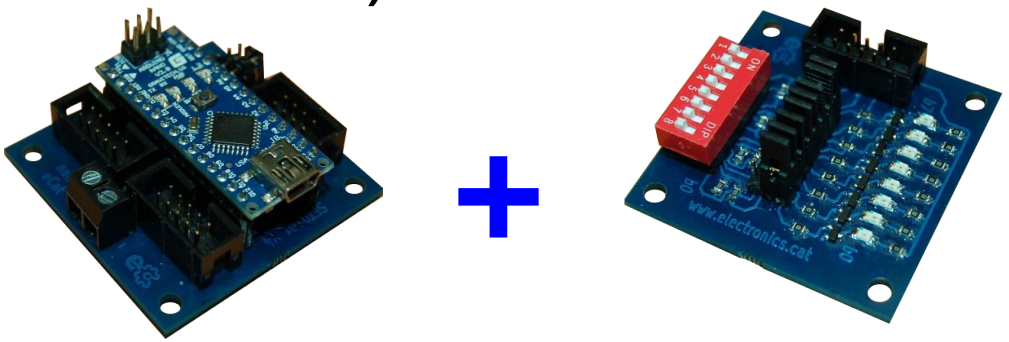
Les sortides es visualitzen mitjançant leds (apagat : zero lògic, encès : u lògic).

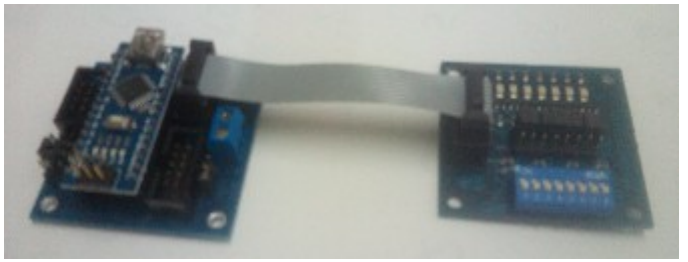
Arduino i Raspberry Pi

pr01.abp – Entrades digitals



A la placa d'entrades i sortides, 01_04 v3, s'ha de configurar el pont del bit 7 de P2 (pin 13 d'Arduino) com a sortida i el bit 0 de P2 (pin 19 d'Arduino) com a entrada.





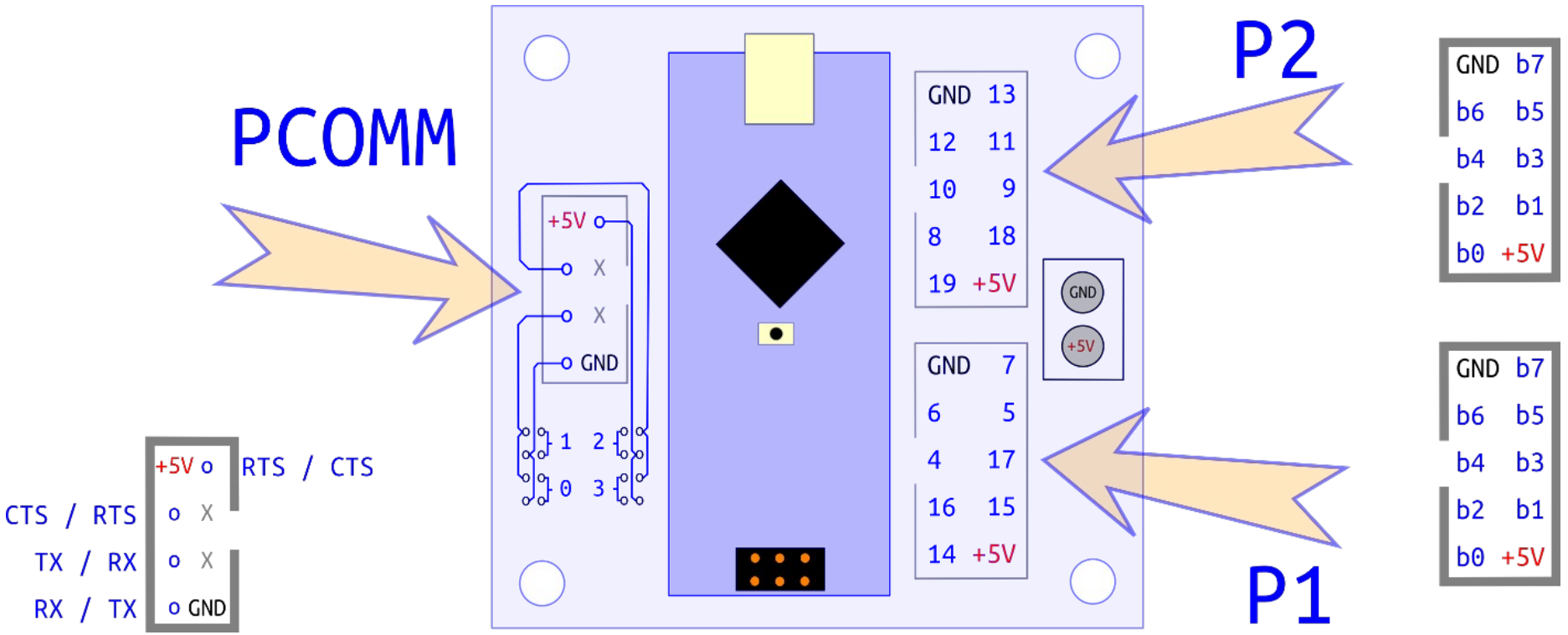
http://www.binefa.cat/php/arduino/ardublock/pr01.abp

Arduino i Raspberry Pi

pr02.abp - Exercici

- Desenvolupeu pr02_P2.abp per a crear una seqüència infinita des de b7 a b0 de P2 amb un interval de mig segon (500 ms) :

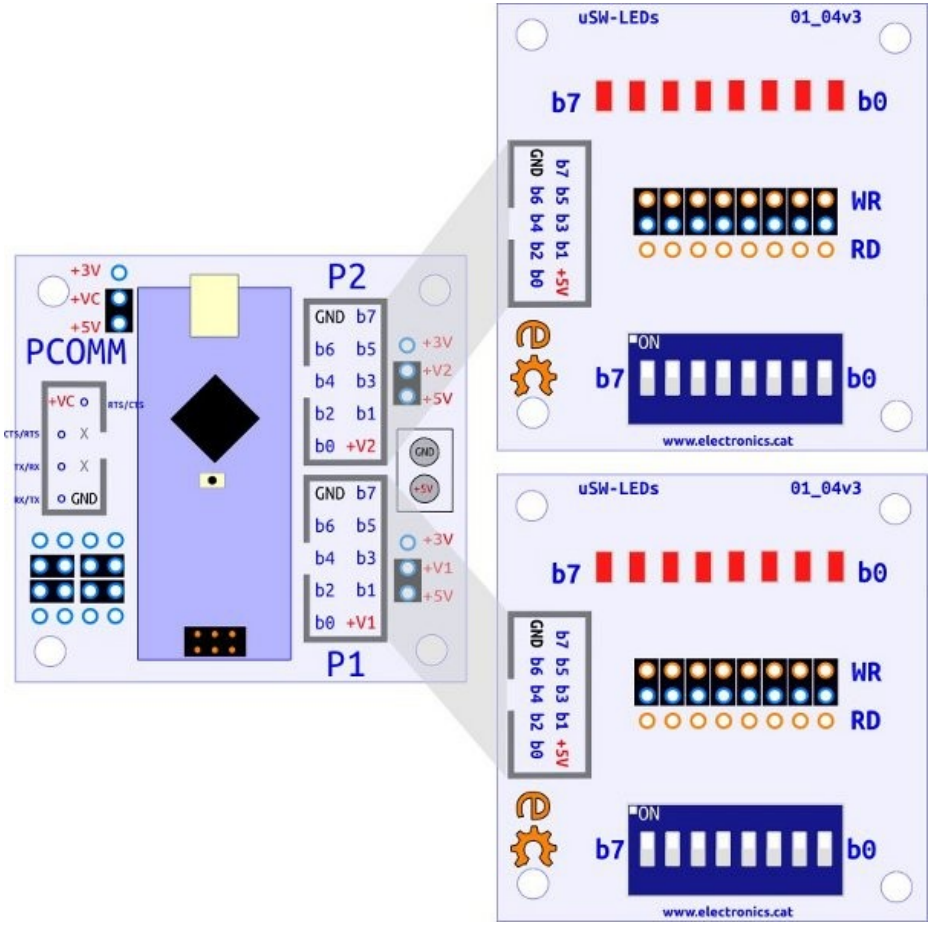
1000000, 00000000, 01000000, 00000000, 00100000, ... , 00000000, 00000001, 00000000

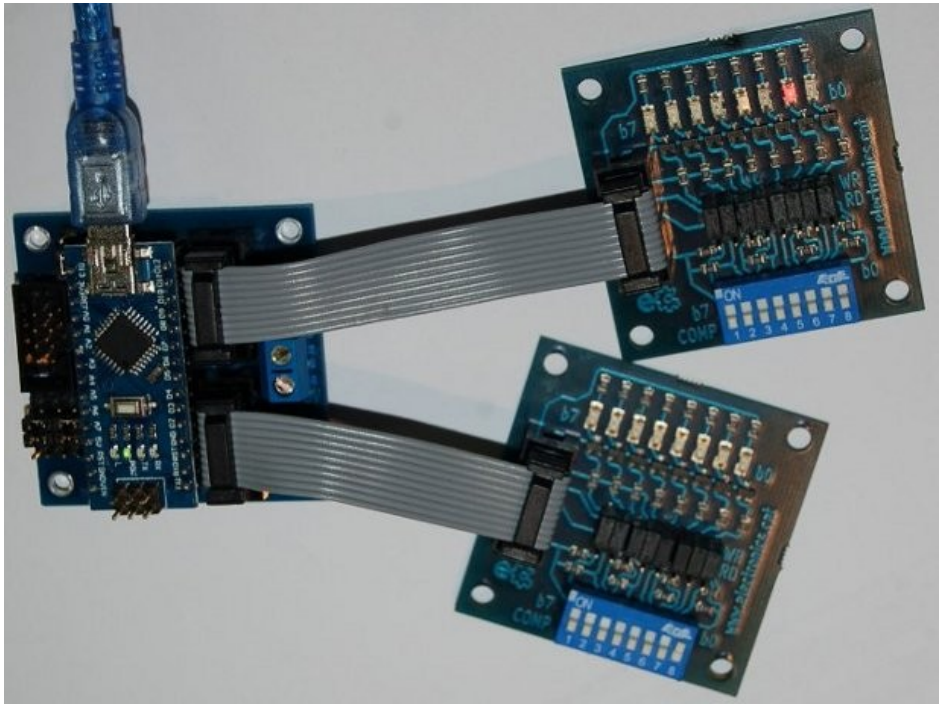


http://www.binefa.cat/php/arduino/ardublock/pr02_P2.abp
http://www.binefa.cat/php/arduino/ardublock/pr02_P1.abp

Arduino i Raspberry Pi

pr02.abp - Exercici





Vídeo : https://www.youtube.com/watch?v=efSOm-ZIIq0

http://www.binefa.cat/php/arduino/ardublock/pr02_P2.abp
http://www.binefa.cat/php/arduino/ardublock/pr02_P1.abp

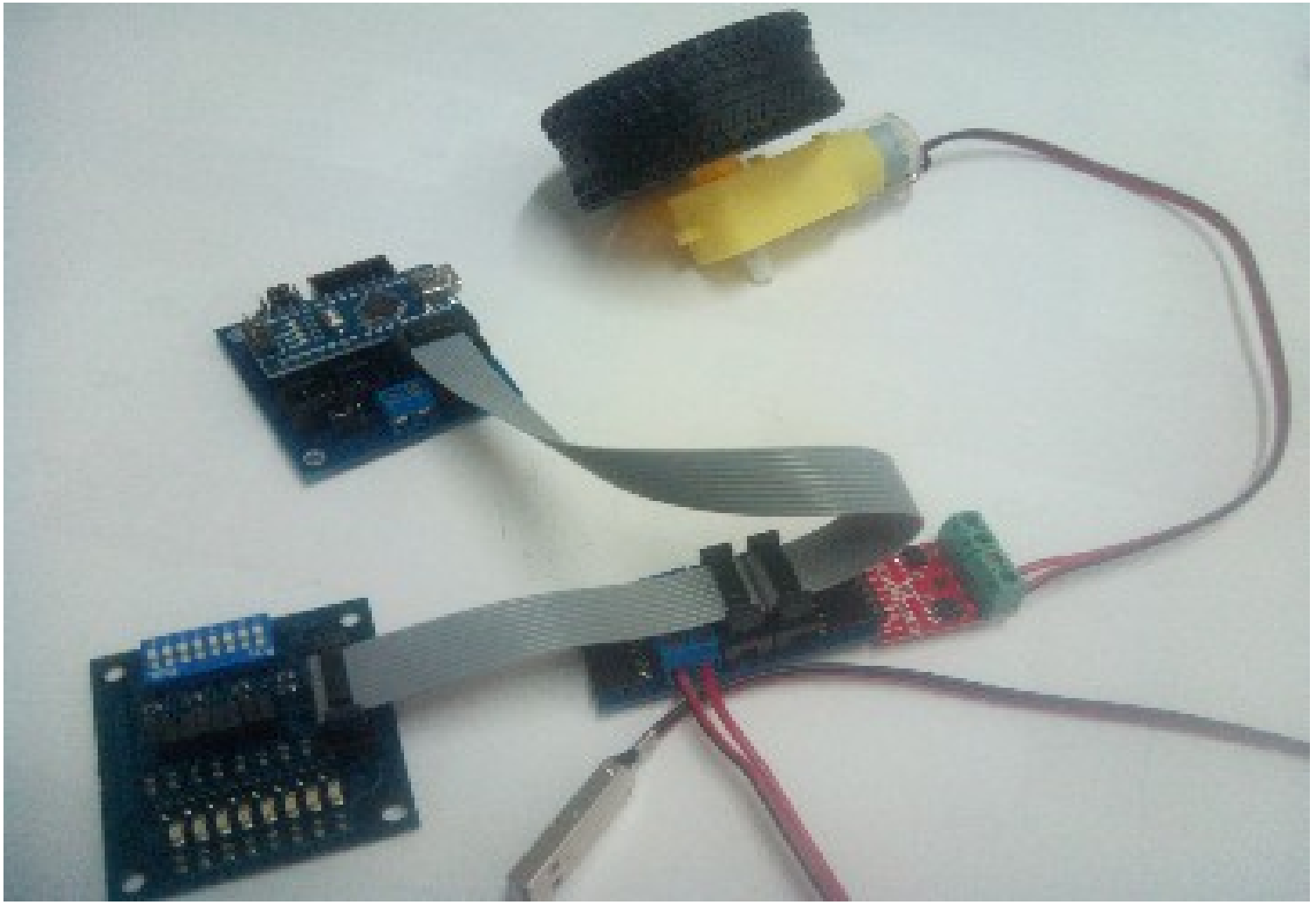
Arduino i Raspberry Pi

pr02.abp - Exercici

http://www.binefa.cat/php/arduino/ardublock/pr02_P2.abp
http://www.binefa.cat/php/arduino/ardublock/pr02_P1.abp

Arduino i Raspberry Pi

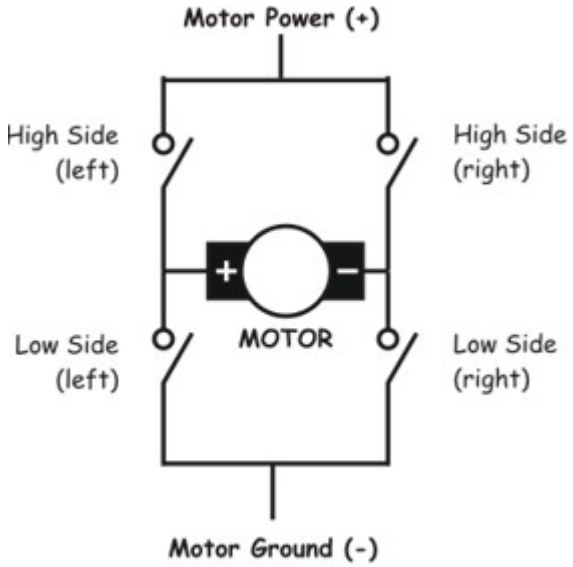
pr02.abp - Exercici

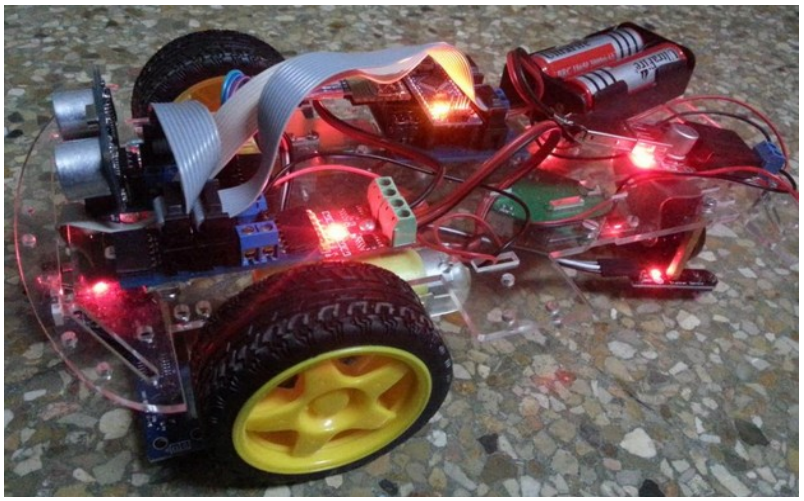


http://www.binefa.cat/php/arduino/ardublock/pr02_P2.abp
http://www.binefa.cat/php/arduino/ardublock/pr02_P1.abp

