TWO WHEELS, ONE ARM (MOTION EVOLUTION PROJECT)

M – Artificial Intelligence – Evolution Programs

1. CONTEXT

During this project, you will have to work on a simple simulated robot, mainly made of two wheels and an articulated arm.

This poor little robot is unable to move - and so, your aim is to help him to go straight forward, the farther you can, with a better and brighter future. Maybe.

2. SUBJECT

Mother Nature does not care of little robots feelings, and there is no exception for this one, who only knows how to randomly move his arm. But there is maybe a solution for his descendants.

Maybe you could mimic the Nature, and generate the better straight forward movement sequence you can!

Let's see what we expect from you:

- You have to design every single part of your program. No further information will be given other than those contained in this document or in the joined files.
- We DO NOT expect a movement sequence ONLY! Trace your progress, show us how your little robot found his way! We will judge it too.
- Every document you can provide in order to present your work is welcome: charts, design explanations, scientific papers, etc.
- You must pay attention to every element of design, and expose your solution with accuracy.
- You have to deal with your environment. You doubt that is accurate? You think you lack of information? Find a way to bypass your problems, and show us how you have done.

You are allowed to modify the simulation scene to add more sensors and get more information if you need it.

3. WARNING!

Remember to trace EVERY STEP of your work! We will ask your captain’s log during the assessment.

Be scientific!

4. TOOLS

There is a little description of every tool needed to make your project.

4.1. OPERATING SYSTEM

We have tested V-REP on Windows 10, but it should work the same way with Win 7 and 8.1.

Some implementation is available for Linux and Mac, but has not been tested by our team.

4.2. COPPELIA ROBOTICS V-REP

4.2.1. SETUP

V-REP is the simulation program. You can find it here (choose the "Edu" version):
http://www.coppeliarobotics.com/downloads.html

The Educational license is enough to work on this project.

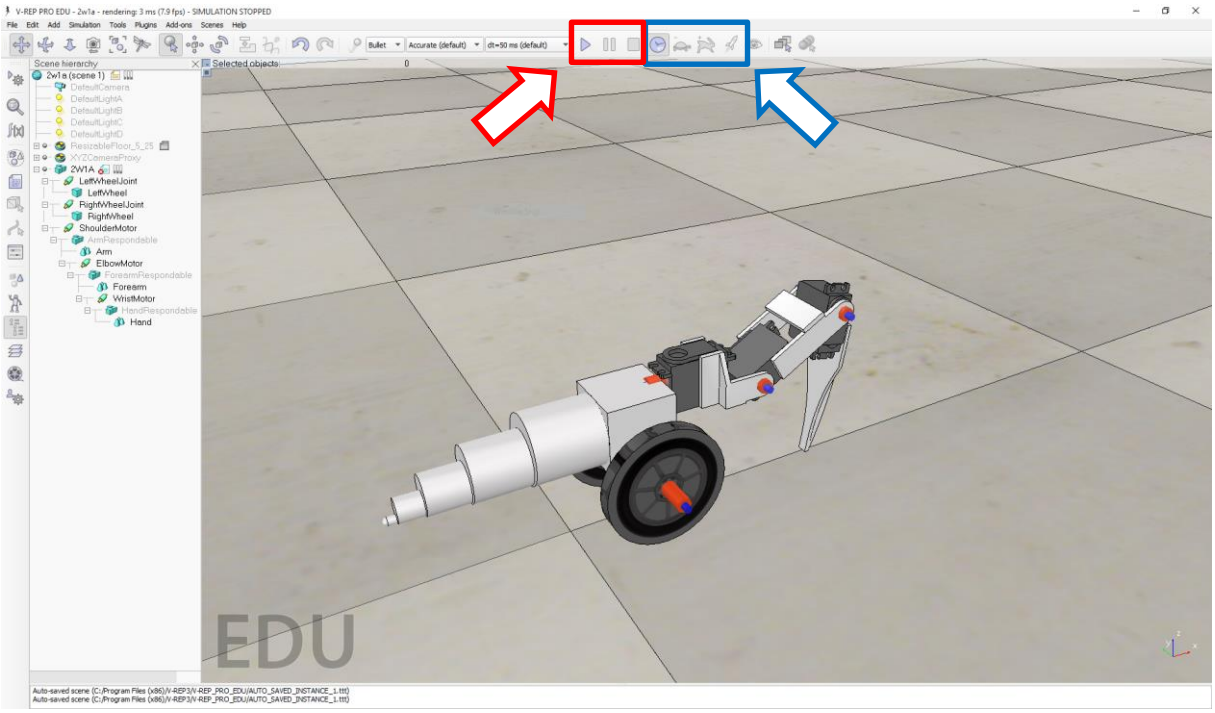
Follow this guide to enable the remote API server:
http://www.coppeliarobotics.com/helpFiles/en/remoteApiServerSide.htm

If you code with the regular (local) API, available in C and C++, you don't have to enable it.
Please, keep in mind that not every regular API function is available in the remote API.

