"Teaching robotic dogs new tricks"
.. or How to hack an I-Cybie

Introduction

France Cadet performed surgery on several robotic dogs, customized their forms, and reprogrammed them with unusual behaviours.

In **Dog[LAB]01** her new dogs are genetically manipulated animal combinations, plastic chimeras. For instance, one is the "ultimate" domestic pet, a mixture of equal parts cat and dog. This earnest Frankenpet alternately wags its tail playfully, grooms itself, does feline stretches and, eventually, falls asleep and dreams dog dreams. Another is a cowdog - named "Dolly" after the famous cloned sheep - and as a result is prone to robotic BSE, twitching and collapsing while whining like a sad puppy. The results are constructions partially based on actual scientific and artistic experiments – an ironic demonstration of the potential consequences of cloning, eugenics and other contemporary experiments in biotechnology.

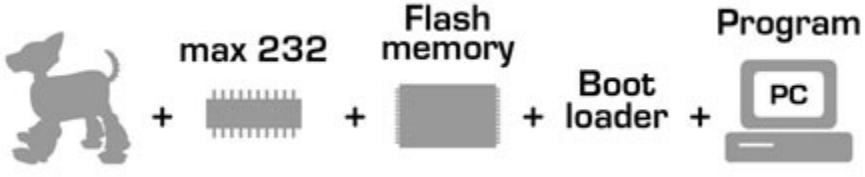
In **Dog[LAB]02** a whole pack of 20 of these "cloned" robotic cow-dogs will appear to suffer from BSE in unison.

Some bugs deliberately added to the robots' programs from **Bug[LAB]01** will alter the normal behaviour of the dogs and appear randomly. They will remind us that the more life-like robots become, the more prone they'll be to neurosis and illness and eventually they will end up hanging on a wall as Cadet's "hunting trophies".

AIBO from Sony

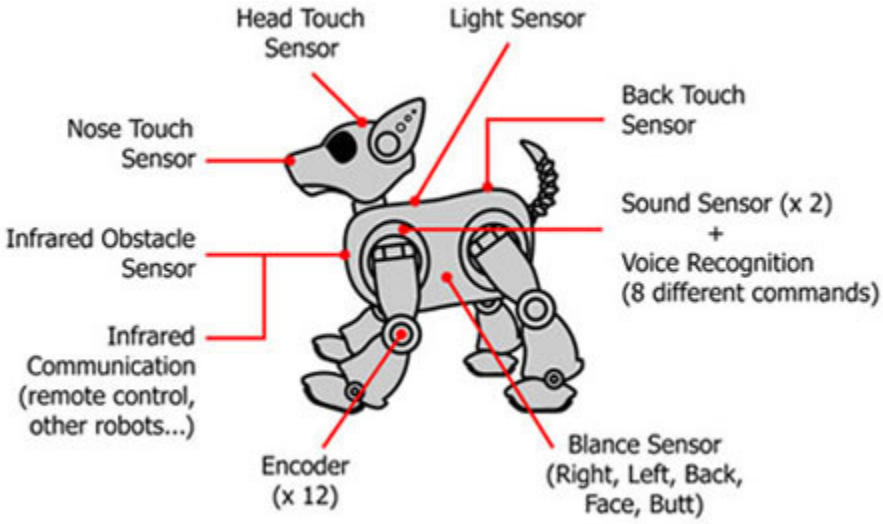
I-Cybie from Silverlit

All these strange animals have been obtained by modifying the shape ,the hardware and software of commercially available robotic dogs: the **I-Cybie** dogs from **Silverlit**. These internal modifications are necessary because, unlike **Sony's AIBO**, I-Cybie hasn't be designed to be reprogrammed.



An internal 2MB flash memory which contains the new programs must be added, and a bootloader must be installed to allow the robot to read the flash memory and to make it start on this new program instead of its original program, which is no longer used.

A MAX232 chip must be soldered inside the robot to allow the communication with the serial port of a PC (as well as a plug and a switch on his back). The shell of the robot is fully removed, the electronics is modified, the shell is customized and then reassembled.



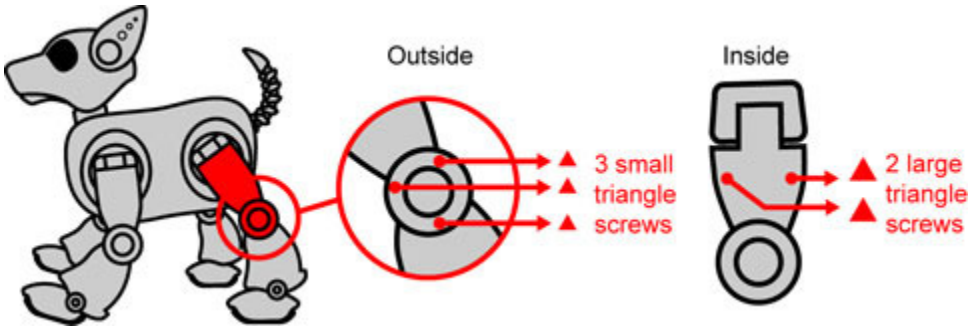
Then all the movements of the robot have to be reprogrammed in C language on the computer, then compile and downloaded into the flash memory of the robot through the RS232 port thanks to the C232 cable which has been adapted to the robot (mini jack et USB power). **ICSDK** (I-Cybie System Development Kit from **aibopet**), **Context** (freeware text programmers editor) and "**Terminal**" (bray's terminal indeed) are used to compile and download the C program into the robot via the serial port, and to communicate with it. Once the program downloaded, the robot can be disconnected from the PC, it is now autonomous and runs on its own new program.