Arduino i Raspberry Pi

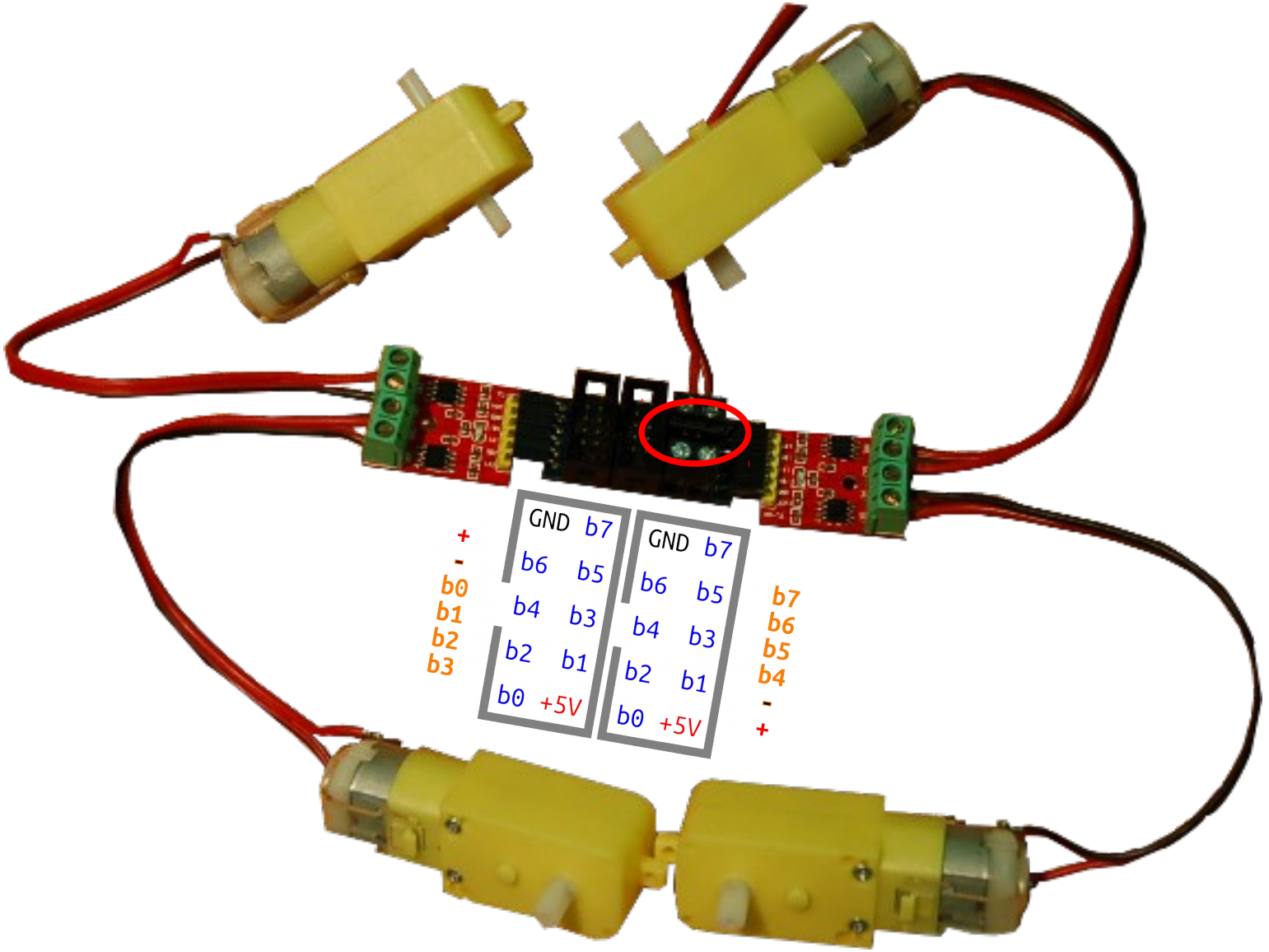
Pont en H





Arduino i Raspberry Pi

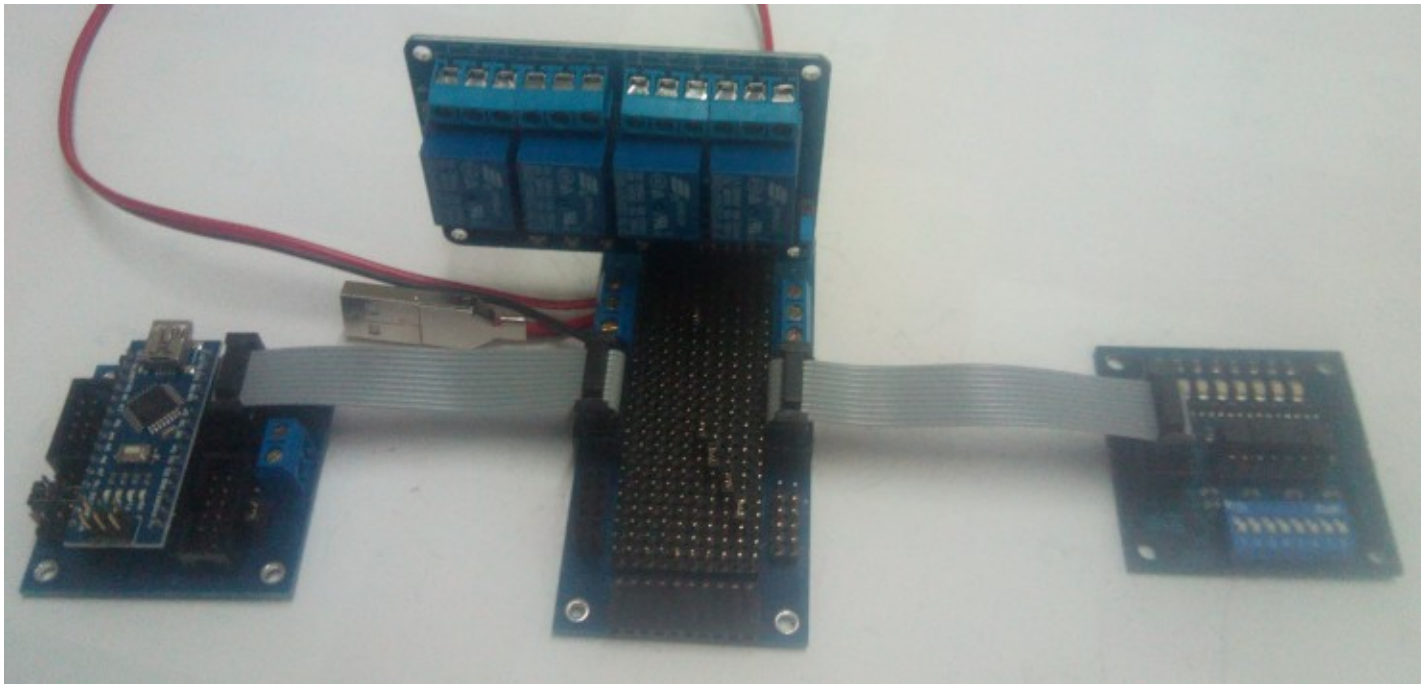
Pont en H

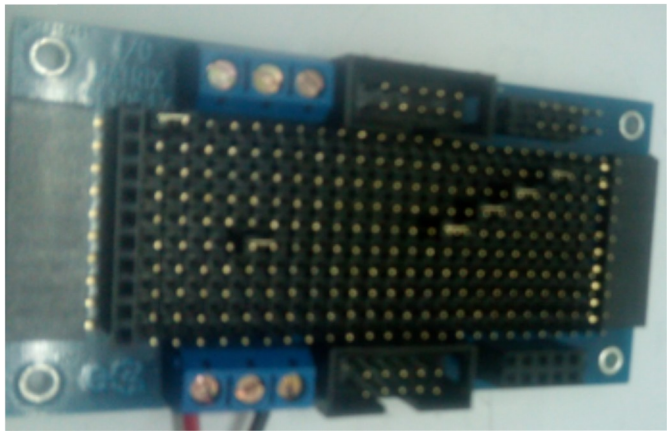


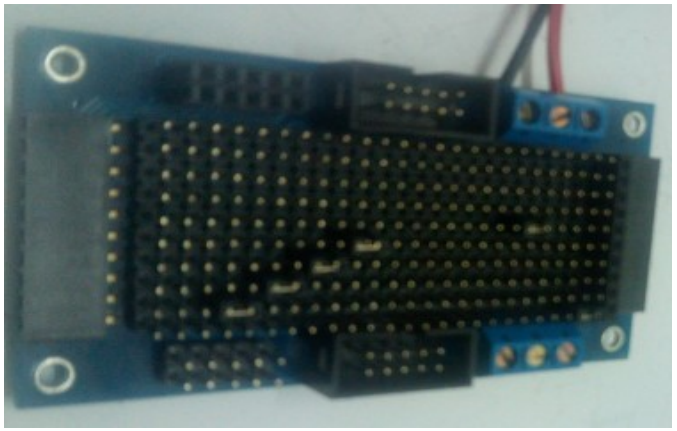
http://electronics.cat/php/common/index.php?lang=ca&page=520

Arduino i Raspberry Pi

pr02.abp - Exercici



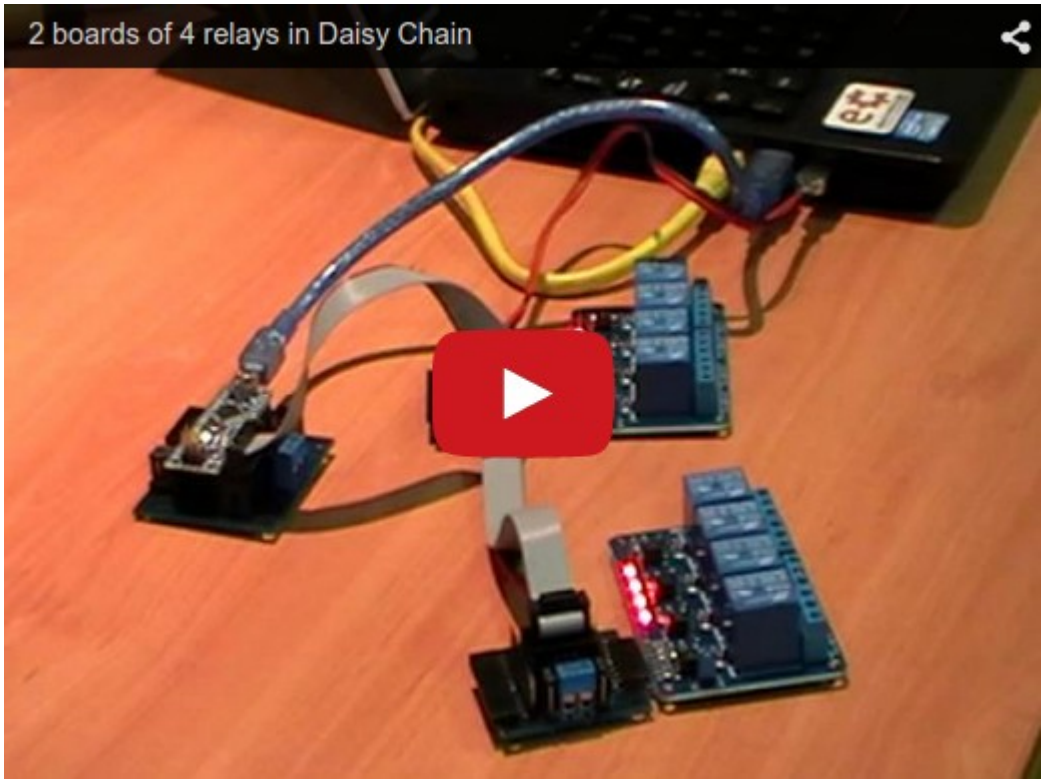


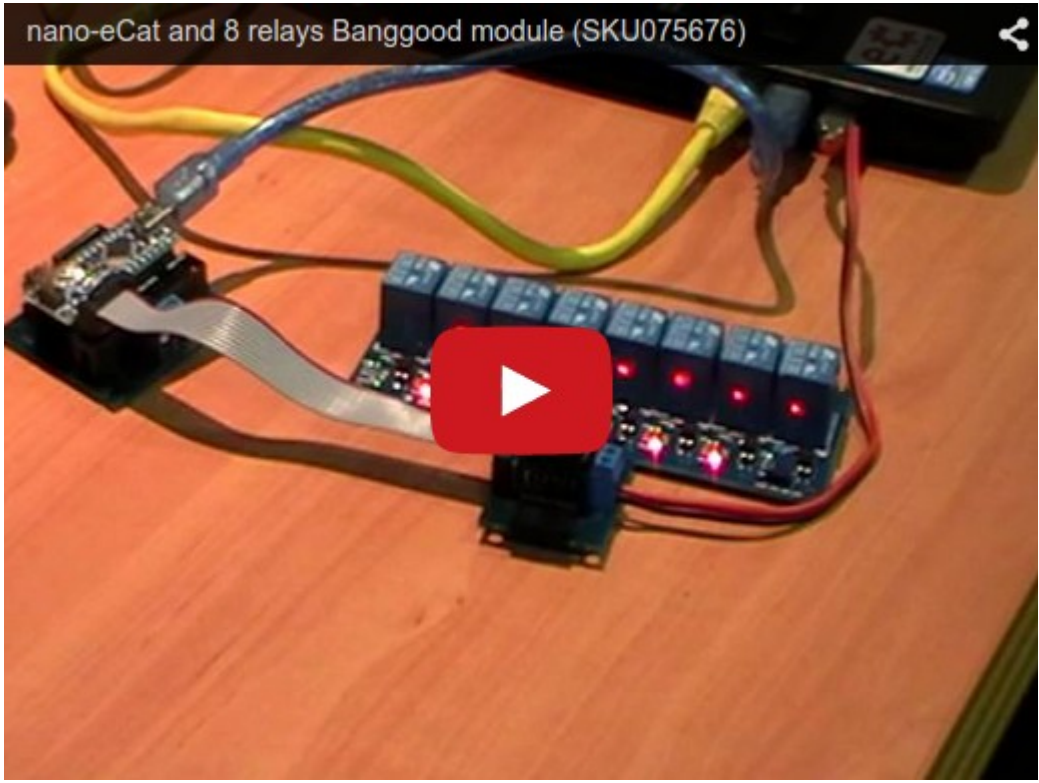


http://www.binefa.cat/php/arduino/ardublock/pr02_P2.abp
http://www.binefa.cat/php/arduino/ardublock/pr02_P1.abp

Arduino i Raspberry Pi

pr02.abp - Exercici





http://binefa.cat/blog/

http://www.binefa.cat/php/arduino/ardublock/pr02_P2.abp
http://www.binefa.cat/php/arduino/ardublock/pr02_P1.abp