4.2.2. V-REP PROJECT FILES

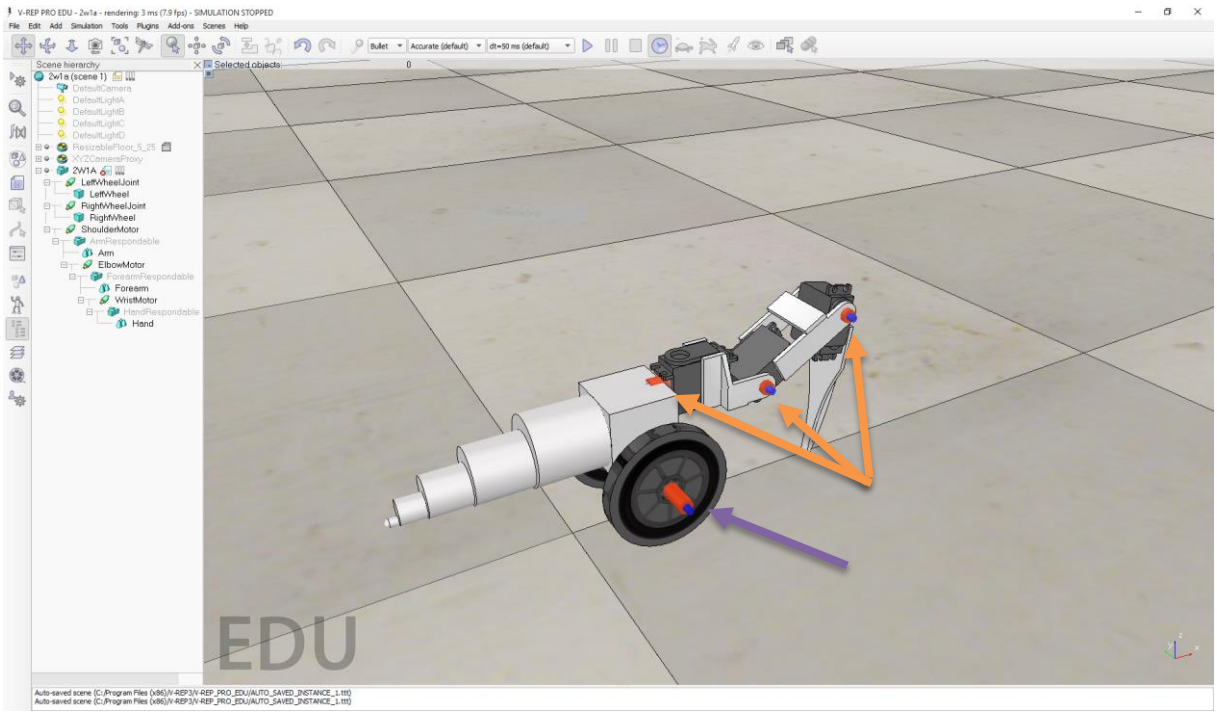
Extract the `2wheels1arm_simulation.zip` archive.

Open `2w1a.ttt`, the V-REP simulation project. You can launch the simulation by clicking on the blue triangle, in the tool bar (in the red rectangle in the screenshot):



You can speed-up the simulation by increasing the real-time multiplier in the configuration (in the blue rectangle, on the screenshot).

4.3. WHAT CAN I SEE ON THE SCREEN?



The orange arrows points on the robot joints: they are the actual articulations and the motors of the arm. These joints are what you can control.

The purple arrow points to a wheel joint: it is not motorized, you cannot control it.

The other elements of the robot are just its structure.

You are free to add sensors from the object libraries, obstacles (maybe for a bonus!) but you are not allowed to modify the actuators and the structure of the robot.

4.4. SAMPLE APPLICATION

To control the robot, we provide you a basic Python 2.7 solution, using the remote control API. **Using this solution or even Python is not mandatory!** It is here only for a demonstration purpose.

If it helps you, we used the PyCharm IDE: https://www.jetbrains.com/pycharm/

Let's see what the important parts are:

REMOTEAPI.DLL / VREPCONST.PY / VREP.PY:

These files are part of the control API. You are free to examine it, but we advise you not to modify it…

2W1A.PY:

This is a use example of the API. You can start your project with this file as a base, or just get inspired by it.

5. USEFUL LINKS

V-REP is a very complete program, but also well documented. There is some useful links to use it at its best:

- Enabling the remote API on the client side: http://www.coppeliarobotics.com/helpFiles/en/remoteApiClientSide.htm
- Regular API reference: http://www.coppeliarobotics.com/helpFiles/en/apiOverview.htm
- Remote API reference: http://www.coppeliarobotics.com/helpFiles/en/remoteApiOverview.htm
- How to use graphs embedded in V-REP: http://www.coppeliarobotics.com/helpFiles/en/graphs.htm
- The Coppelia V-REP forum is quite useful too: http://www.forum.coppeliarobotics.com/

Dig into the documentation if you want to do more.

Please, report any problem at this address: thibaut1.royer@epitech.eu with this tag: "[EP-PartI][Issue]