We can control most of the motors and sensors of the robot: the 16 motor drive (12 real servo for the paws, and 4 cc motors: neck, head, mouse and tail), as well as the sounds (ADPCM format, 8bit, sample rate: 8KHz), the light of its eyes (green, yellow, red) and all the sensors (3 touch sensors, 1 light sensor, 2 sound sensors,1 voice recognitions with 8 different commands, balance sensor (right, left, back, butt, face…).

Step 1: Taking I-Cybie apart

You need to separate the two sides of I-Cybie's main body shell. For that you should first remove the four leg parts.

1. Remove the four upper parts of the legs

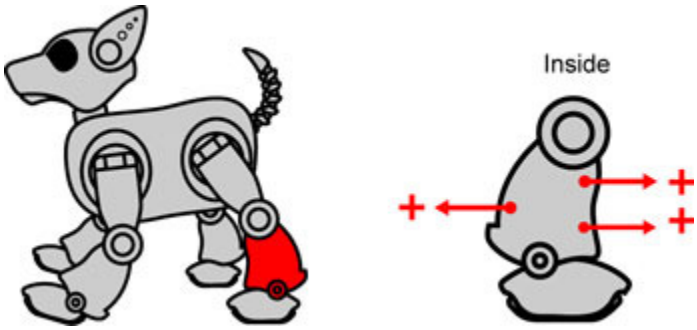


Each leg part has **two large triangular** screws and **three small triangular** screws holding it on.

There are three small triangular screws holding a small round piece of plastic on the other side of the legs that you do not have to remove.

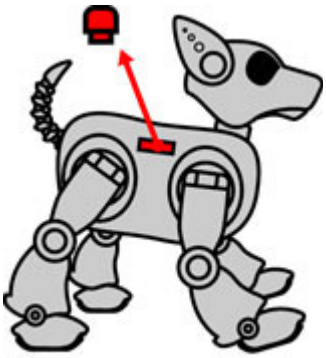
NOTE: Triangular screws can be removed by:
- using the properly sized slot screwdriver and angling it into the triangular slot or
- getting a piece of metal and filing it down the proper triangular shape or
- using the special triangle screwdriver coming with a replacement shell.

2. Remove the four lower parts of the legs



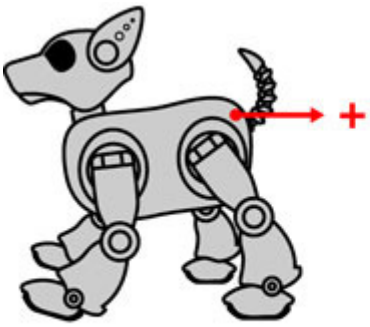
Each leg part has **three Philips** (cross shaped) screws inside. There are 4 inner parts and 4 outer parts.

3. Remove the body shell

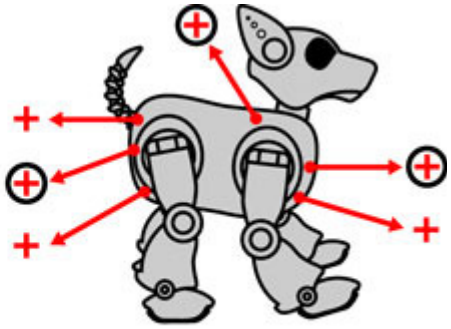


Rigth Side = 1 cartridge

Before removing the body shell, you must remove the blank **cartridge** from the right side of the body shell.



Left Side = 1 screw



Right Side = 6 screws
+ 3 plastic caps

Then you need to remove the **seven Phillips** screws holding the body together. On the dog's **left side**, there is only **one screw**. On the dog's **right side**, there are **six** (one for each hole).

Three are visible. The other three are hidden under **plastic caps**.

You must remove the plastic caps first !

Put the special tool (sort of "T" shaped screwdriver) in the hole, fit in slot on screw cap, push it hard inside, then turn 90°, gently pull out the screw and the plastic cap should come out with it

NOTE: there may be two plastic caps in the same hole. Then use a Phillips screwdriver like all the rest.

The sides will easily move apart (if not you forgot a screw).