Maquinari

Concepte de relé

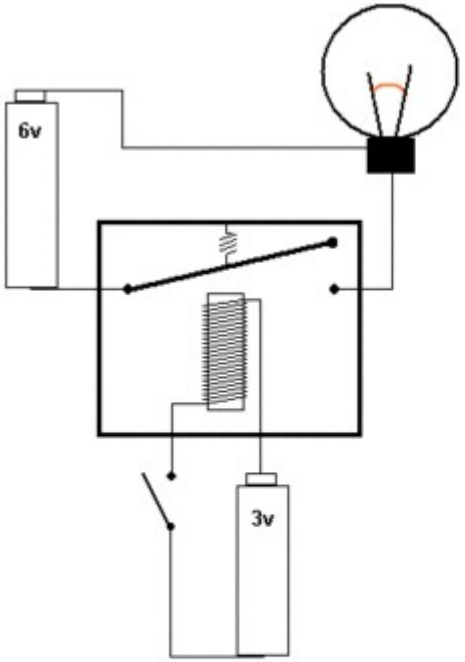


Figure 1: Relay off

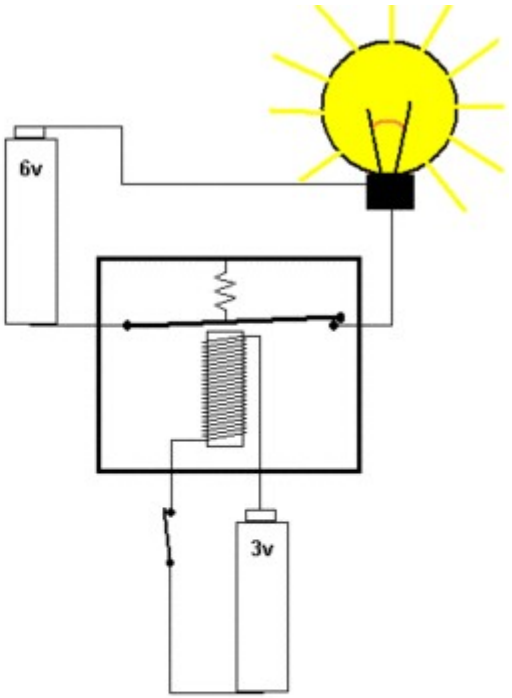
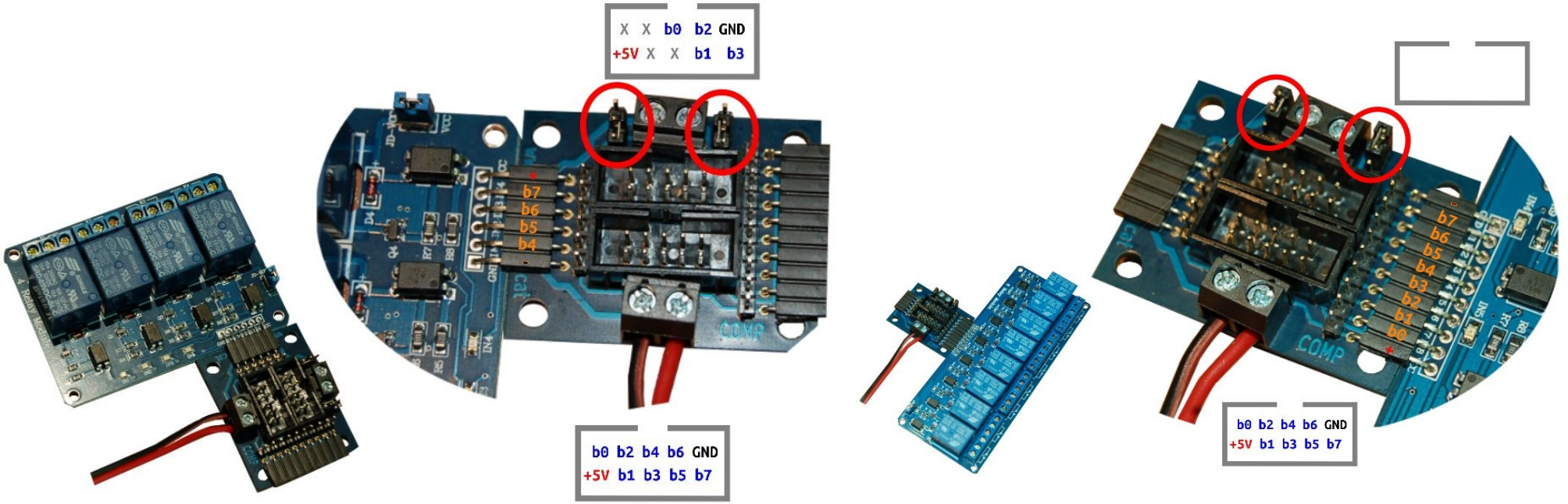
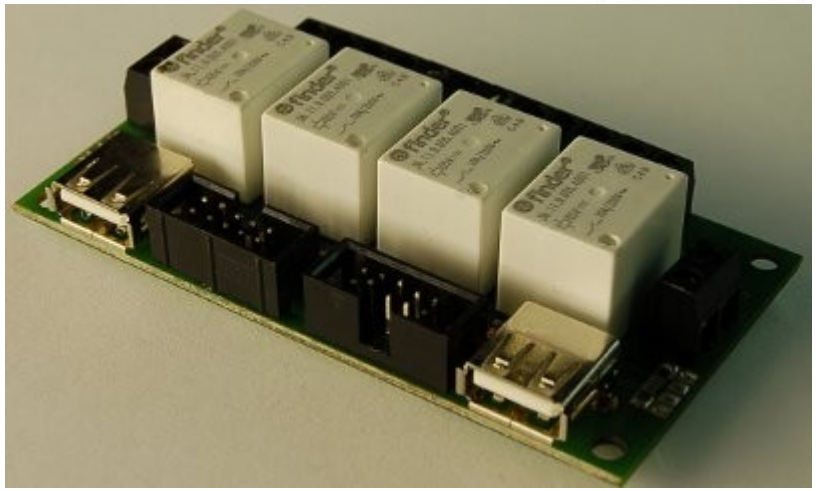


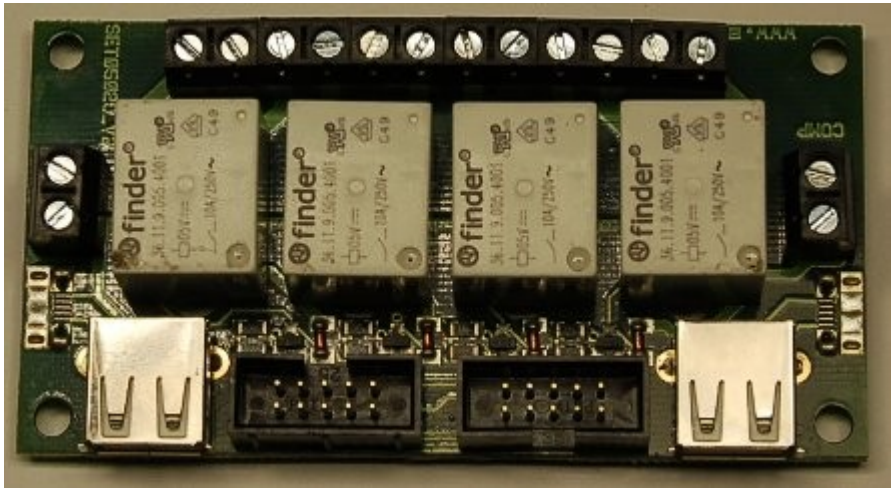
Figure 2: Relay on

Maquinari

4 Relés - Placa set05_02



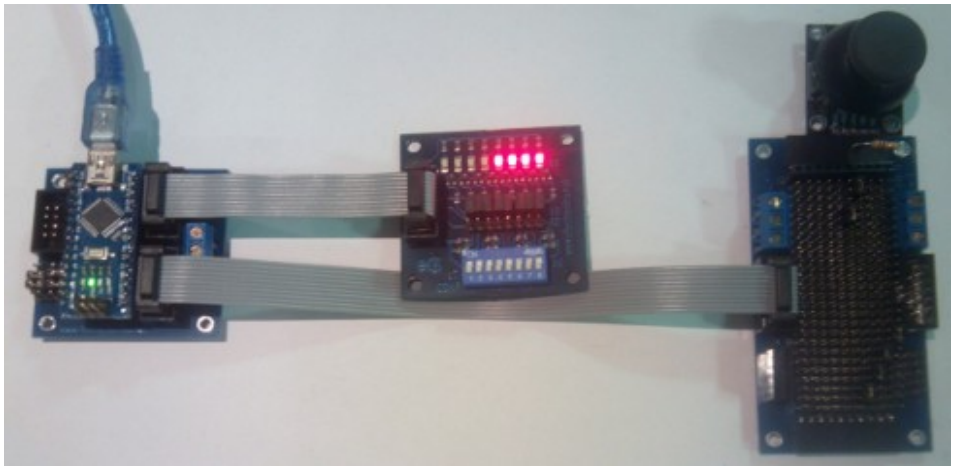


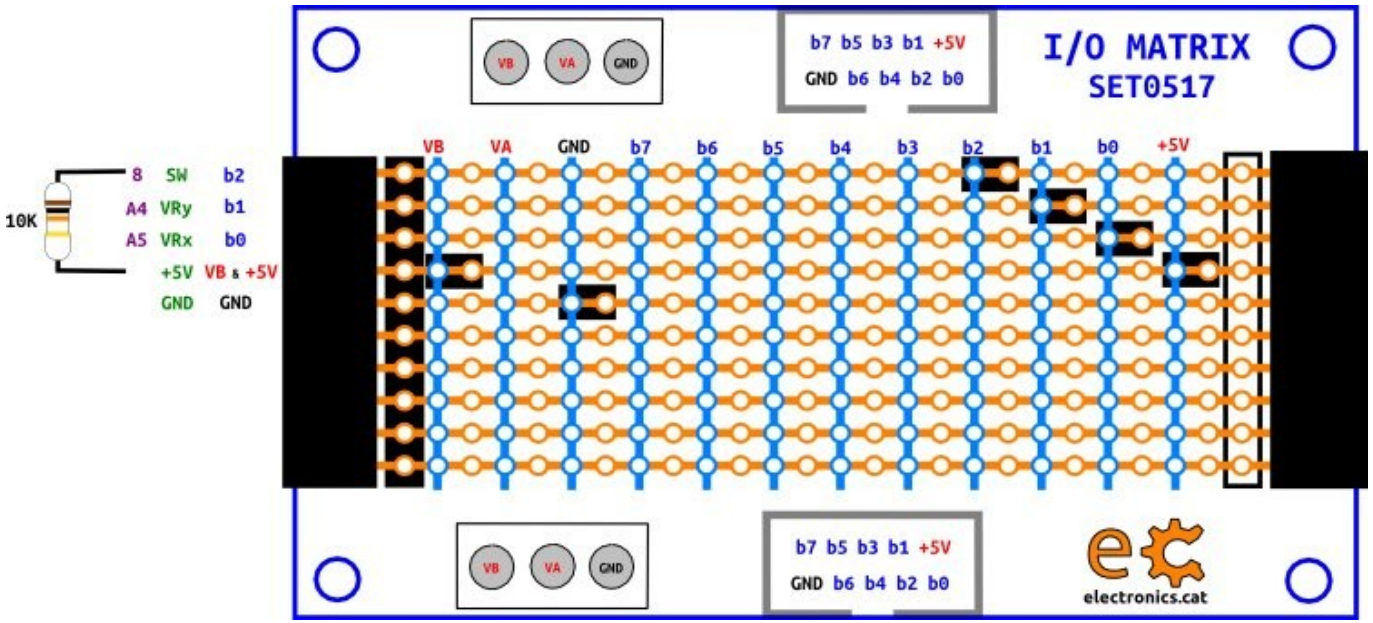


http://electronics.cat/php/common/index.php?lang=ca&page=502

Arduino i Raspberry Pi

pr03vuMeter.abp - Exercici



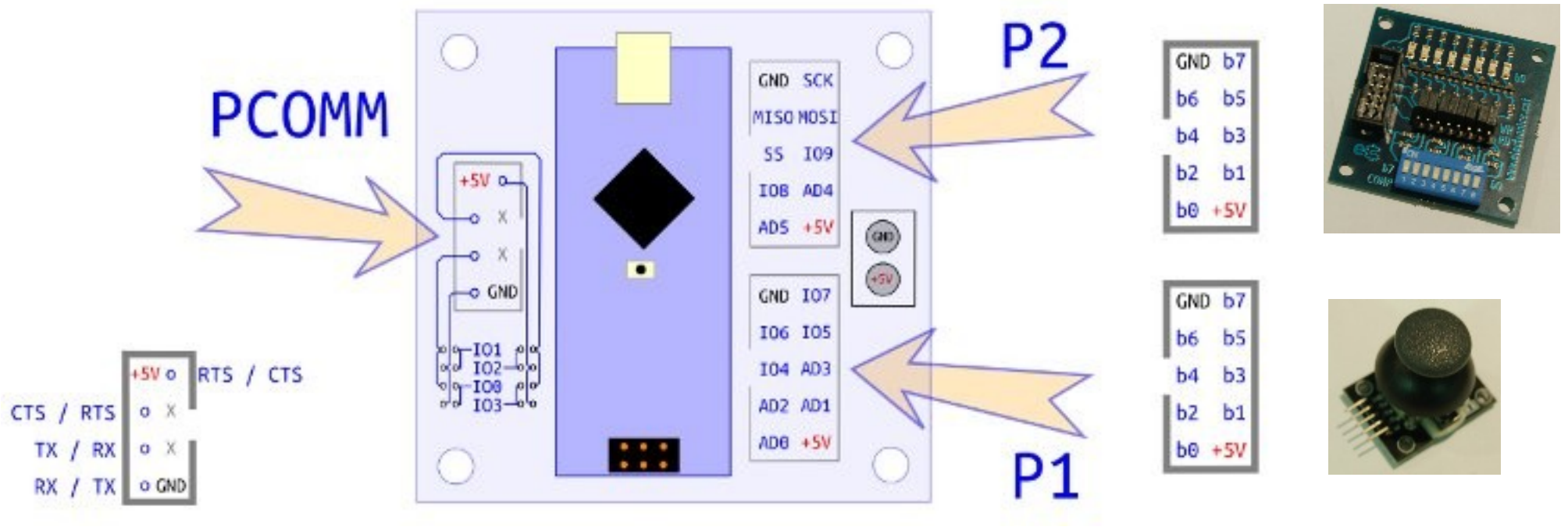


http://www.binefa.cat/php/arduino/ardublock/pr03vuMeter3bits.abp

http://www.binefa.cat/php/arduino/ardublock/pr03vuMeter8bits.abp

Arduino i Raspberry Pi

pr03vuMeter.abp - Exercici



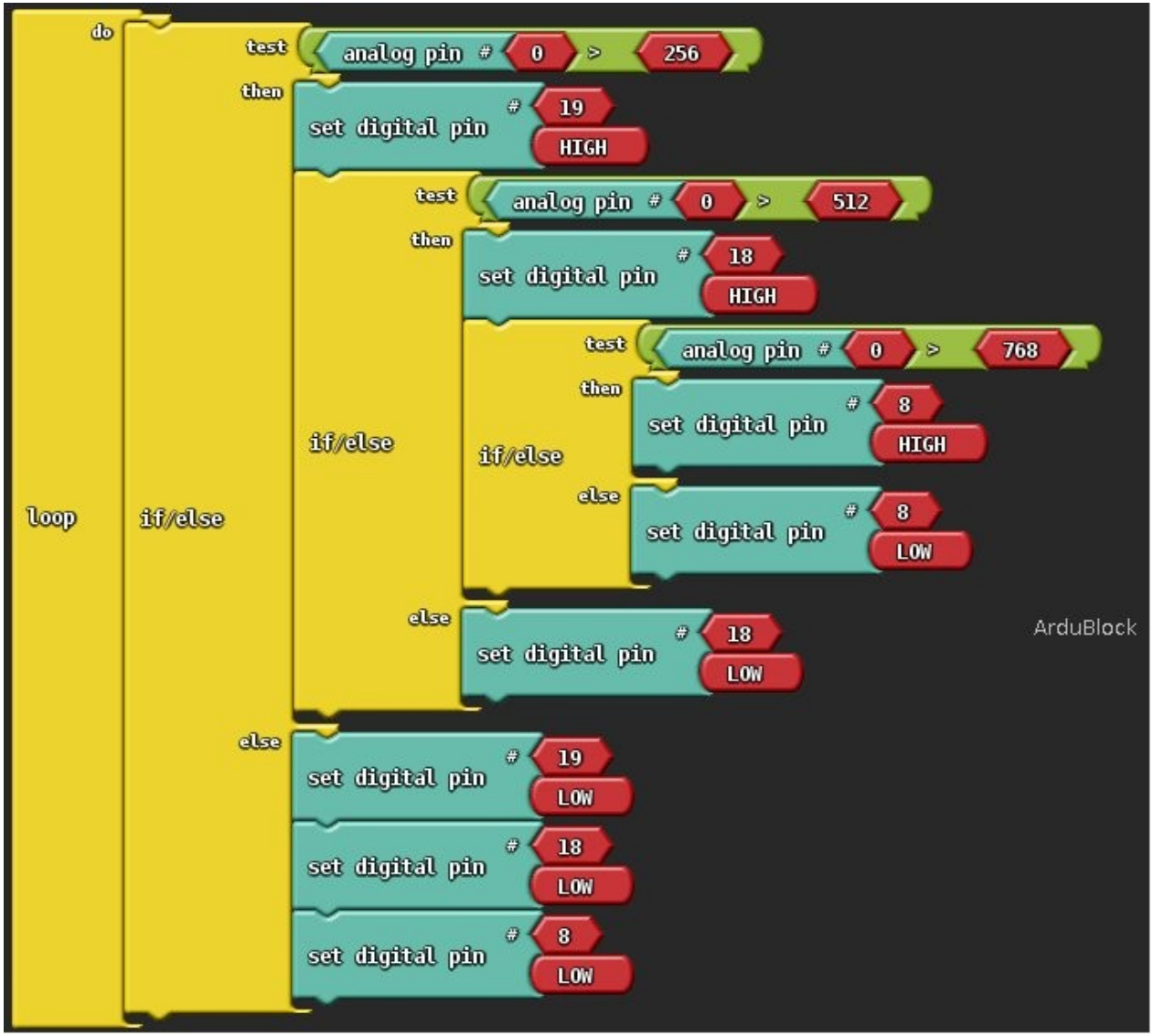
El valor analògic llegit màxim és 1023 i el mínim és 0

