Webots mini tutorial

1 Start Webots

In room CM103, Webots 8 is installed on the Windows systems. Please check document *Installing Webots on your personal systems* for troubleshooting and information how to install Webots on your personal computers.
After starting the Webots, choose the Guided Tour (which should be offered the first time you start Webots, otherwise you can also start it from the menu *Help* → *Webots Guided Tour*). Please go through all the Guided Tour examples and have a look at the short descriptions in the window. You can Stop, Run and Revert the examples by using the corresponding toolbar buttons. Please do try all these buttons:

- [Revert]: Reload the .wbt file and restarts the simulation from the beginning
- [Step]: Go one simulation step forward (physics)
- [Real-time]: Run the simulation in real-time
- [Run]: Run the simulation at maximal speed with the visualisation
- [Fast]: Run the simulation at the maximal speed allowed by the CPU power (OpenGL rendering is disabled for better performance)

Note that next to the toolbar buttons there are two indicators: The left indicator shows the simulation elapsed time. The value is displayed as Hours:Minutes:Seconds:Milliseconds. The elapsed time indicates the time, it stops when the simulation is stopped. The other indicator is the speedometer which indicates how fast the simulation is currently running with respect to real time. When the speedometer shows about 1x, this means that the speed of the displayed simulated bodies is approximately equal to the speed that real physical bodies would have.
To do: See how the elapsed time and speedometer are affected by the simulation [Real-time], [Run] and [Fast] buttons.

2 Navigate in Webots

Using some of the examples of the Guided Tour, learn how to navigate in 3D using the mouse:
To do: Try pressing each of the mouse buttons and the wheel while dragging the mouse left/right/up/down.
It is also possible to move objects using the mouse. This can be achieved while the simulation is stopped or running. In order to move an object: first select the object with a left mouse click, then hold down the shift key and use the mouse:

- Translation: press the left mouse button to shift solid objects in the xz-plane (parallel to the ground).

- Lift: press both left and right mouse buttons (or the middle mouse button), and move the mouse up/down to lift/lower a solid object.
- Axis-aligned handles: When a solid object is selected, some arrow-shaped handles appear in the 3D window. These handles can be used to translate and rotate the object along the corresponding axis

To do: Try to translate / rotate / lift some robots and obstacles while the simulation is running and while it is stopped.
To apply a force to an object, place the mouse pointer where the force will apply, hold down the `Alt` key and left mouse button together while dragging the mouse. Linux users should also hold down the Control key (`Ctrl`) together with the `Alt` key.

3 Scene Tree

In Webots, the Scene Tree is the window that describes the world model in a VRML-like language. Geometrical shapes and dimensions, color and textures, physical properties ... all these different parameters are defined in the Scene Tree. As an example you can try to modify the gravity in some of the examples of the Guided Tour.
For example, open one of these worlds: Ghostdog, Gantry Robot or Q-RIO Robot

- Open the Scene Tree window if it is not opened yet (Menu *Windows* → *SceneTree*)
- In the Scene Tree, expand the topmost node: WorldInfo
- In the WorldInfo node: select the gravity field
- In the gravity field: change the y gravity component from -9.81 to 0.
- Run the simulation: now your simulation should be running in zero-gravity !

The field WorldInfo → basicSimulationStep specifies the duration of the simulation step in milliseconds. The simulation step defines how much to advance in simulated time before recomputing (integrating) the physics forces. Rigid bodies simulation is like integration: The smaller the simulation step, the more accurate the simulation, the larger the simulation step, the faster the simulation. If the simulation step is too large, unrealistic behavior may arise, for example: instability (vibration or explosion) of the simulation, robot passing though the ground or walls, etc. If the step is too small the simulation becomes too slow and you may have to wait too long for your results. Because there is this trade off between CPU time and faithfulness, it is important to always adjust the simulation step.
To do: Open some of the worlds of Guided Tour and try to increase / decrease the simulation step and Run the simulation again. What do you notice? Later on when you will be working on your lab project, remember to adjust the simulation step to your needs.

4 Basic concepts in Webots

Please read sections *Getting Started with Webots* and *Language Setup* Webots User Guide (*Help* → *User Guide*) to understand the basic concepts of Webots (e.g. controllers, worlds, physics).

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