Step 2: Hardware modifications

1. Add the serial connection

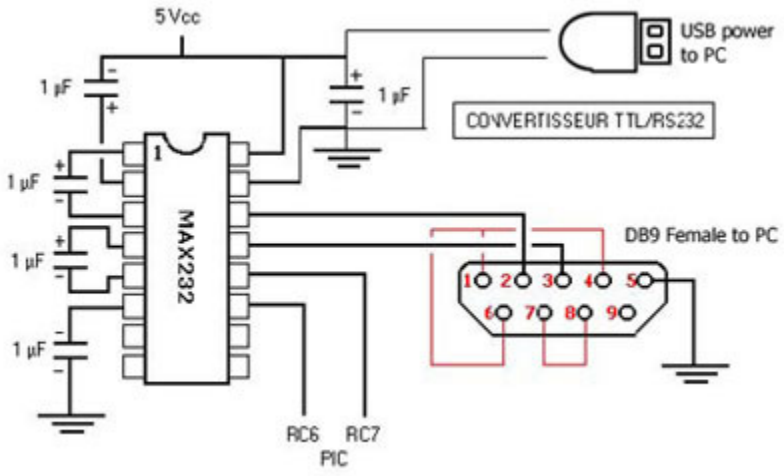
Now you must add a serial connection to be able to communicate with the robot through the serial port of the PC.

The standard signal voltage of the serial port of a computer (RS-232) is : –12 +12 volts.

The standard UART signals voltage of most of the microprocessors (TTL), including I-Cybie's main chip: is 0-5 volt.
So you must use a TTL-RS232 converter which will convert the RS232 voltage (-12V +12V) to TTL voltage

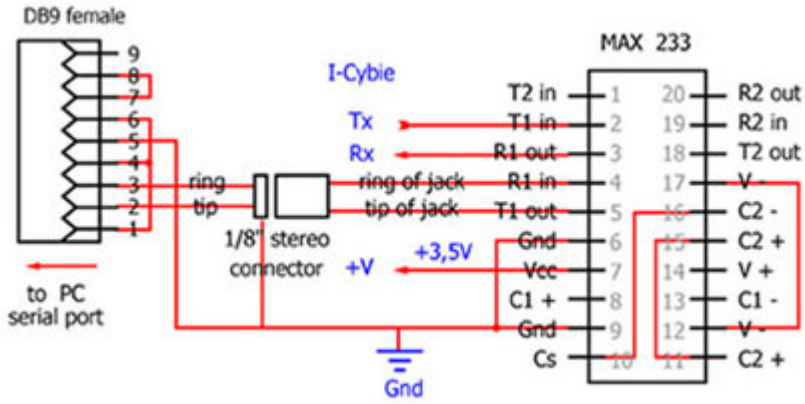
(0V +5V) and vice versa.

Solution 1: using a MAX232



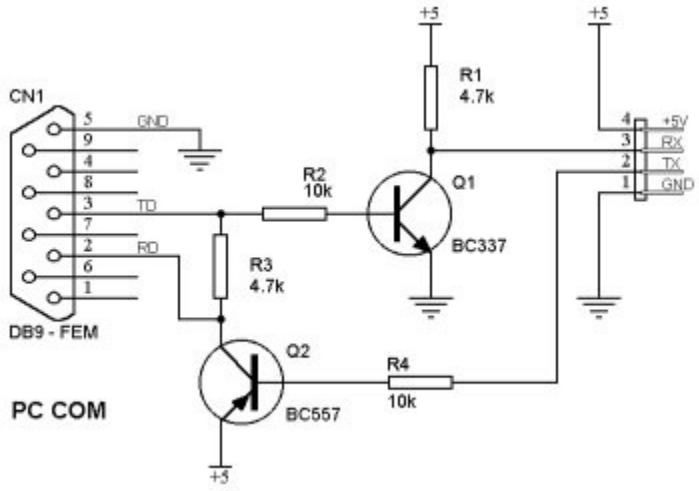
The MAX232 chip is the most familiar chip used to build this electronic device. Here is the electronic diagram. The power supply is taken from the USB port of the computer to avoid an additional power supply.

Solution 2: using a Max 233



It is the same functioning as the MAX232 but it already includes the capacitors, no need to add external capacitors.

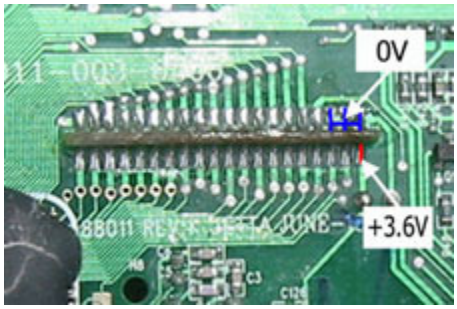
Solution 3: using transistors

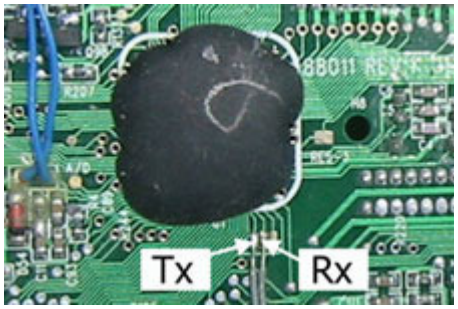


The hardware modifications of the robot have been simplified by putting the electronic device needed (max 232 chip + capacitors) inside the cable (inside the DB9 shell indeed) which will be used to download the programs and communicate with the PC. Thus no need any longer to add it inside the robot.