http://www.binefa.cat/php/arduino/ardublock/pr03vuMeter3bits.abp

http://www.binefa.cat/php/arduino/ardublock/pr03vuMeter8bits.abp

Arduino i Raspberry Pi

pr03vuMeter3bits.abp - Exercici

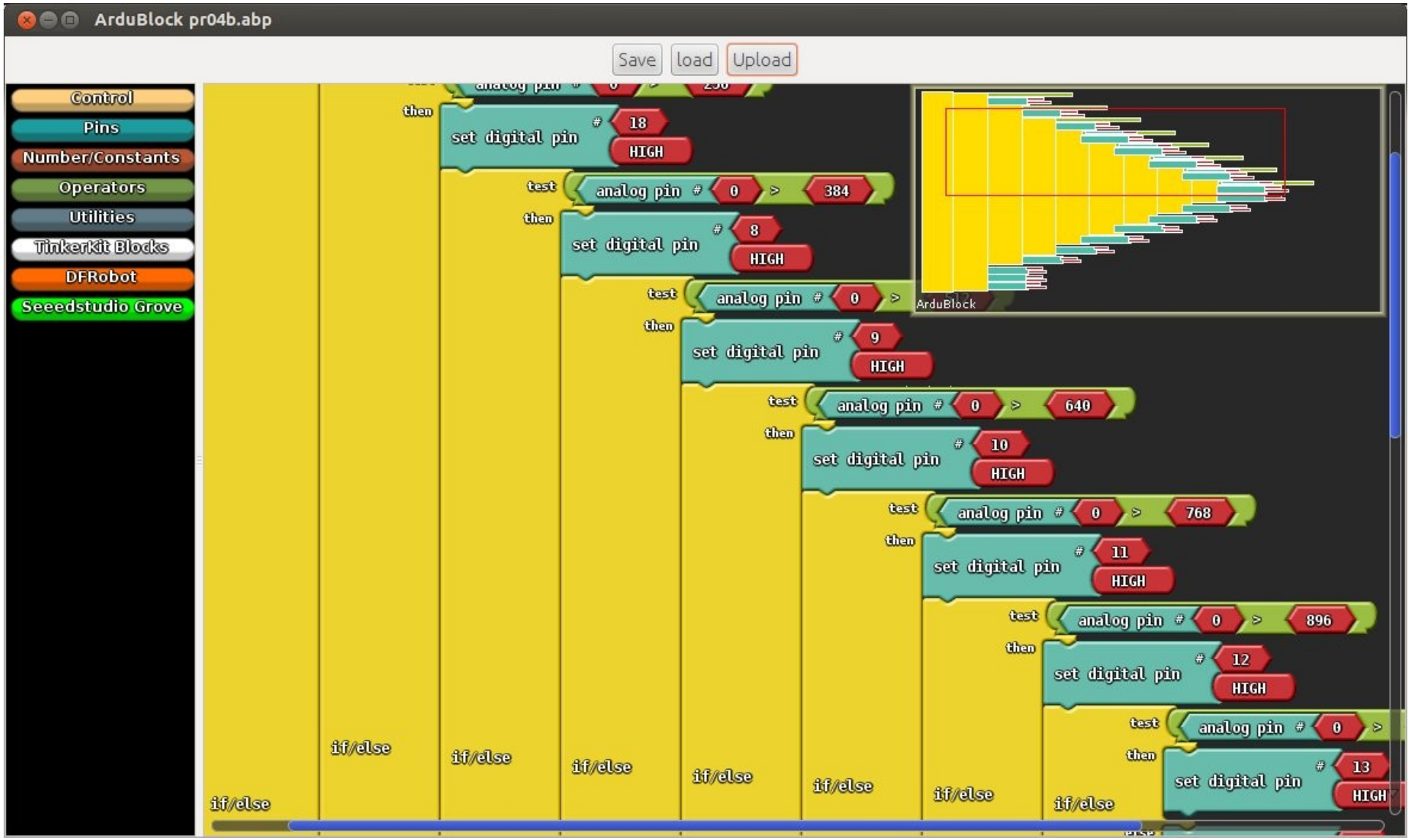


http://www.binefa.cat/php/arduino/ardublock/pr03vuMeter3bits.abp

http://www.binefa.cat/php/arduino/ardublock/pr03vuMeter8bits.abp

Arduino i Raspberry Pi

pr03vuMeter8bits.abp - Exercici



http://www.binefa.cat/php/arduino/ardublock/pr03vuMeter3bits.abp

http://www.binefa.cat/php/arduino/ardublock/pr03vuMeter8bits.abp

Arduino i Raspberry Pi

KIWIBOT

@_Leantec

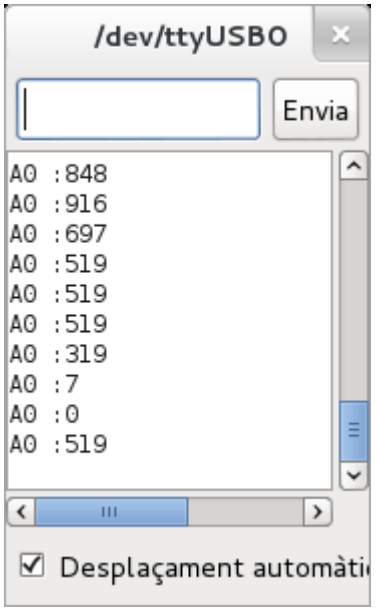
@jo_pujol

http://www.kiwibot.es

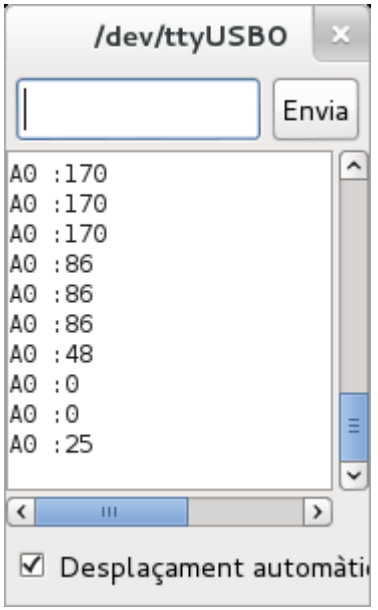
Arduino i Raspberry Pi

pr04joystick.abp - Exercici

http://www.binefa.cat/php/arduino/ardublock/pr04joystick.abp

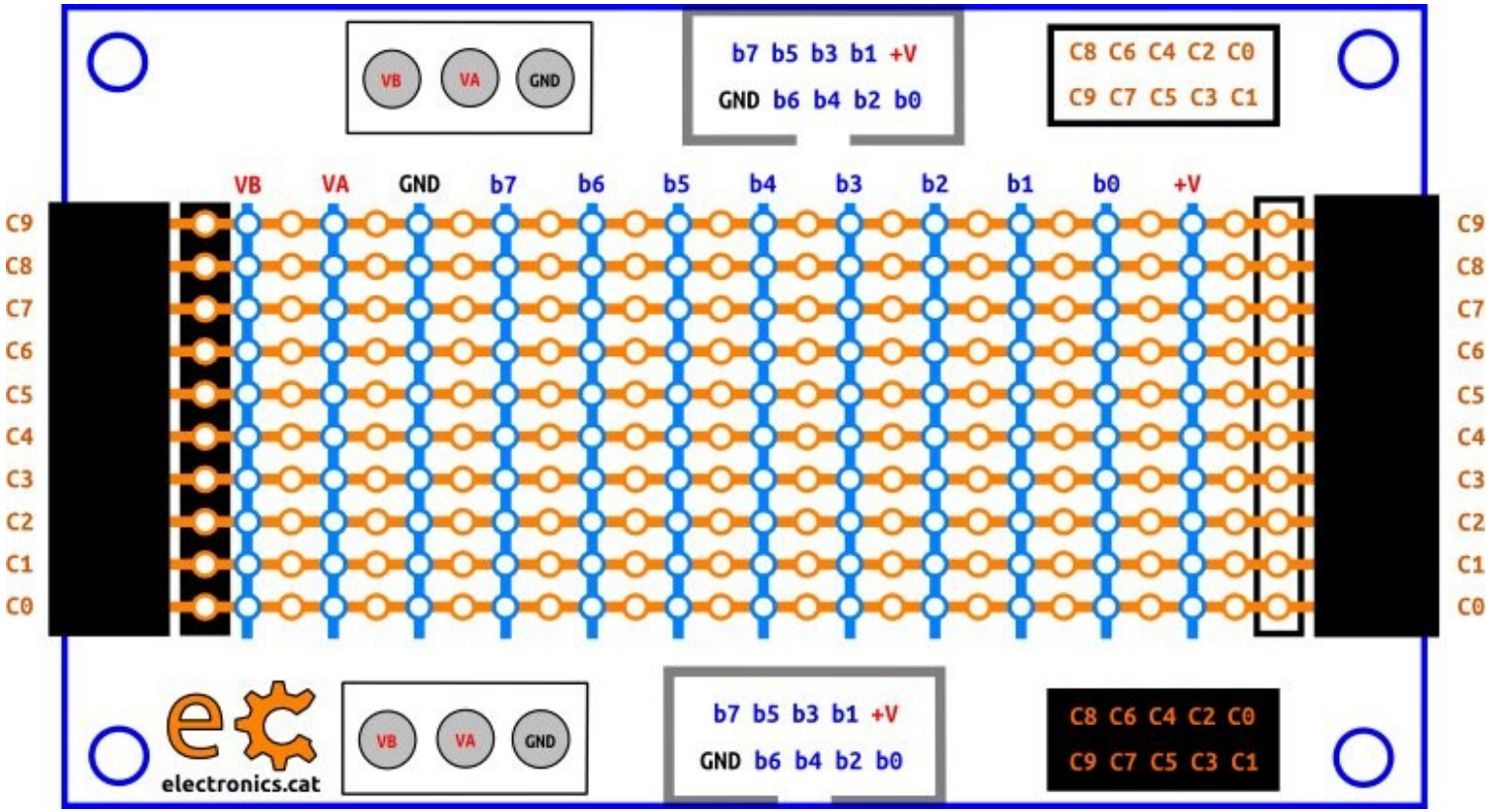


http://www.binefa.cat/php/arduino/ardublock/pr04joystickB.abp



Arduino i Raspberry Pi

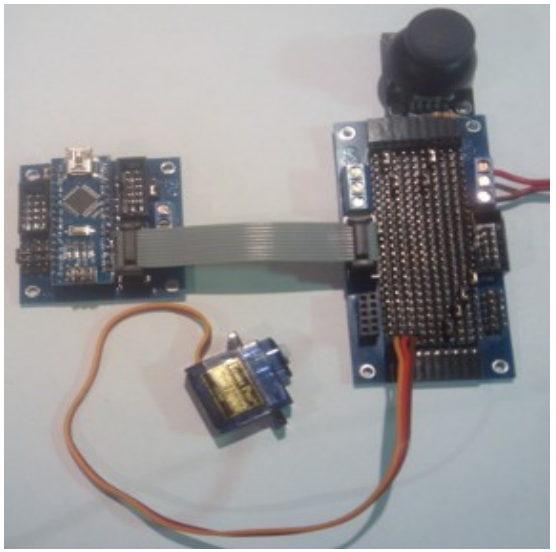
Matriu

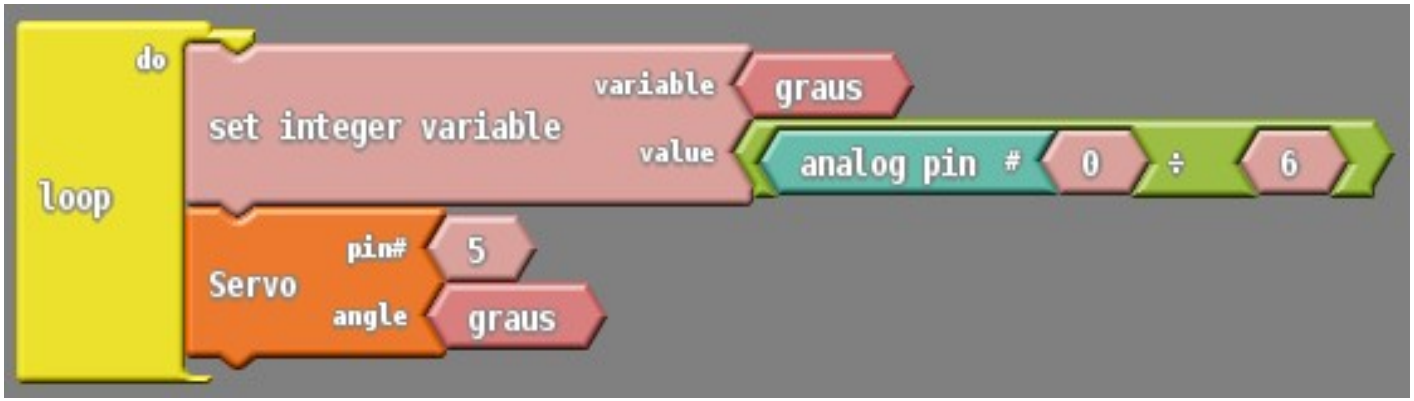


http://electronics.cat/php/common/index.php?lang=ca&page=517

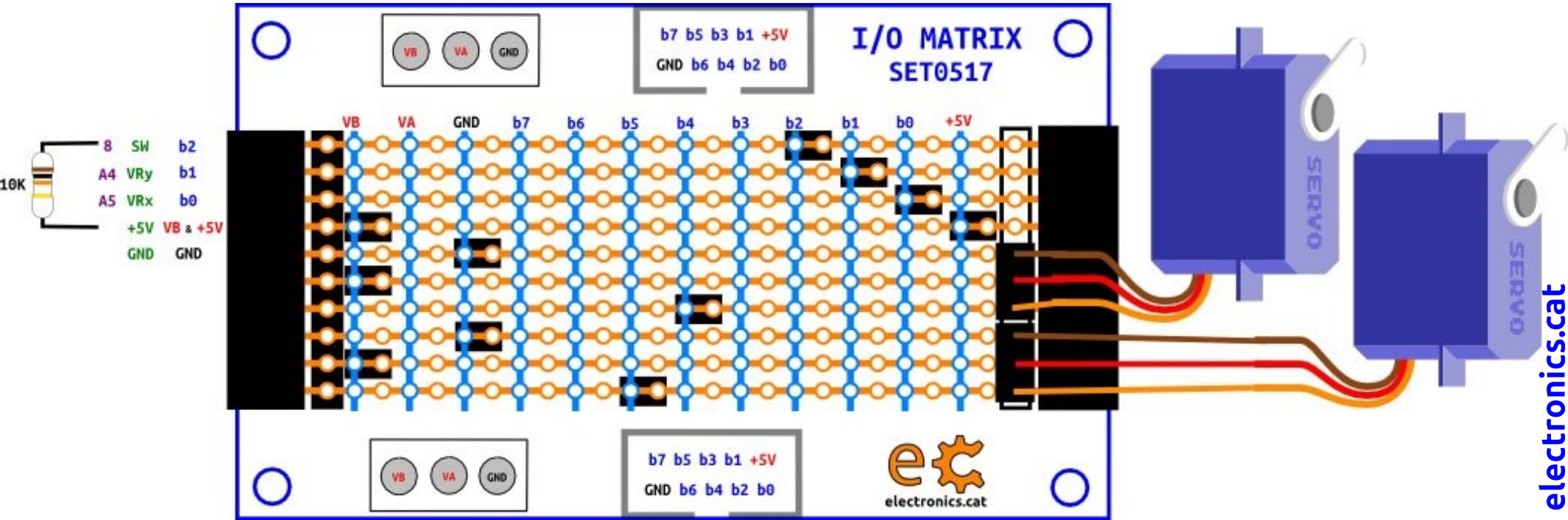
Arduino i Raspberry Pi

pr04joystickServo.abp - Exercici



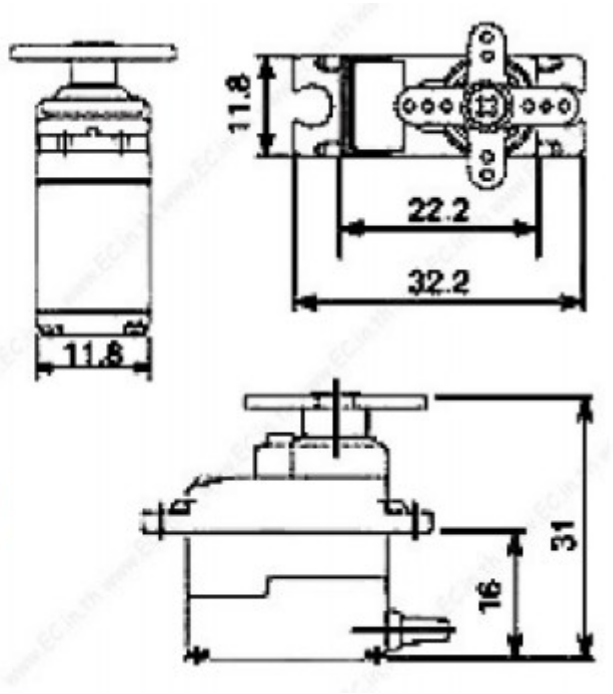


