

COM1005 – Third laboratory session: The Nao Robot

Objective:

This first laboratory session with the Nao robot is for you to familiarize yourself with the robot itself, but more importantly with the GUI that will allow you to control the Nao. So have fun and play with your robot (Be careful not to have too much fun as the robot is still fragile and very expensive!).

Choregraphe

Choregraphe (the equivalent of choreography in French) is the software that will allow you to connect to the Nao robot, set most of the Nao's parameters, send commands that the robot will have to execute and finally watch its performance (and possibly debug it in case of error).

Once you have launched the program from the binary, the main window should appear shortly after. Choregraphe's main window is made of:

- On the left hand side:
 - At the top is the content of your current project, displayed in a tree-like structure. There you can import new behaviour, create and delete directories and project files.
 - At the bottom you will find the box libraries. This is where all the modules for programming the Nao robot are stored in different categories for ease of use. You can switch between the “standard” and “advanced” libraries with the tabs on top (only the standard library will be required for today's session). Next to the box libraries is the position library containing the basic positions pre-programmed into the Nao. And finally, there is the video monitor that will show you, when connected to a real robot, what the Nao sees in real time.
- The middle section is split in two parts:
 - The top, that is empty at the moment, is where you will be able to drag and drop boxes and link them together to build your program.
 - The bottom contains different tabs allowing you to monitor most of the robot's activity and the state of its sensors and memory. This is where you should

first look is case of error (especially the log viewer).

- On the right hand side, you should only focus on the robot view, displaying in a virtual environment the actions and dialogues of your robot. If you double-click on some parts of the virtual robot, a window should open showing you the settings for the different joints and allowing you to modify those angles. The robot applications part will have no use for us.

- On top of all this sits the toolbar, which contains from left to right:

- Create a new project



- Open an existing project



- Save the current project



- Undo the last action



- Redo the last action



- Connect to a robot



- Disconnect from a robot



- Launch the program



- Stop the program



- Display the debug/errors (works only while connected to a real robot)

- A progress bar displaying the progression in the loading process



- The volume of Nao's speakers



- An animation mode



- The autonomous mode: When switched on the Nao will seek to interact with you like any bored child.



- The rest button: Commands the Nao to get into the crouching position and set its motors' stiffness to 0.



- The wake up button is simply the opposite of the rest button.



- Finally, at the far end is the battery status, which will light up once you are connected to a real robot and change colour when the Nao should be connected to a power source.



Exercise

Starting Choregraphe from the Usb Key

Insert the USB data stick containing the Choregraphe zip file that you have downloaded from the module web page. Open the USB stick from My Computer.

If you have not already extracted the Choregraphe folder from the Choregraphe zip file, right click on the zip file and select “Extract here”. Now go into the Choregraphe folder and run the choregraphe.bat file (double click on it). At this point you may be prompted for a pass key. Open the file called “codes.txt” and select one of the four keys and supply it in response to the Choregraphe prompt. Choregraphe should now start.

A window concerning the Windows firewall may pop up. If it does simply click “cancel” to clear it from your screen.

You may also get a message saying “Failed to create virtual robot”. If this appears then select “Edit” on the top menu, followed by “Preferences”. Go to the “Virtual Robot” tab in the preference window, click “Browse” and select the Choregraphe folder you are running the program from in the file manager window that appears. Then click “OK” and the virtual robot will be available.

Starting the robot


To start the robot, you only need to push once on the chest button. Nao should come to life with a display of lights around its eyes and on its head.

The robot is not entirely ready for you to work with -- the initialization phase can take some time, so be patient. Once the process is done Nao will say “Ogn Gnouk”.