Here is the used version which includes a SMD card (Surface Mounted Device).

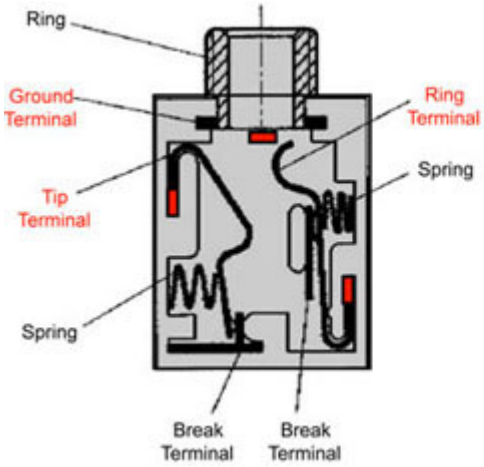
Now you must solder the wires onto the motherboard to connect the **stereo female mini-jack** (serial connection to the PC) and add a **bipolar switch** to turn ON and turn OFF the robot.

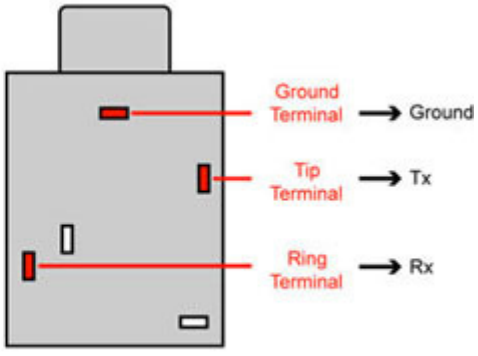




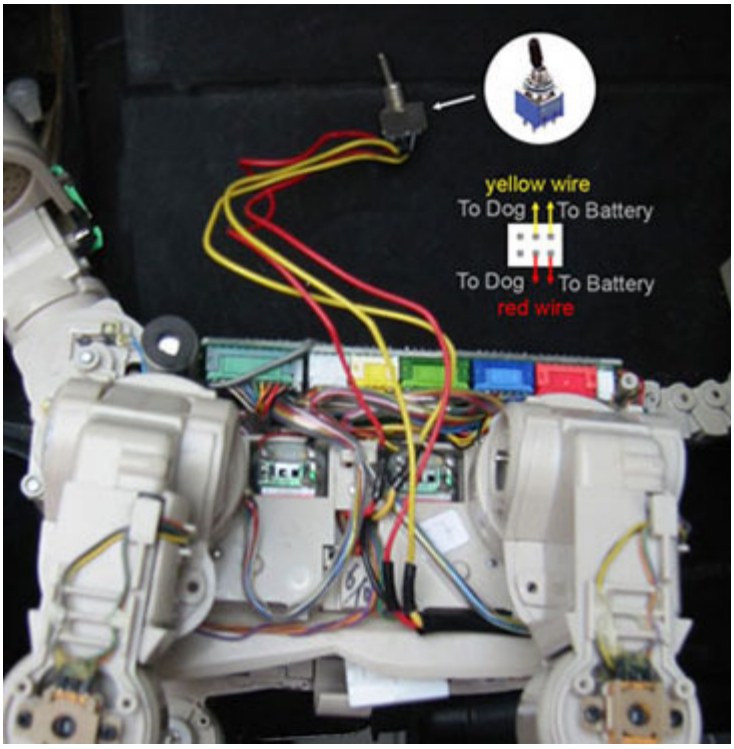
You must solder **3 wires**:
- a black wire for the ground (Ground of the jack)
- a wire on the TX of the main chip (TX to the Tip of the jack)
- a wire on the Rx of the main chip (Rx to the Ring of the jack)

Tx = **T**ransmitting = **T**ip of the jack
Rx = **R**eceiving = **R**ing of the jack.





2. Add an ON/OFF swicth



The battery plug has 3 cables:
- a red one: +12V
- a yellow one: +6V
- a black one: 0V

Cut the red and the yellow cables and solder long cables to the bipolar switch as indicated on the picture

Don't forget to place heat shrink tube before soldering the cables.

Step 3: CROM install

Now we must put the working 2MB cartridge which contains the right booloader in the right side of the dog.

We will use the **ICSDK** (I-Cybie System Development Kit) from **aibopet** to program the robot.

All the technical details and steps for this are described on his website. See **here**.
For more general info see **here**.

Step 4: Reassemble the dog

Then drill two holes in the body shell:
- a **6mm** diameter hole for the **mini-jack** on the right part
- a **5mm** diameter hole for the **switch** on the left part

Place the switch and the min-jack.
Now you can reassemble the body shell and legs parts.