http://www.binefa.cat/php/arduino/ardublock/pr04joystickServo.abp



Arduino i Raspberry Pi

Servo



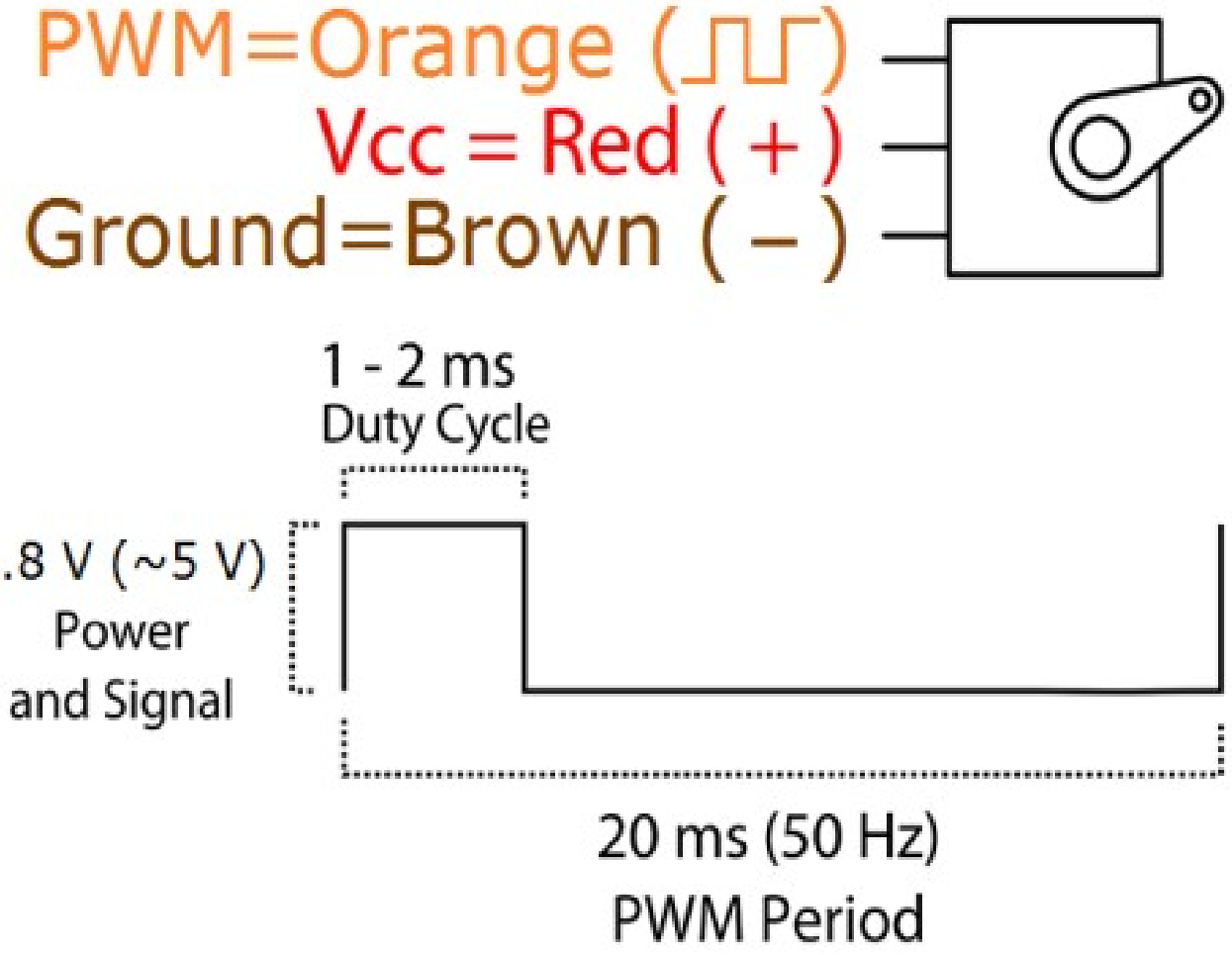
Specifications

- Weight: 9 g
- Dimension: 22.2 x 11.8 x 31 mm approx.
- Stall torque: 1.8 kgf·cm
- Operating speed: 0.1 s/60 degree
- Operating voltage: 4.8 V (~5V)
- Dead band width: 10 µs
- Temperature range: 0 ºC – 55 ºC

http://datasheet.sparkgo.com.br/SG90Servo.pdf

Arduino i Raspberry Pi

Servo

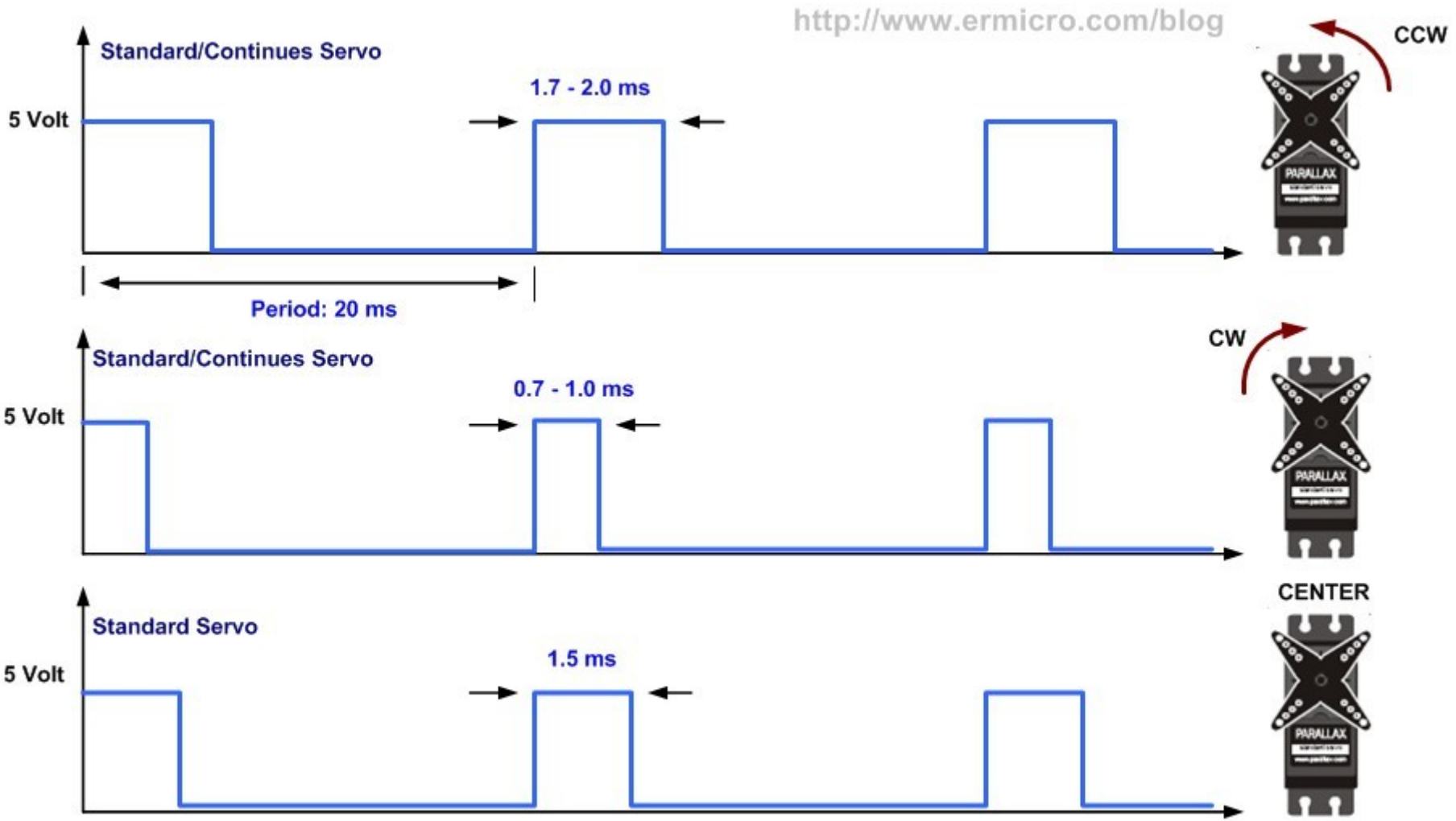


Position "0" (1.5 ms pulse) is middle, "90" (~2 ms pulse) is all the way to the right, "-90" (~1 ms pulse) is all the way to the left.

http://datasheet.sparkgo.com.br/SG90Servo.pdf

Arduino i Raspberry Pi

Servo

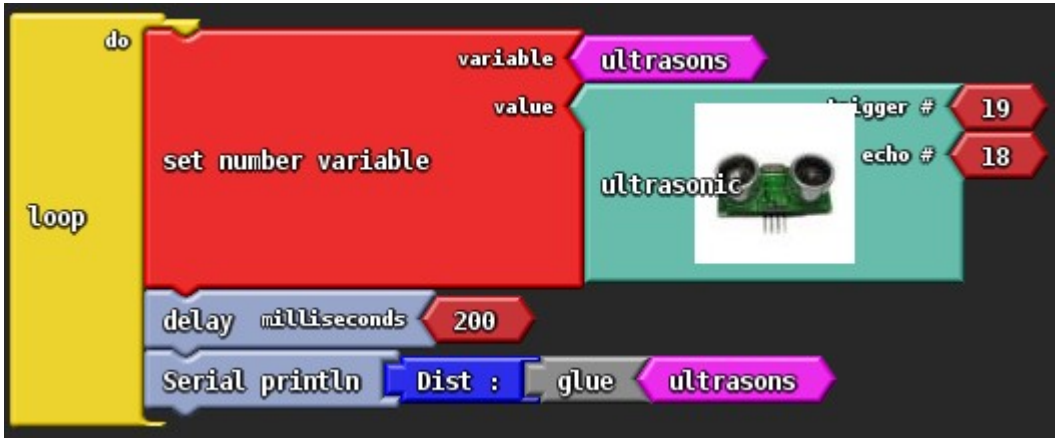


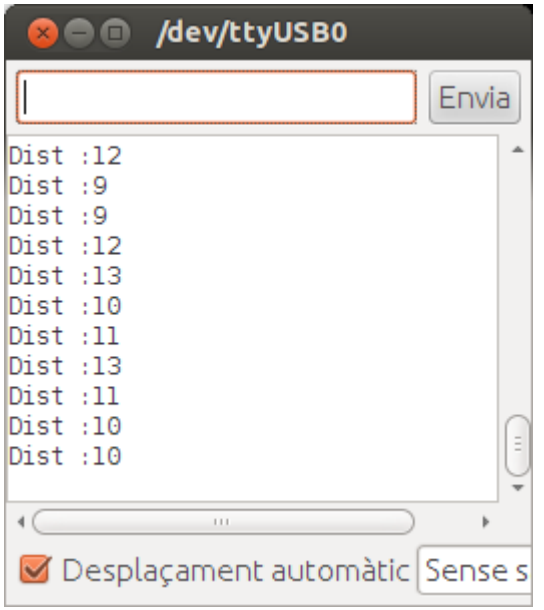
Servo Motor PWM Timing Diagram

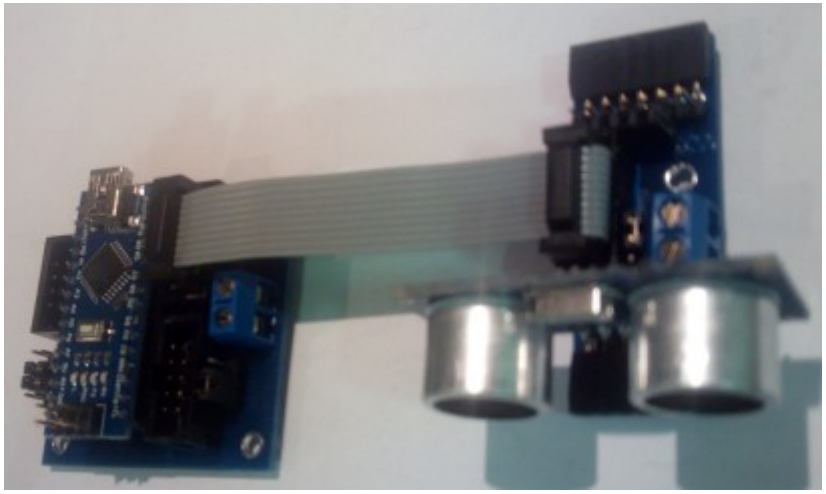
http://www.ermicro.com/blog/wp-content/uploads/2009/02/servo_01.jpg

Arduino i Raspberry Pi

pr05ultrasons.abp Mesura ultrasònica







http://www.binefa.cat/php/arduino/ardublock/pr05ultrasons.abp

http://www.binefa.cat/php/doc/pr002/

Arduino i Raspberry Pi

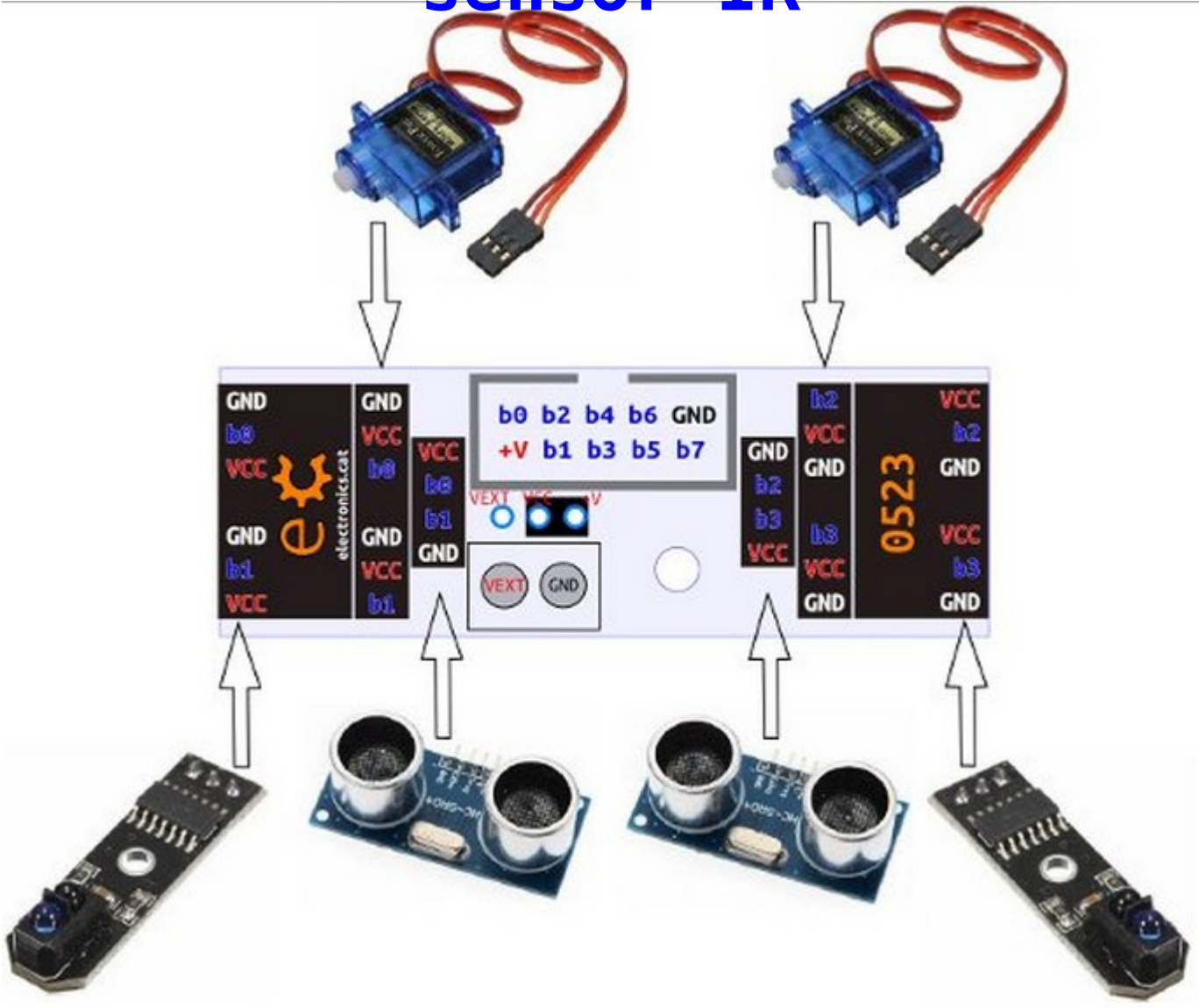
Exercici Ultrasons + Servo

Emprant l'ArduBlock feu que el servo es mogui en funció de la distància llegida pels ultrasons.