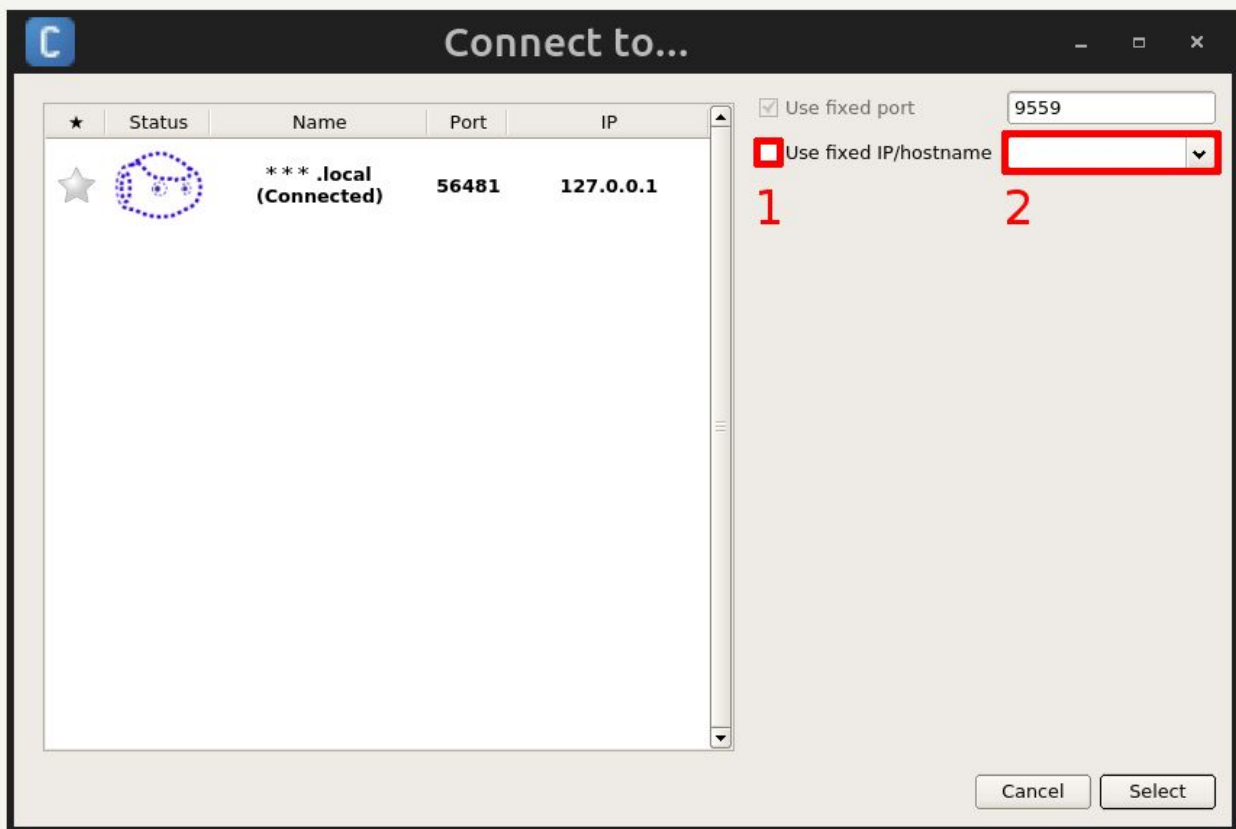
Connecting to the robot

To connect to the robot, first check that your computer is connected to the “DIARobotLAN” wireless network. If not you can connect to this network using the password: NAORobot .

Then push Nao's chest button once. Nao should tell you what its IP address is (write it down for later).

Then simply click on the connect button .

A new window should appear in front of you that looks similar to this:



The first line on the left is the virtual robot, which you should connect to if you want to experiment with choregraphe, without being connected to a real robot.

In our case we want to access a real robot through its ip address. On the right, tick the box (marked 1) and in the corresponding field (marked 2) enter the ip address with the dots.

Finally, click on select. The window will directly close itself and after some time you should be connected to the Nao robot and ready to send commands.

Programming the robot


Before going into the programming of the robot itself a few more points, concerning Choregraphe, should be made clear.

Programming the robot will be done through a graphical language. This means that rather than writing source code in C++ or Python, we will be using boxes linked together to build our program. In Choregraphe all the building blocks are available in the

“Box Libraries” and are dragged and dropped in the upper part of the middle section.

Furthermore, as for any other language there should be a marked beginning and end to our program, so that the robot knows where to start reading commands and where to stop. Choregraphe is making our life easier on this point as it already provides a starting point and an end point. If you look at the upper part of the middle section you

will notice, on the left, a symbol similar to  , that will be the beginning of our chain

of command. And on the right,  marks the end. The space in between is called your workspace and any available box can be placed in here.

Choregraphe's boxes

As explained previously boxes in Choregraphe are the building block of your program, but what do they look like?



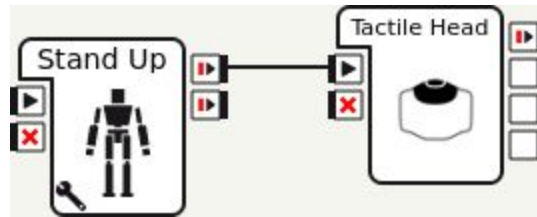
This is an example of a standard box. It has:

- a name describing its function
- an icon picturing the function
- One input on the left, marked by the arrow.
- One or more outputs on the right, marked by a red rectangle and an arrow on top. While most standard boxes have only one output, some can provide more information to the next box, thus, requiring more outputs.
- In the bottom left corner some boxes might also have a wrench. Upon clicking on this icon a small window should appear where you can further configure the box's function.