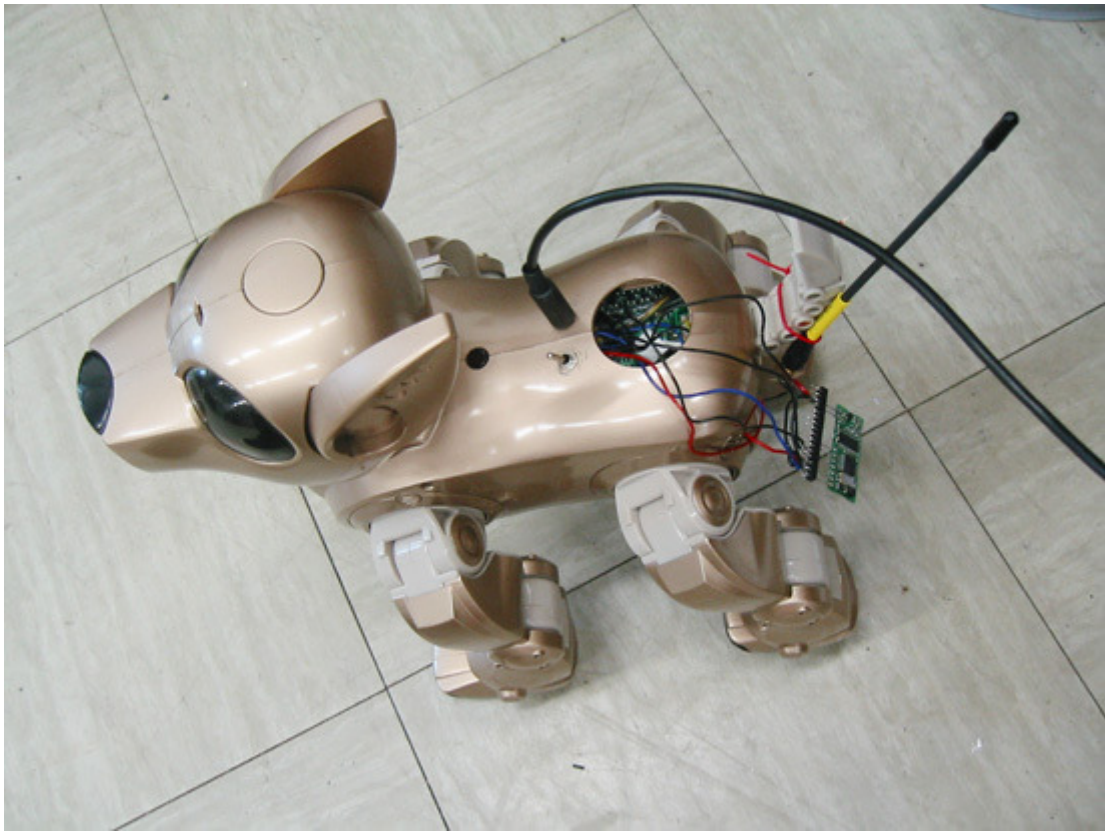
Step 4: Program it

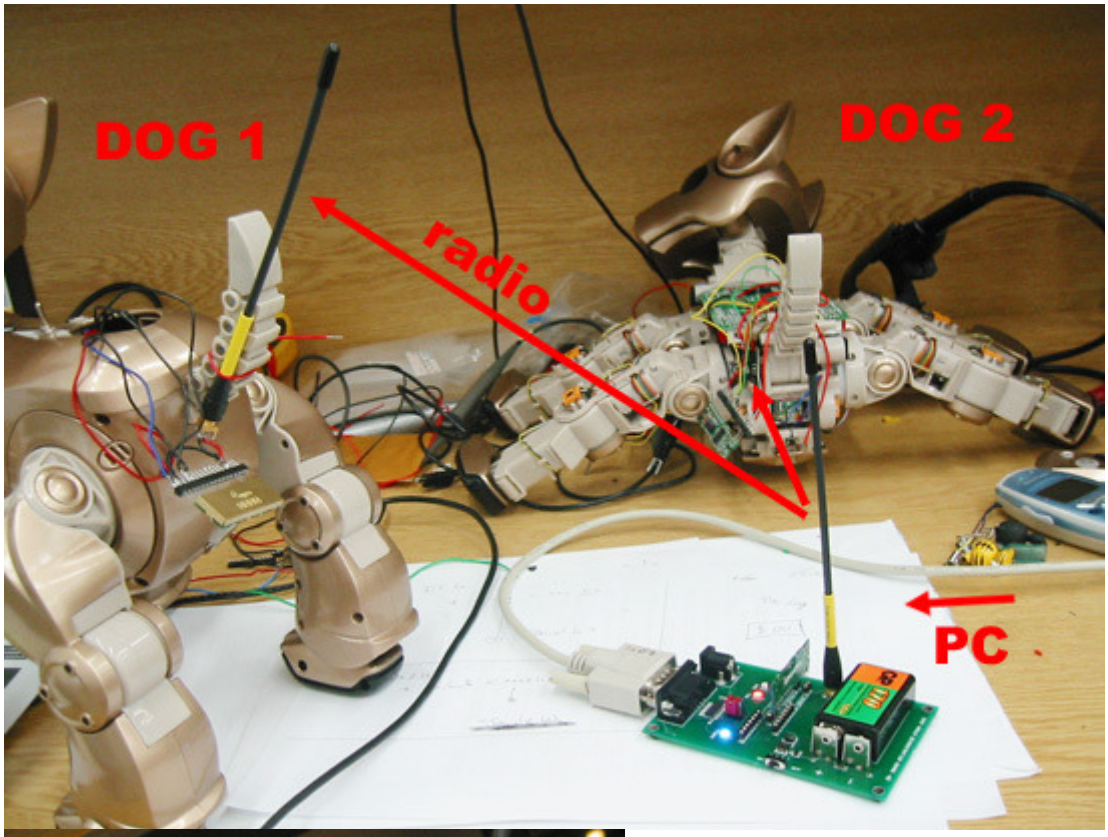
Now you can use your Super I-Cybie and program it with the **ICSDK** from **aibopet**.
See there for the instructions and Have Fun..!