Haureu de tenir en compte que el servo accepta un valor mínim i un màxim.

Arduino i Raspberry Pi

Connexions a la placa 0523 – Connexió sensor IR



Arduino i Raspberry Pi

Exercici Ultrasons + Servo + sensor IR

Emprant l'ArduBlock feu que el servo es mogui en funció de la distància llegida pels ultrasons, en cas de que el sensor d'infrarojos detecti presència.

Haureu de tenir en compte que el servo accepta un valor mínim i un màxim.

Arduino i Raspberry Pi

Arduino Nano + LCD + Joystick + Servo

```
#include <LiquidCrystal.h>
#include <Servo.h>

LiquidCrystal lcd(16, 17, 4,5, 6, 7); // P1
//LiquidCrystal lcd(8,9,10,11,12,13); // P2
Servo servo1; Servo servo2;

const int buttonPin = 8;
//const int buttonPin = 16;
int analogPinX = 5,analogPinY = 4;
//int analogPinX = 0,analogPinY = 1;
int buttonState = 0;

void setup() {
  // set up the LCD's number of columns and rows
  lcd.begin(16, 2);
  lcd.print("electronics.cat");
  pinMode(buttonPin, INPUT);
  servo1.attach(10);
  servo2.attach(11);
  servo1.write(90);
  servo2.write(90);
}
```

```
unsigned long int nAnalogValue2Degrees(unsigned long int nAnalogValue){
  return (nAnalogValue * 180) / 1023;
}

void loop() {
  buttonState = digitalRead(buttonPin);
  unsigned long int degX = nAnalogValue2Degrees(analogRead(analogPinX));
  unsigned long int degY = nAnalogValue2Degrees(analogRead(analogPinY));
  // set the cursor to column 0, line 1 (note: line 1 is the second row, since counting begi
  lcd.setCursor(0, 1);
  if (buttonState == HIGH) {
    lcd.print("F ");
  }else{
    lcd.print("N ");
  }
  lcd.print("X:");lcd.print(degX); lcd.print("d  Y:");lcd.print(degY);lcd.print("d      ");
  servo1.write(degX);
  servo2.write(degY);
}
```

http://www.binefa.cat/php/doc/lcdJsServo/
http://www.binefa.cat/php/arduino/ardublock/lcdJsServo/lcdJsServo.ino

Arduino i Raspberry Pi

Arduino Nano + LCD + Joystick + Servo

```
#include <LiquidCrystal.h>
#include <Servo.h>

LiquidCrystal lcd(16, 17, 4,5, 6, 7); // P1
//LiquidCrystal lcd(8,9,10,11,12,13); // P2
Servo servo1; Servo servo2;

const int buttonPin = 8;
//const int buttonPin = 16;
int analogPinX = 5,analogPinY = 4;
//int analogPinX = 0,analogPinY = 1;
int buttonState = 0;

void setup() {
  // set up the LCD's number of columns and rows:
  lcd.begin(16, 2);
  lcd.print("electronics.cat");
  pinMode(buttonPin, INPUT);
  servo1.attach(10);
  servo2.attach(11);
  servo1.write(90);
  servo2.write(90);
}
```

http://www.binefa.cat/php/doc/lcdJsServo/
http://www.binefa.cat/php/arduino/ardublock/lcdJsServo/lcdJsServo.ino

Arduino i Raspberry Pi

Arduino Nano + LCD + Joystick + Servo

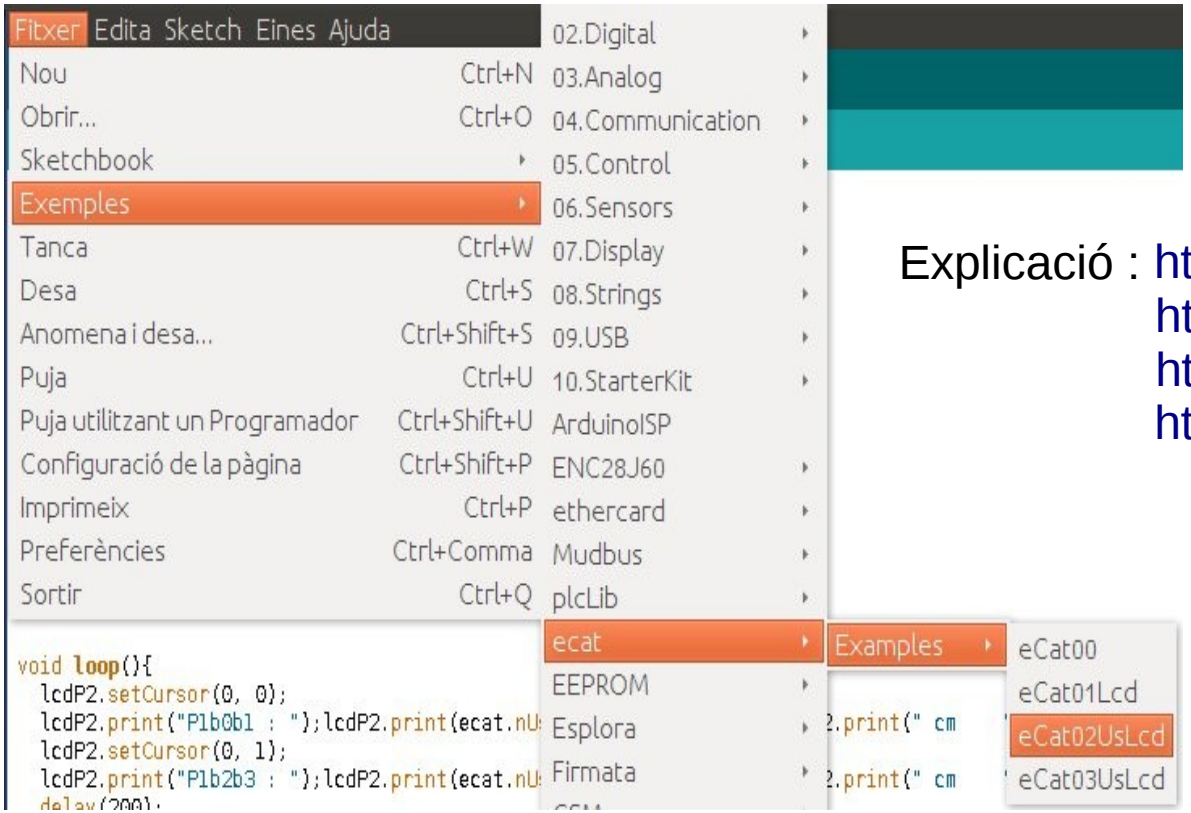
```
unsigned long int nAnalogValue2Degrees(unsigned long int nAnalogValue){
  return (nAnalogValue * 180) / 1023;
}

void loop() {
  buttonState = digitalRead(buttonPin);
  unsigned long int degX = nAnalogValue2Degrees(analogRead(analogPinX));
  unsigned long int degY = nAnalogValue2Degrees(analogRead(analogPinY));
  // set the cursor to column 0, line 1 (note: line 1 is the second row, since counting begins with 0):
  lcd.setCursor(0, 1);
  if (buttonState == HIGH) {
    lcd.print("F ");
  }else{
    lcd.print("N ");
  }
  lcd.print("X:");lcd.print(degX); lcd.print("d  Y:");lcd.print(degY);lcd.print("d      ");
  servo1.write(degX);
  servo2.write(degY);
}
```

http://www.binefa.cat/php/doc/lcdJsServo/
http://www.binefa.cat/php/arduino/ardublock/lcdJsServo/lcdJsServo.ino

Arduino i Raspberry Pi

Biblioteca ecat.h per a l'IDE d'Arduino

http://www.electronics.cat/doc/arduinoLib/ecat.zip



Explicació : http://www.binefa.cat/php/doc/lib-eCat01/
http://www.binefa.cat/php/doc/lib-eCat02/
http://www.binefa.cat/php/doc/lib-eCat03/
http://binefa.cat/blog/?p=140

Arduino i Raspberry Pi

Biblioteca ecat.h per a l'IDE d'Arduino

http://www.electronics.cat/doc/arduinoLib/ecat.zip

Explicació : http://www.binefa.cat/php/doc/lib-eCat01/
http://www.binefa.cat/php/doc/lib-eCat02/
http://www.binefa.cat/php/doc/lib-eCat03/
http://binefa.cat/blog/?p=140

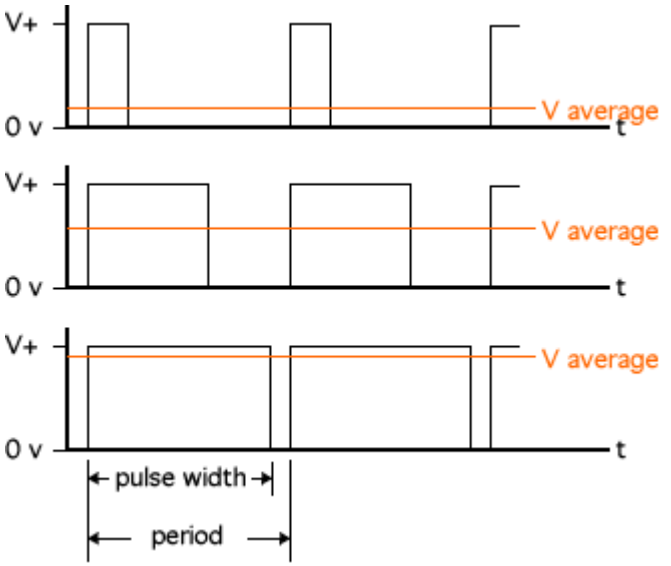
```
#include <ecat.h>

#define ROBOT_ATURAT      0
#define ROBOT_ENDAVANT    1
#define ROBOT_ENDARRERA   2
#define ROBOT_DRETA       3
#define ROBOT_ESQUERRA    4

String szMissatge;
Ecat ecat;
boolean bConnectat;
int nG,nA,nB,nEstatActual;

void setup(){
  ecat.setupNibbleMode(NIBBLE_H_P1,OUTPUT);
  ecat.vUltrasonicSensorP1b0b1_init();
  pinMode(ecat.nPinP1B2,INPUT);
  pinMode(ecat.nPinP1B3,INPUT);
  pinMode(ecat.nPinP2B7,OUTPUT);
  pinMode(ecat.nPinP2B6,INPUT);
  pinMode(ecat.nPinP2B5,INPUT);
  pinMode(ecat.nPinP2B4,INPUT);
  ecat.setupNibbleMode(NIBBLE_L_P2,INPUT);
  Serial.begin(9600);
  nG = 150;
  nA = nB = 30;
  bConnectat = false;
  nEstatActual = ROBOT_ATURAT;
}

```

http://electronics.cat/downloads/code/robot08.ino

Arduino i Raspberry Pi

Modulació per amplada de pols PWM

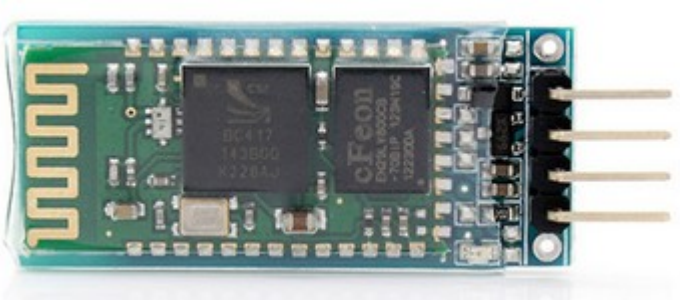
```
31  int nPwmA(){
32    int nAux = nG + nA;
33    if(nAux > 255)
34      nAux = 255;
35    return nAux;
36  }
37
38  int nPwmB(){
39    int nAux = nG + nB;
40    if(nAux > 255)
41      nAux = 255;
42    return nAux;
43  }
44
45  void vRobotAturat(){
46    nEstatActual = ROBOT_ATURAT;
47    ecat.vWriteHighNibbleP1(0x00);
48  }
49
50  void vRobotEndavant(){
51    //ecat.vWriteHighNibbleP1(B00000110);
52    nEstatActual = ROBOT_ENDAVANT;
53    digitalWrite(ecat.nPinP1B4,LOW);
54    analogWrite(ecat.nPinP1B5,nPwmA());
55    analogWrite(ecat.nPinP1B6,nPwmB());
56    digitalWrite(ecat.nPinP1B7,LOW);
57  }
```



Arduino i Raspberry Pi

Preparant la comunicació BlueTooth

```
#include <ecat.h>

Ecat ecat;
boolean bP2B0;

void setup(){
  pinMode(ecat.nPinP2B7,OUTPUT);
  pinMode(ecat.nPinP2B0,INPUT);
  Serial.begin(9600);
  bP2B0 = digitalRead(ecat.nPinP2B0);
}

void loop(){
  String szMsg;

  while(Serial.available()){
    delay(3);
    char c = Serial.read();
    szMsg += c;
  }
  if(szMsg == "n"){
    digitalWrite(ecat.nPinP2B7,HIGH);
  }
  if(szMsg == "f"){
    digitalWrite(ecat.nPinP2B7,LOW);
  }
  if(bP2B0 != digitalRead(ecat.nPinP2B0)){
    bP2B0 = digitalRead(ecat.nPinP2B0);
    if(bP2B0){
      Serial.println("P2B0 HIGH");
    }else{
      Serial.println("P2B0 LOW");
    }
  }
  szMsg = "";
}
```



http://electronics.cat/doc/hc06/bluetooth04.ino

Arduino i Raspberry Pi

Preparant la comunicació BlueTooth

```
#include <ecat.h>

Ecat ecat;
boolean bP2B0;

void setup(){
  pinMode(ecat.nPinP2B7,OUTPUT);
  pinMode(ecat.nPinP2B0,INPUT);
  Serial.begin(9600);
  bP2B0 = digitalRead(ecat.nPinP2B0);
}
```

http://electronics.cat/doc/hc06/bluetooth04.ino

Arduino i Raspberry Pi

Preparant la comunicació BlueTooth

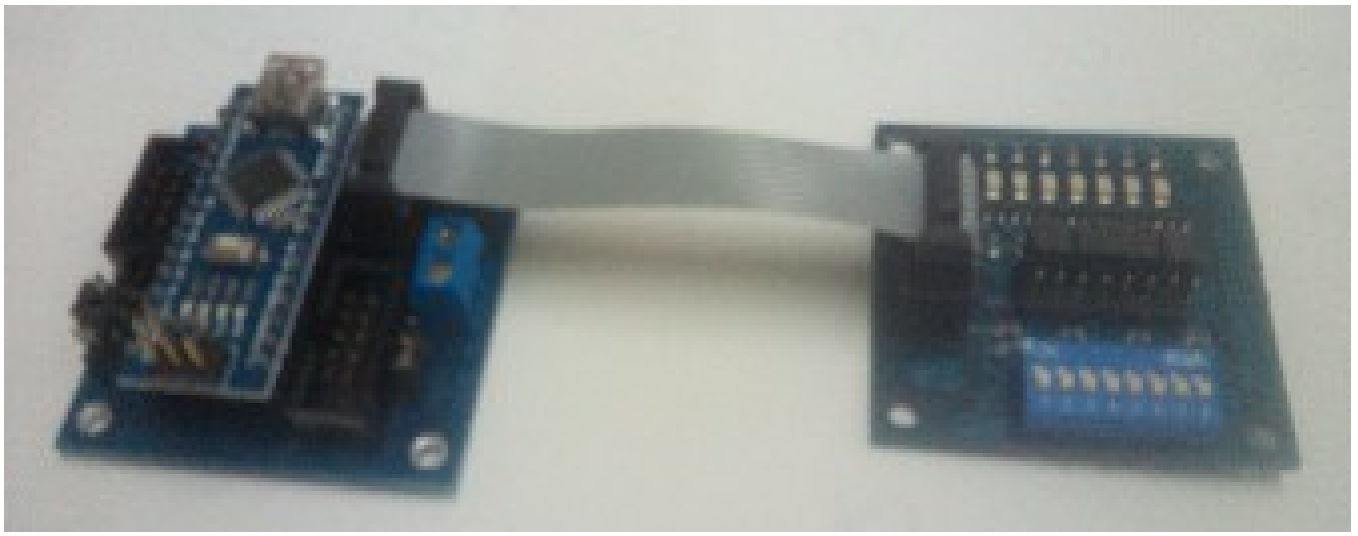
```
void loop(){
  String szMsg;

  while(Serial.available()){
    delay(3);
    char c = Serial.read();
    szMsg += c;
  }
  if(szMsg == "n"){
    digitalWrite(ecat.nPinP2B7,HIGH);
  }
  if(szMsg == "f"){
    digitalWrite(ecat.nPinP2B7,LOW);
  }
  if(bP2B0 != digitalRead(ecat.nPinP2B0)){
    bP2B0 = digitalRead(ecat.nPinP2B0);
    if(bP2B0){
      Serial.println("P2B0 HIGH");
    }else{
      Serial.println("P2B0 LOW");
    }
  }
  szMsg = "";
}
```