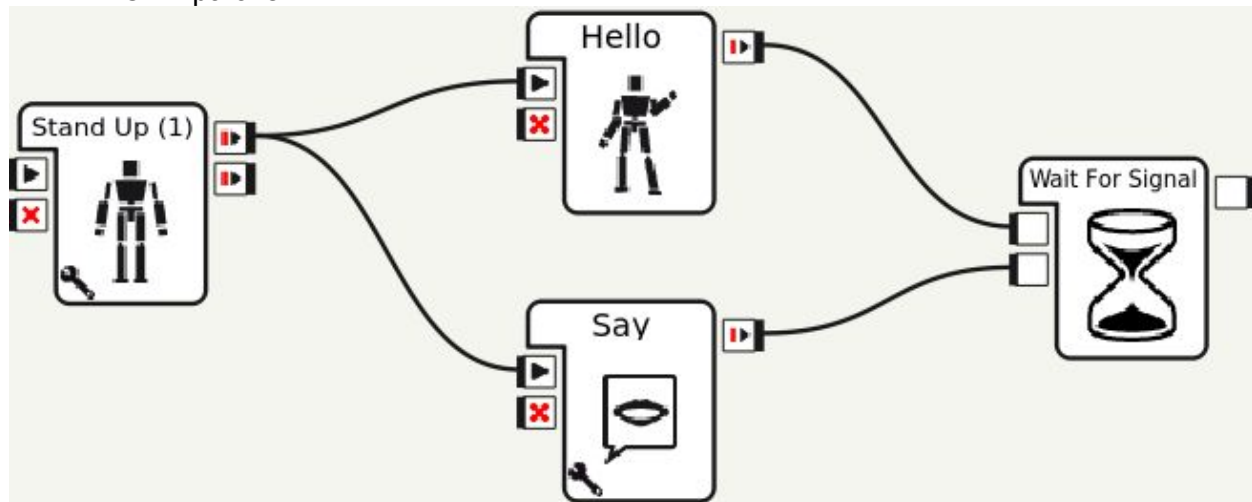
Linking boxes together

To create a chain of commands (a program), all that is now required is to link the boxes together. There are only two ways of doing that:

- In a sequence:



- Or in parallel:





To link a box to the next one you only need to click on the output of a box and drag the link to the input of the other box.

Notice that when we are connecting boxes in parallel at the end of the parallel part there is a “Wait for signal” box. Because the two functions that are executed in parallel might not end at the same time, before executing any other command, the “Wait for signal” box will wait for both function to end, preventing the execution of contradicting commands.

Launching / stopping your program

Once you have made sure that you are connected to a robot (whether a virtual or a real one),

you can launch your program by pushing the button . A small window will appear displaying information concerning the data transfer between your computer and the robot. Once this small window disappears the robot will begin executing your chain of commands. To abort or simply

stop the execution of a program just press the  button.

Exercise

In this laboratory session we will only build a simple choreography for you to understand the inner workings of the interface.

The choreography should contain the following steps:

1. At the beginning, and to allow you to move from your computer to the arena, the robot should “wait” for about 10 or 20 seconds.
2. Before doing anything with the robot you should ask it to “stand up”.


3. Our robot being some kind of a gentlemen, it should then “say” hello and “wave” its hand at the same time.
4. As described previously, before executing any other command we will have to “wait for” both commands to finish (both the waving and saying hello).
5. Next is some entertainment, the robot will perform a “tai-chi chuan” “dance”.
6. At the end of the “dance” to signify its tiredness, it will have to “wipe its forehead” and “Say” “I am tired” at the same time.
7. We wait for both commands to finish.
8. To rest a little bit, the robot should “lie down on its back” and “wait” there for some time (around 2-3 seconds).
9. After “standing up”, the robot should “move” forward 50 centimeters.
10. Now the robot should “say” “Mission accomplished”.
11. Finally, before disconnecting you should always make the robot “crouch” and “rest”, so that it is in a stable position.

You should construct this program in the Choregraphe simulator, running it as each step is added on the virtual robot to ensure the robot is behaving as expected. To save time as the sequence of steps gets longer, you may want to disconnect the initial arc from the first step and connect it to the last one added to test only the last step added.

Note that when the virtual robot is asked to speak no sound will be heard; however you may check that the spoken output is being generated by checking in the Dialog box which appears in the bottom of the central pane of the Choregraphe interface when you select “Dialog” in the View menu at the top.

After you feel confident that your program is correct you may run it on the physical robot by connecting to the robot as described above.

Disconnecting from the robot

Once you have made sure that no simulation is running, simply click on the disconnect button  and you will be directly disconnected from the real robot and connected back to the virtual Nao.