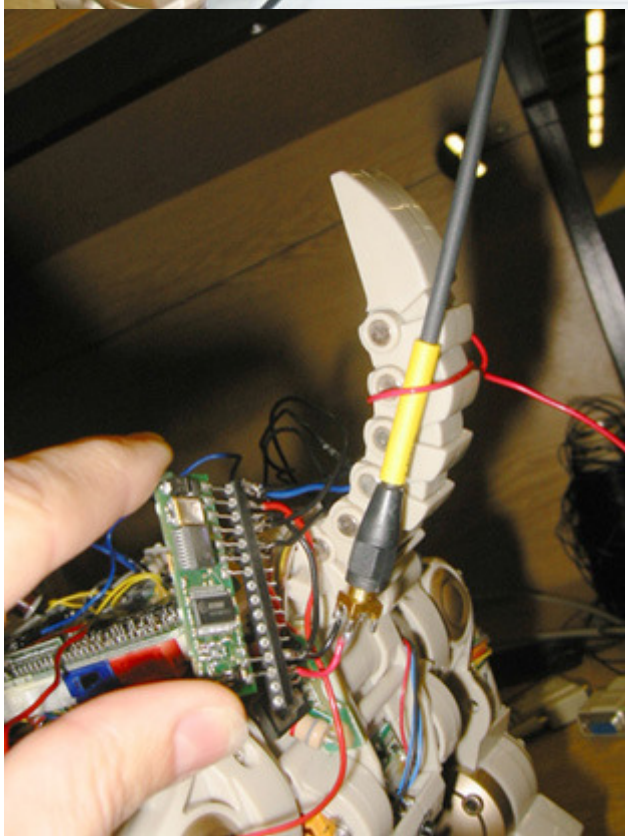
You can have a look at the **VIDA workshop** where some I-Cybies have been hacked in Madrid by some artists.

Add Wireless communication to your dog

The first step was to add a **RADIO communication** to the robots for **Dog[LAB]02** project involving a **large group of robots**.