http://electronics.cat/doc/hc06/bluetooth04.ino

Arduino i Raspberry Pi

Preparant la comunicació BlueTooth

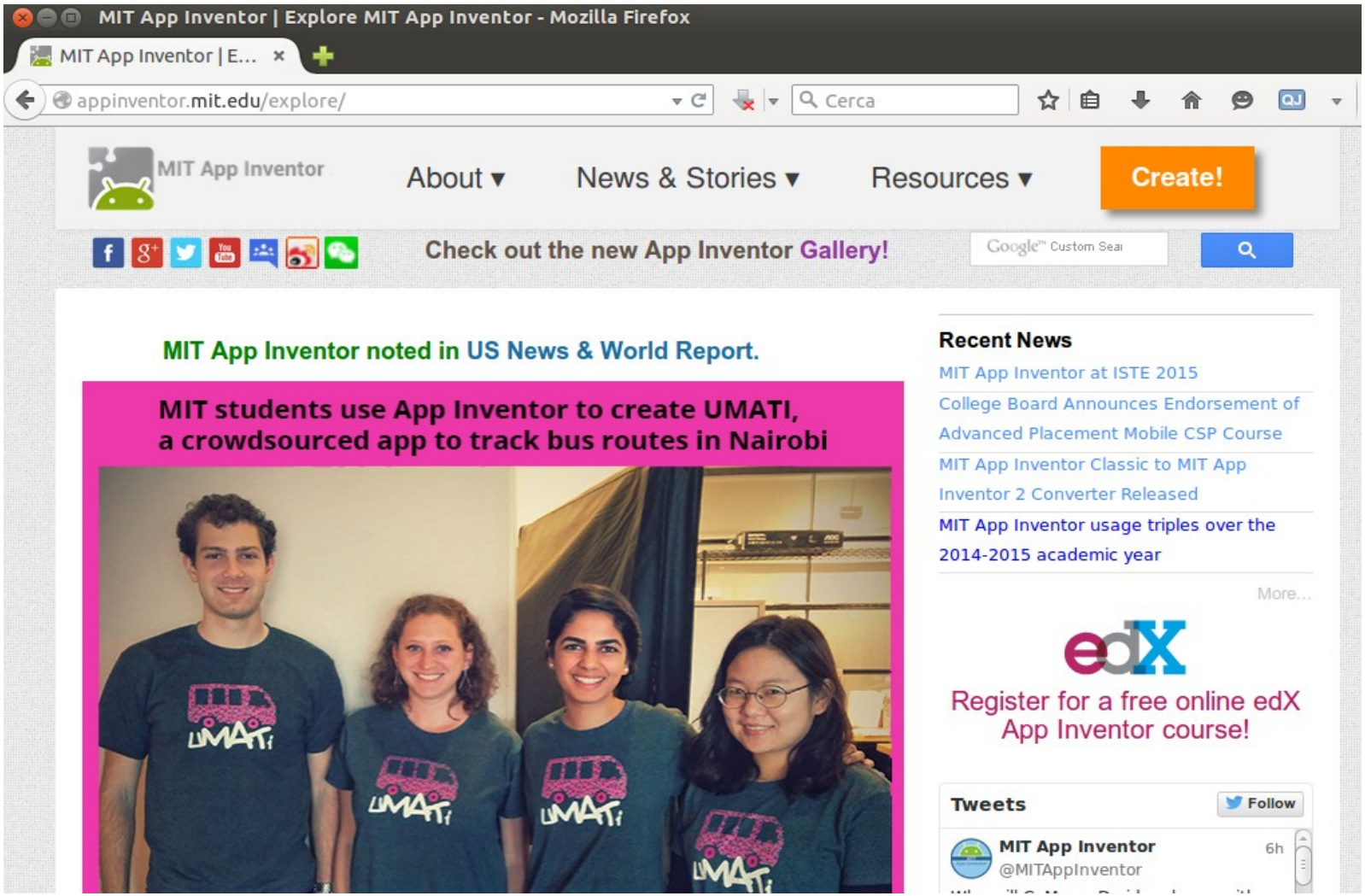
Verifiqueu el funcionament del programa bluetooth04.ino interactuant amb qualsevol dels programes de comunicacions que coneixeu



http://electronics.cat/doc/hc06/bluetooth04.ino

Arduino i Raspberry Pi

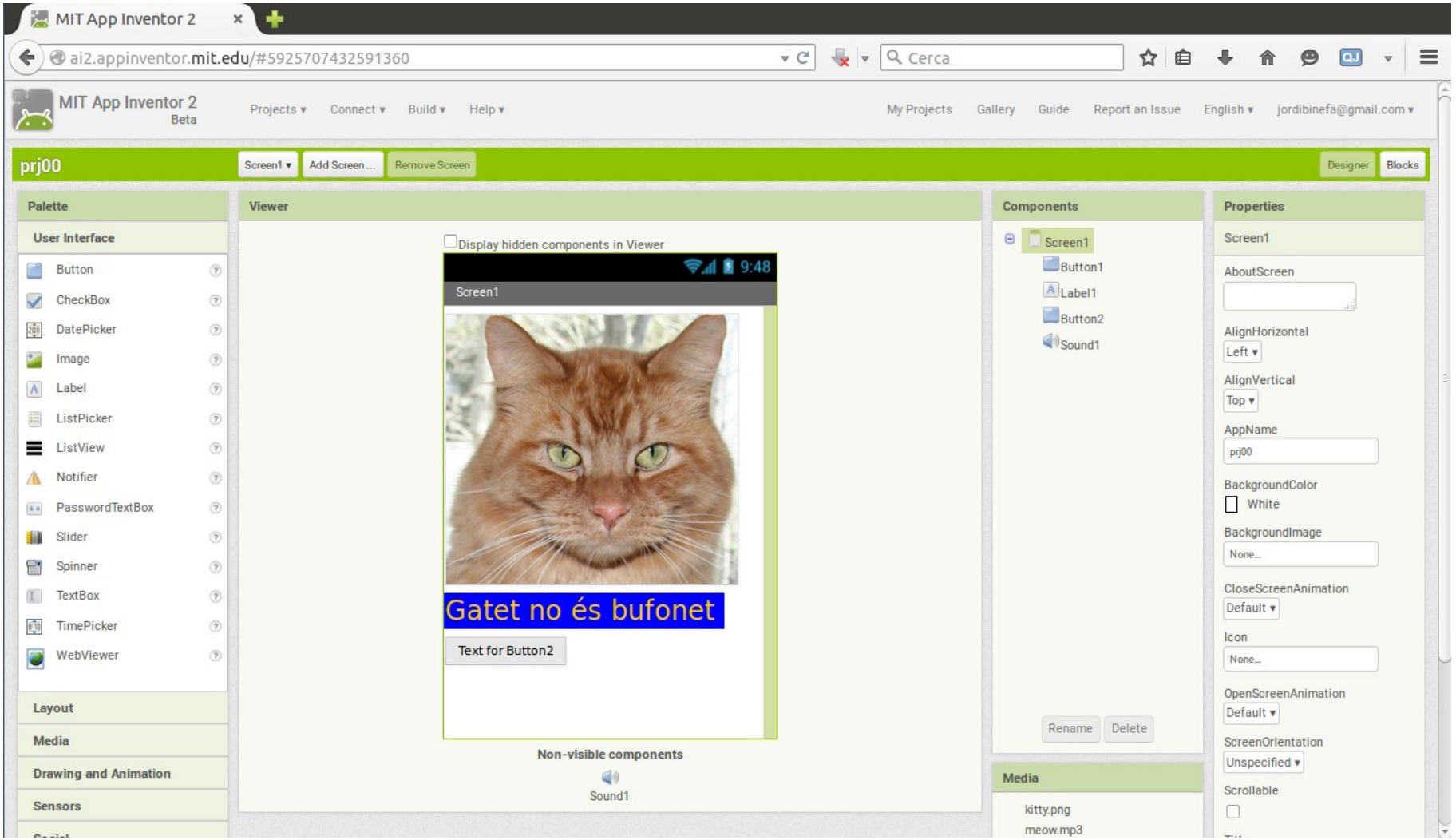
App Inventor



http://appinventor.mit.edu/

Arduino i Raspberry Pi

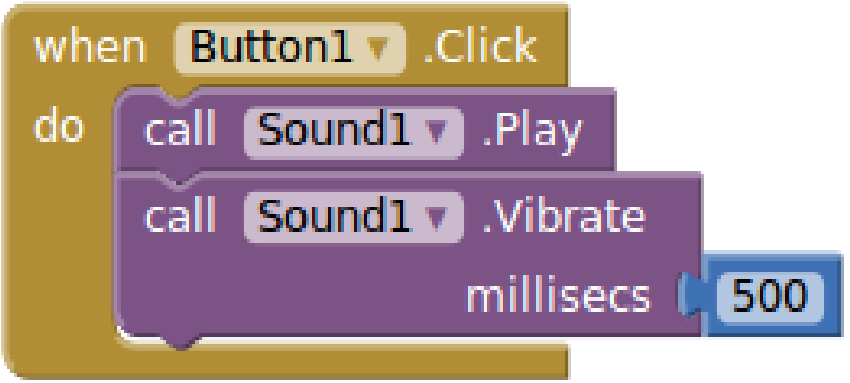
App Inventor



http://binefa.cat/php/appinventor/prj00.aia

Arduino i Raspberry Pi

App Inventor



http://binefa.cat/php/appinventor/prj00.aia

Arduino i Raspberry Pi

App Inventor

Un cop us heu validat a l'App Inventor, importeu l'arxiu prj00.aia -Projects / Import projects (.aia) from my computer- i genereu l'arxiu prj00.apk -Build / App (save .apk to my computer)-.

Un cop generat l'arxiu .apk el passeu al vostre mòbil Android fent servir el cable USB, trametent-lo mitjançant correu electrònic o anant a l'adreça de sota mitjançant el vostre navegador.

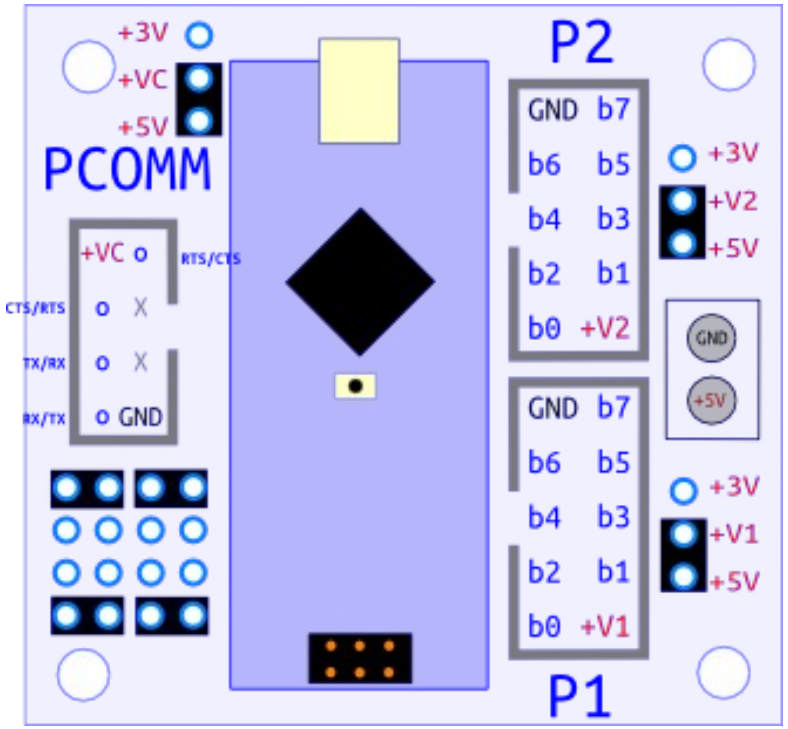
A l'hora de fer la instal·lació el telèfon us avisarà de que la font del programa no és l'estàndard. Temporalment, doneu al vostre mòbil permisos per a fer una instal·lació des de font desconeguda.

Verifiqueu el seu funcionament.

http://binefa.cat/php/appinventor/prj00.aia http://binefa.cat/php/appinventor/prj00.apk

Arduino i Raspberry Pi

Comunicació mitjançant BlueTooth



http://electronics.cat/doc/hc06/bluetooth04.ino

http://electronics.cat/doc/hc06/HC06_04b.aia

http://electronics.cat/doc/hc06/HC06_04b.apk

- Carregueu bluetooth04.ino a l'Arduino Nano
- Desconnecteu cable mini-USB de l'Arduino Nano
- Alimenteu separadament la placa nano-eCat (cal tornavís)
- Assegureu-vos de la posició dels ponts (jumpers) de comunicació
- Preneu nota del número identificador de Bluetooth
- Connecteu placa set0525 a la nano-eCat
- Vinculeu el dispositiu BlueTooth al vostre mòbil Android (contrasenya : 1234)
- Proveu el f direccional

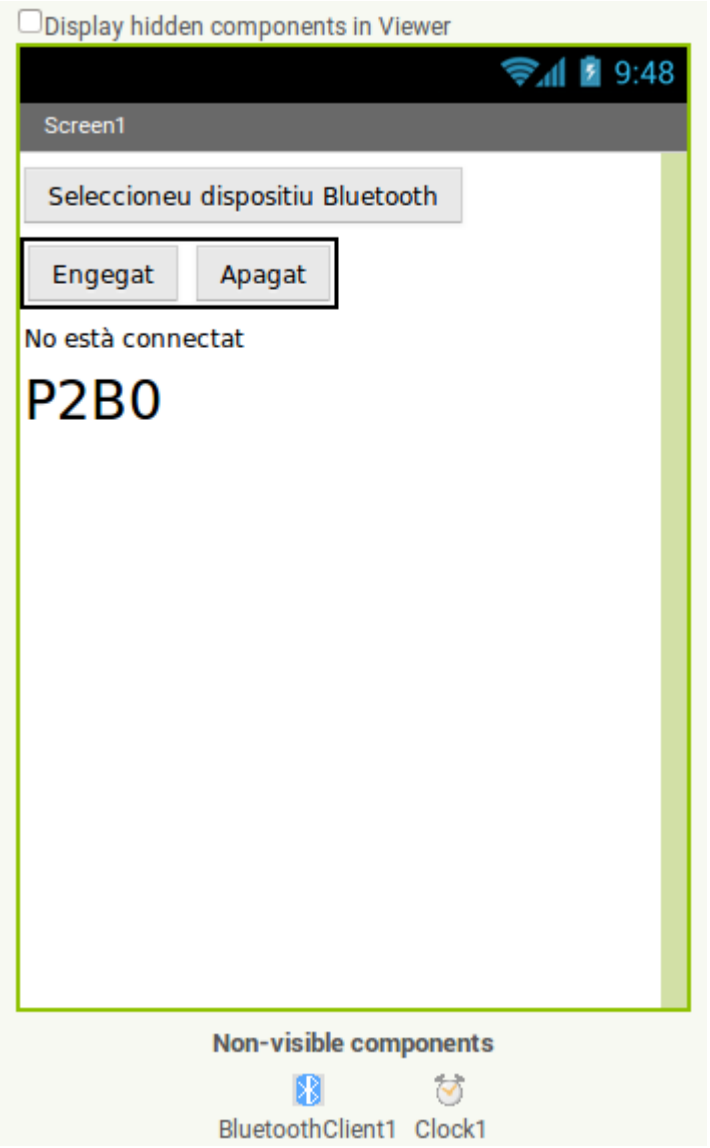
Arduino i Raspberry Pi

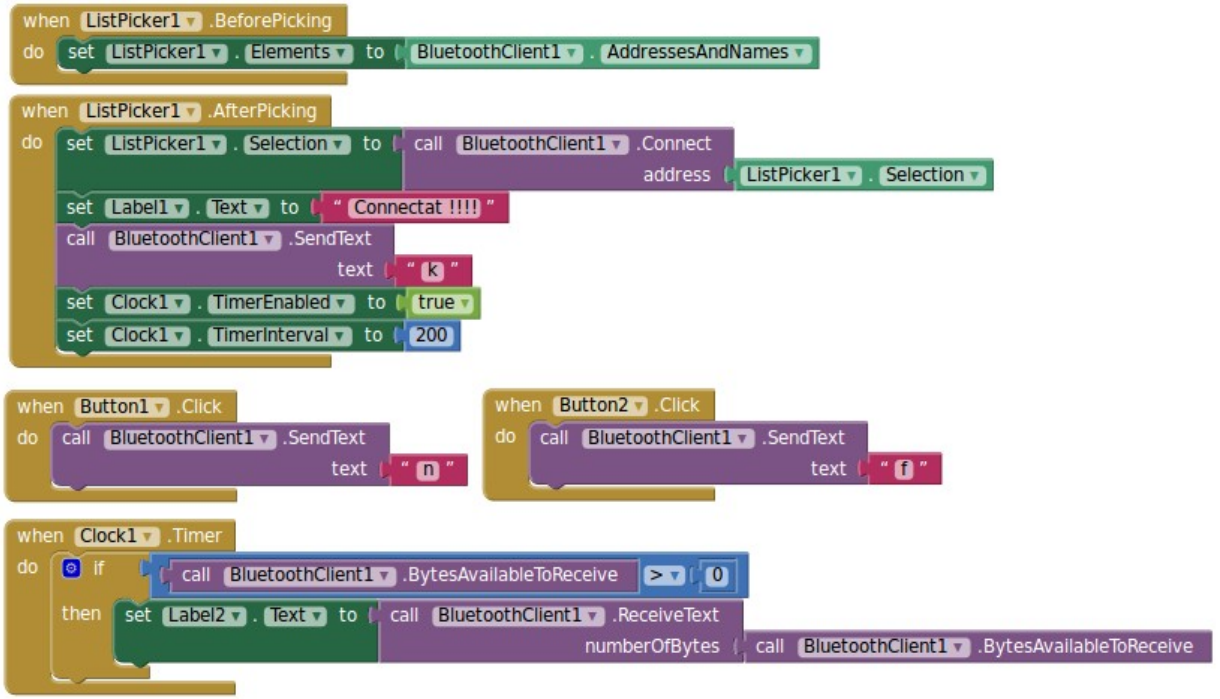
Com trobar pel terminal el número ID del BlueTooth