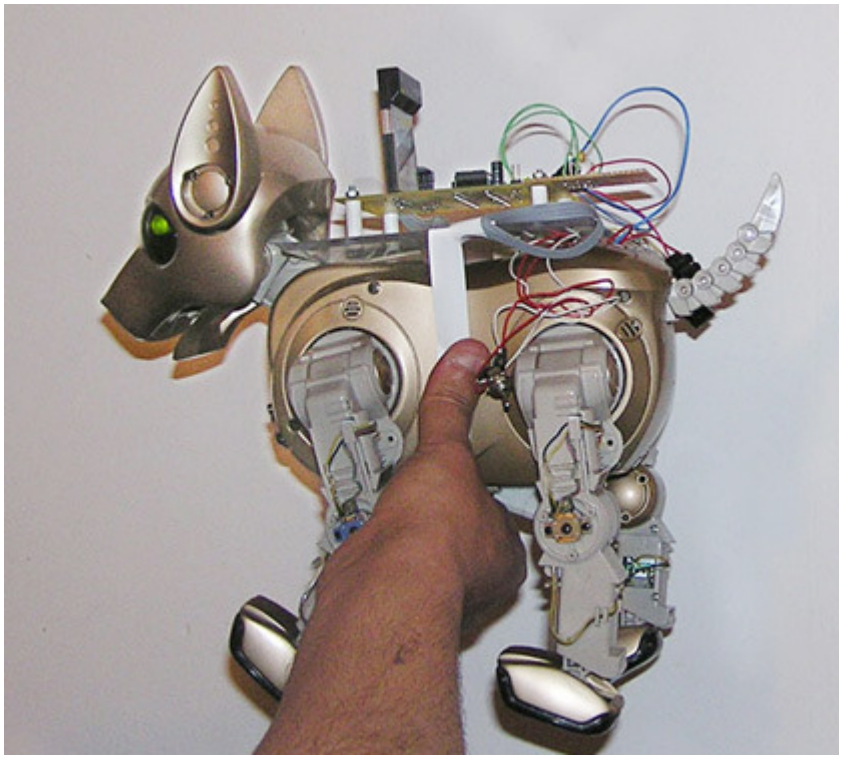




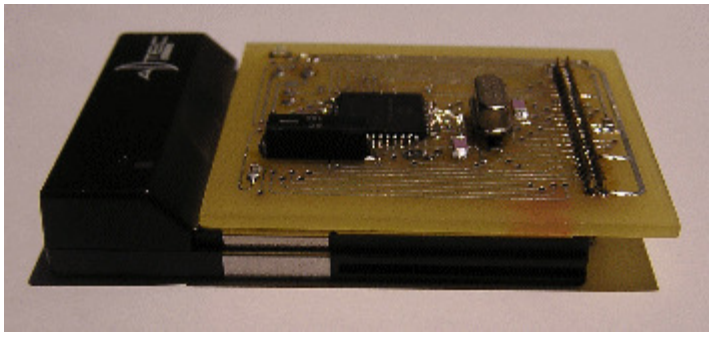


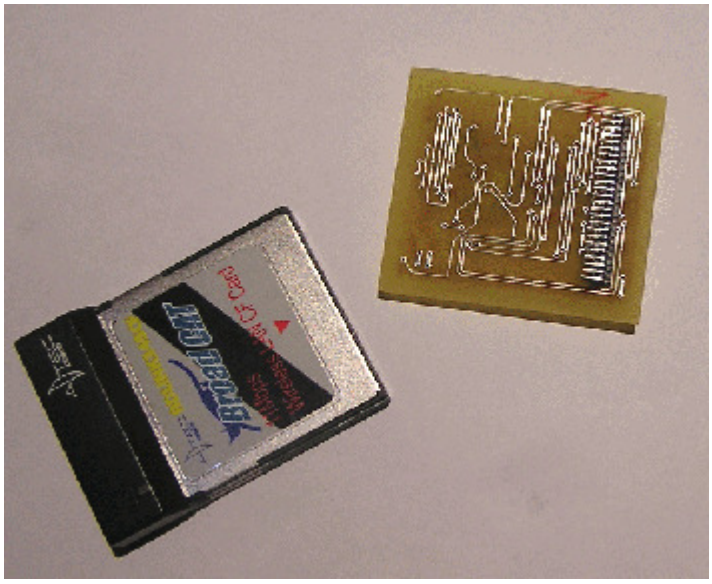
The **home made radio module.**

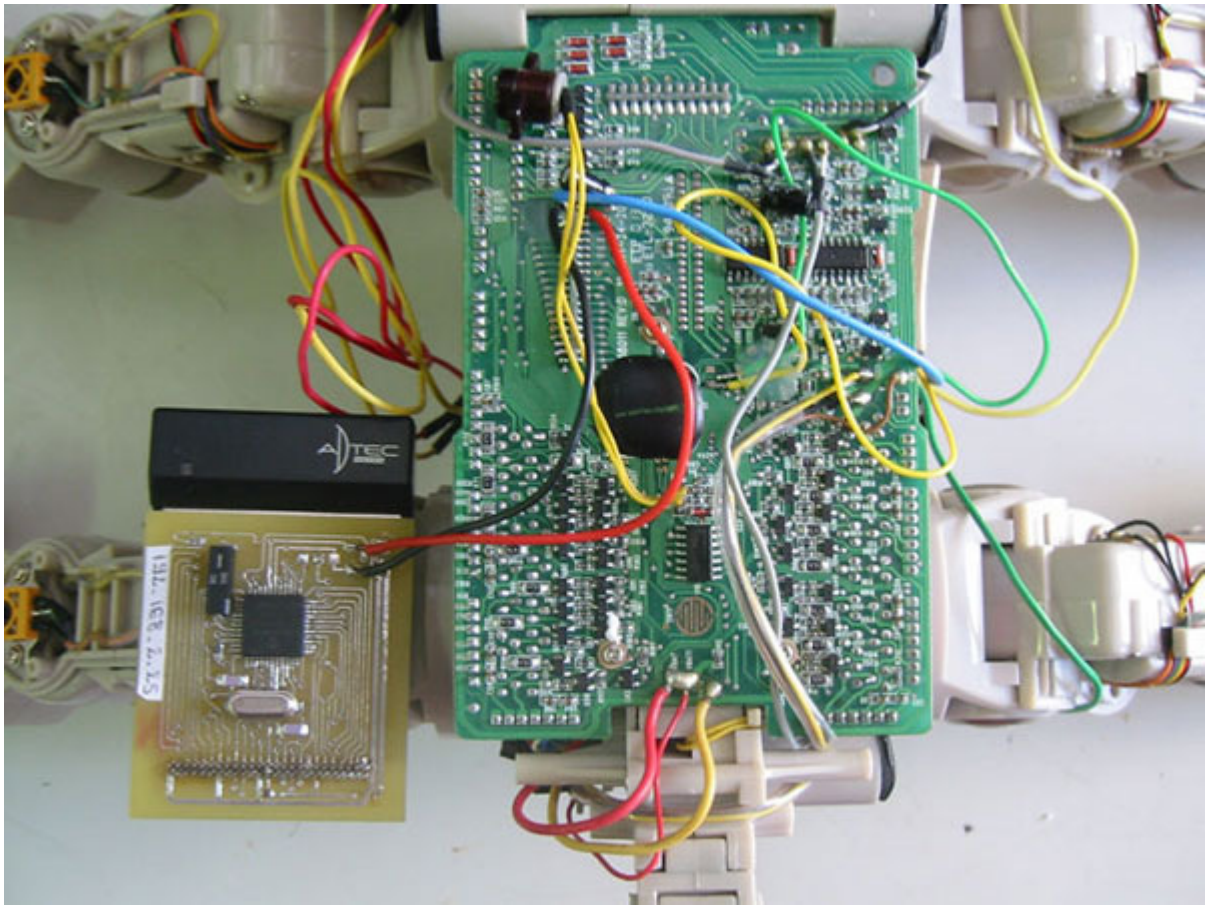
Second step: add **WIFI** to the dog.
The robot with **PicoIp wifi version 1**

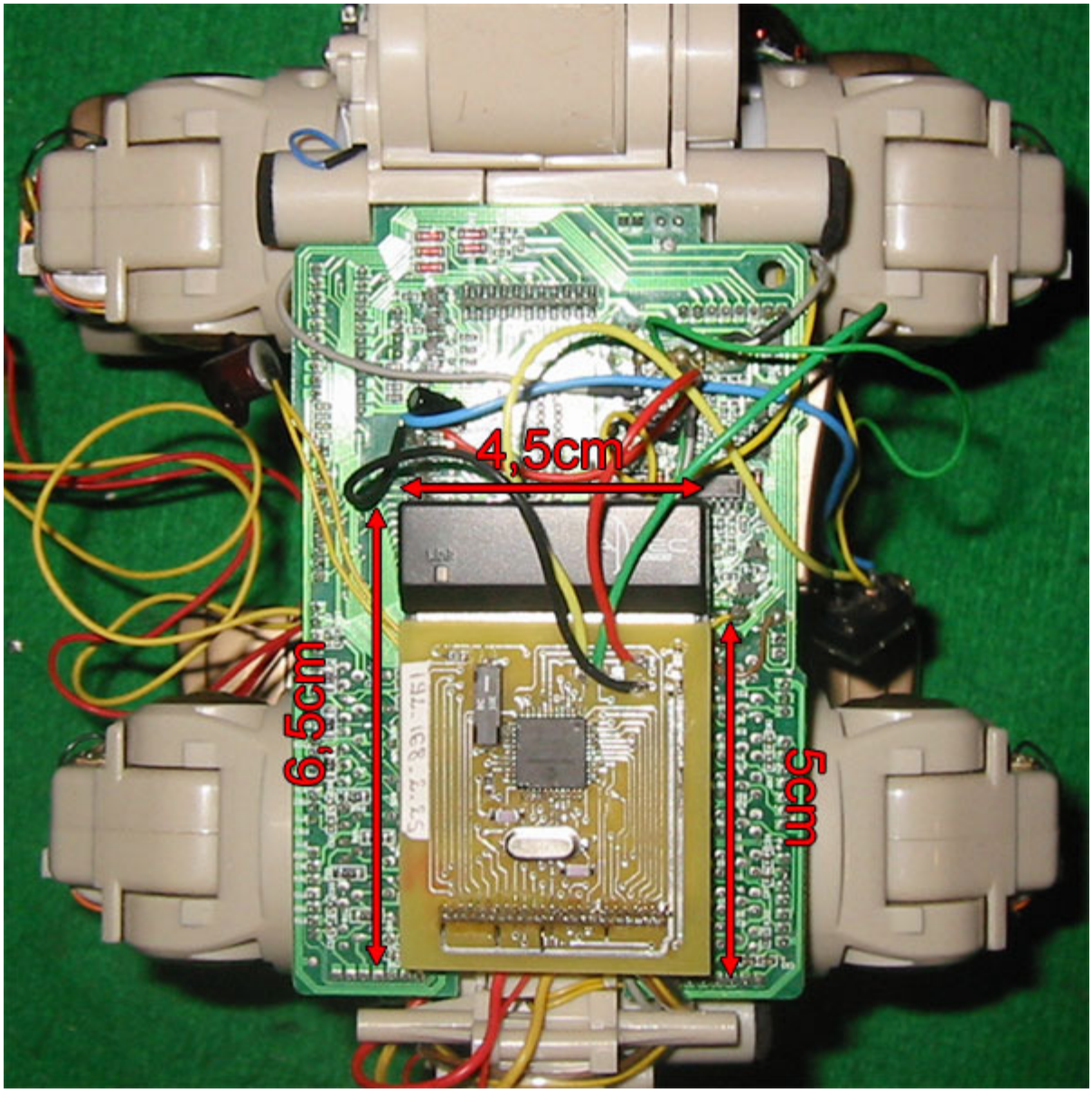


Then a **wifi version of picoIp** has been developped to fit inside the shell of the robot.









More info about I-Cybie modification:

Link 1
Link 2
Link 3