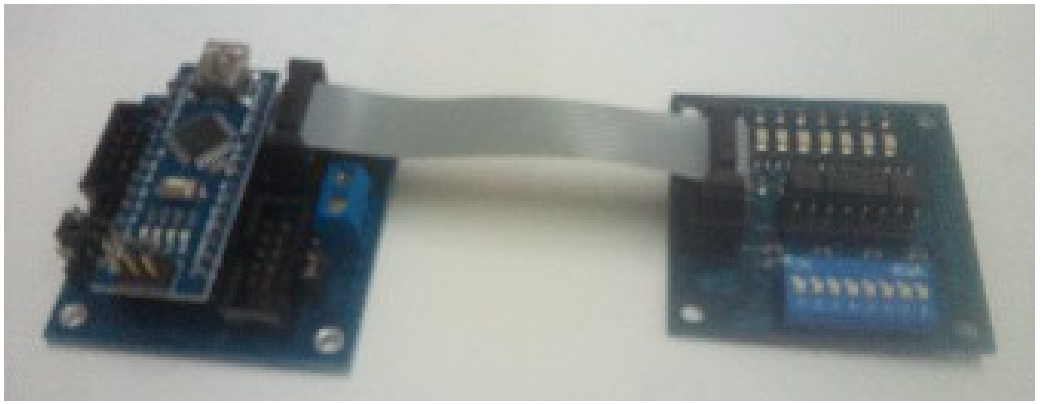
```
$ hcitool scan
Scanning ...
  98:D3:31:30:2C:0D  HC-06
```

Arduino i Raspberry Pi

App Inventor -Comunicació mitjançant BlueTooth

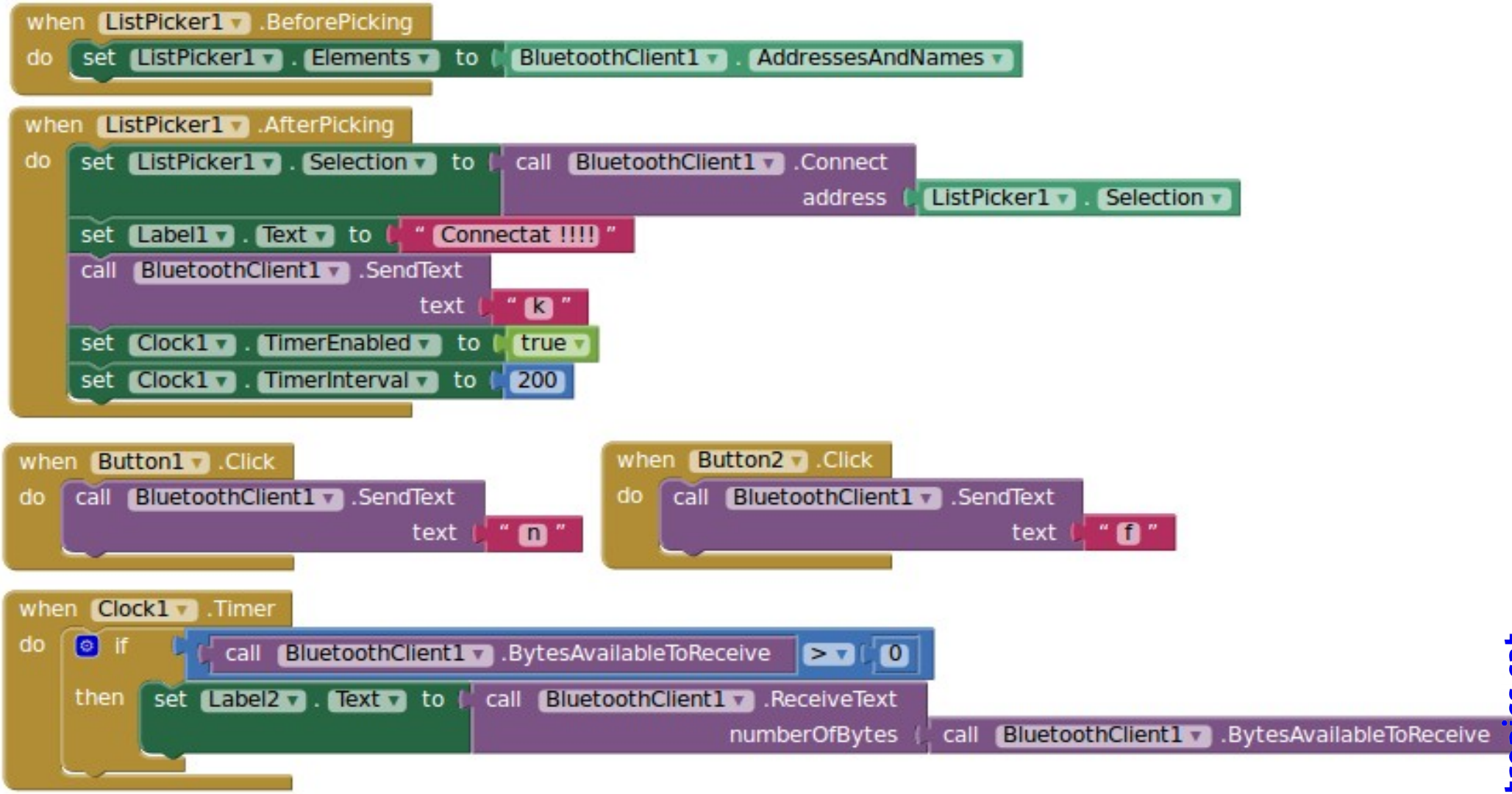






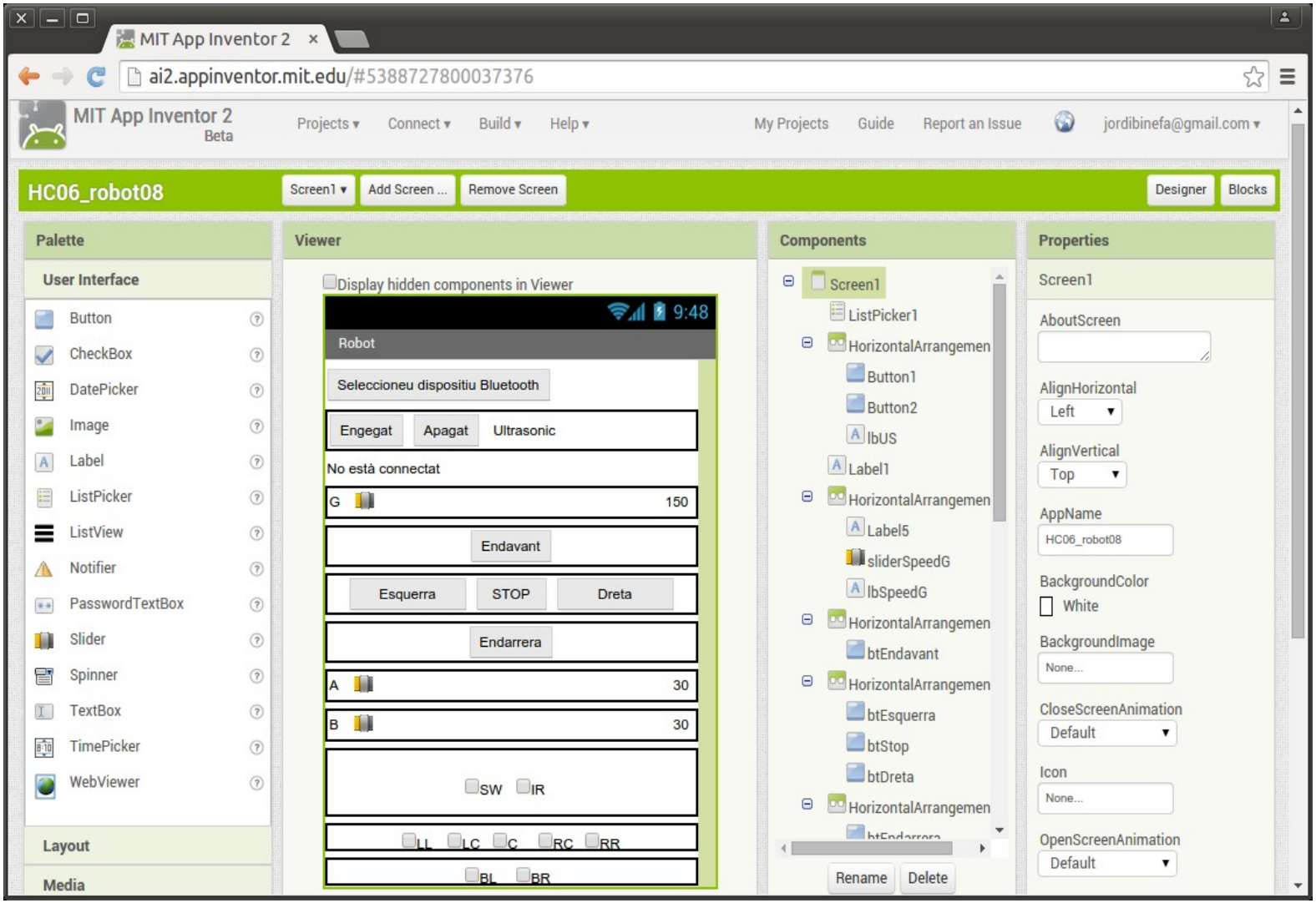
Arduino i Raspberry Pi

App Inventor -Comunicació mitjançant BlueTooth



Arduino i Raspberry Pi

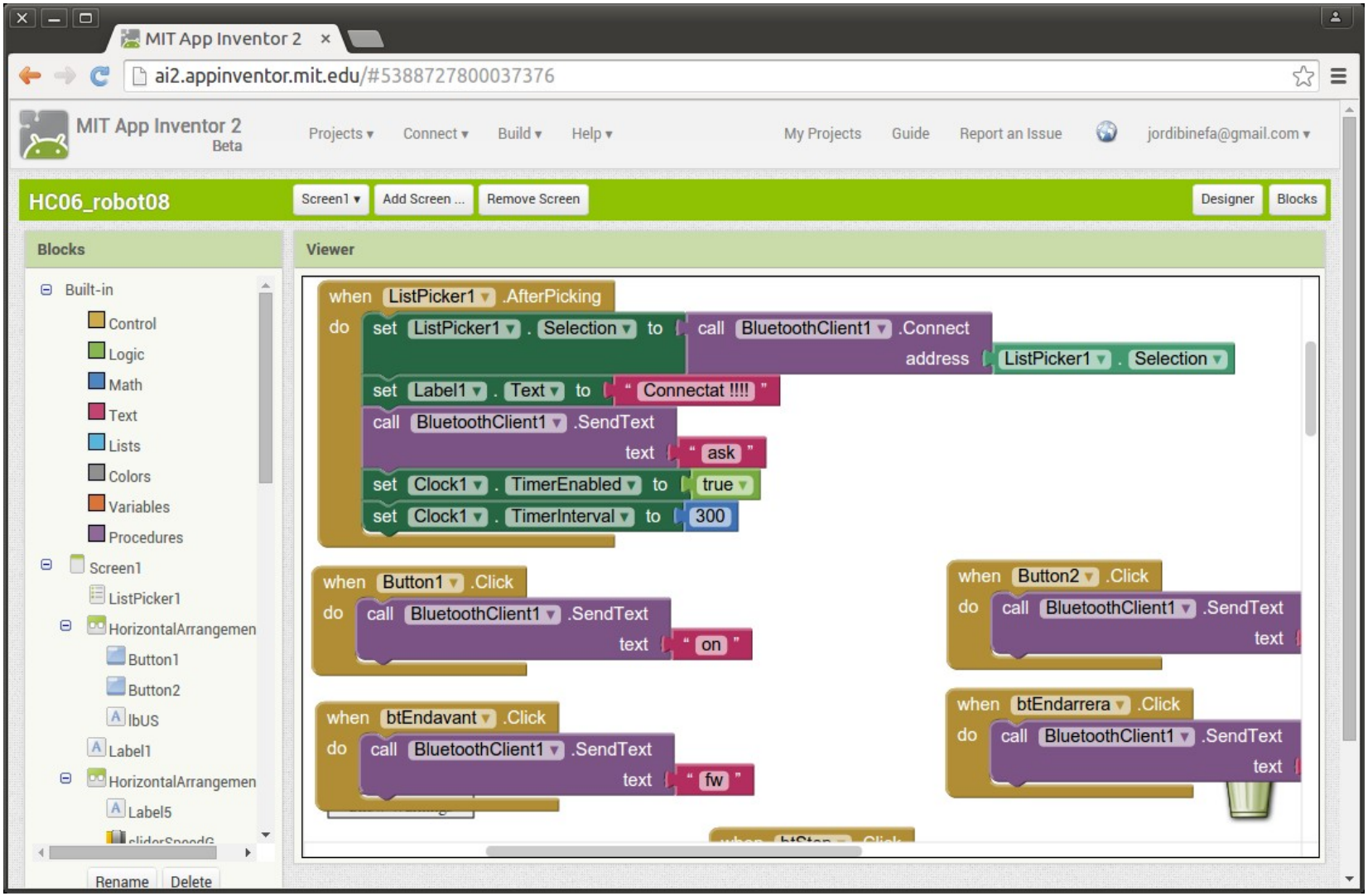
Programar al mòbil Android – App Inventor



http://appinventor.mit.edu/

Arduino i Raspberry Pi

Programar al mòbil Android – App Inventor



http://electronics.cat/downloads/code/HC06_robot08.aia

http://appinventor.mit.edu/

Arduino i Raspberry Pi

Arduino i App Inventor - Comunicació

```
147  void vManageMsg(){
148    vSliders();
149    if(szMissatge == "on"){
150      //digitalWrite(ecat.nPinP2B7,HIGH);
151      analogWrite(ecat.nPinP2B7,nG);
152    }
153    if(szMissatge == "off"){
154      digitalWrite(ecat.nPinP2B7,LOW);
155    }
156    if(szMissatge == "ask"){
157      bConnectat = true;
158      vInformaSensors();
159    }
160    if(szMissatge == "fw"){
161      vRobotEndavant();
162    }
163    if(szMissatge == "bw"){
164      vRobotEndarrera();
165    }
166    if(szMissatge == "st"){
167      vRobotAturat();
168    }
169    if(szMissatge == "le"){
170      vRobotEsquerra();
171    }
172    if(szMissatge == "ri"){
173      vRobotDreta();
174    }
175  }
```

http://electronics.cat/downloads/code/robot08.ino

http://electronics.cat/downloads/code/HC06_robot08.aia

Torn de preguntes ...

… i sessió pràctica.

Arduino i Raspberry Pi

Presentació descarregable a : **http://binefa.cat/blog**

Correu electrònic de contacte : **jordibinefa@electronics.cat**

https://twitter.com/JordiBinefa

https://twitter.com/electronicscat

http://es.linkedin.com/pub/jordi-binefa/13/717/90b

Plaques aviat disponibles a :

http://www.electronics.cat

http://www.makeit.cat

Moltes gràcies per la vostra atenció