

Lab assignment: Haptic programming with H3D

Lab leader: Jonas Moll (jomol@kth.se)
Time and place: November 15th, 13-15
November 16th, 10-12, 15-17
November 22th, 13-15
Computer lab VIT (E-house, floor 5), Lindstedtsv 3

Aim

The main aim of this lab assignment is to show how you can develop applications that are based on haptics. Among other things you will see how you can program rather complex behaviors by executing small simple pieces of code. You will also try out some more complex demos.

Haptics

Most computer users have only gotten in touch with interfaces that only provide visual feedback and even less users have programmed anything but visual interfaces. In this lab you will get the chance to see how you can, by rather simple means, develop multimodal interfaces based on vision and haptics.

In haptic interfaces you can “feel” virtual objects in a computer environment. In many haptic applications you can also “grab” virtual objects and feel forces and inertia. There are many types of haptic equipment that could be used with these interfaces and in this assignment you will use a one-point-interaction 3 Degrees Of Freedom pointing device named Novint Falcon.

In this lab you will use H3D to program simple haptic applications. H3D is developed by SenseGraphics and is an open source API for programming haptic interfaces. H3D uses an extended version of X3D, an XML-based standard for 3D computer graphics. Interaction is handled by routing and by external Python scripts.

Important notes

Note that it is possible for you to begin this lab on your own, since the equipment needed is already in place. **Before you start, download the Lab4.zip file from Bilda and place the “Examples” folder on your desktop.**

Whenever you do the lab it is important that you insert USB-connection in the device AFTER you have logged in, otherwise the device will not initialize properly. Also remember to disconnect the cable when you are done with the equipment.

Sometimes the haptic rendering will not work (you do not feel the objects). In these cases you can try to switch renderer in H3DViewer (All programs→H3DAPI2.1) by choosing from the list under the menu (Rendering→Choose Haptics Renderer).

This lab is divided into several parts. In this first part you will familiarize yourselves with the H3D API. You will be guided through a complete example and you will get the opportunity to see the effects of changing a single value. You will also be introduced to the scene graph concept. A program is run by loading the X3D file in H3DViewer (All programs->H3DAPI2.1).

Assignment 1 (Feel the force!):

- Run the example program “forcefield.x3d” located in the example folder on your desktop
- Load the example in H3DViewer
- The force you felt is due to the statement “<Forcefield force=”1.5 0 0”>. By varying the values of the force attribute (which is a vector) you can get different force effects. Locate the above line and try out some other values of the force attribute. Make sure to hold the Falcon when you run the example program again, to avoid possible damage due to a large force.

Assignment 2 (A simple example program):

- Open (in Notepad++) the H3D source files “example.h3d” and “example.py” located in the example folder on the desktop.
- Go through the example file together and look at some of the basic building blocks used when constructing visual and haptic interfaces in H3D. Where the python-script is invoked, change “jomol” to your own username!
- Run the example program and feel the result.
- Change one of the geometrical objects to another one and show the result to the lab leader. You can locate all available objects (as well as all other available nodes in H3D) in the online reference manual:
http://www.h3dapi.org/uploads/api/H3DAPI_20_beta/docs/H3DAPI/html/classes.htm
1

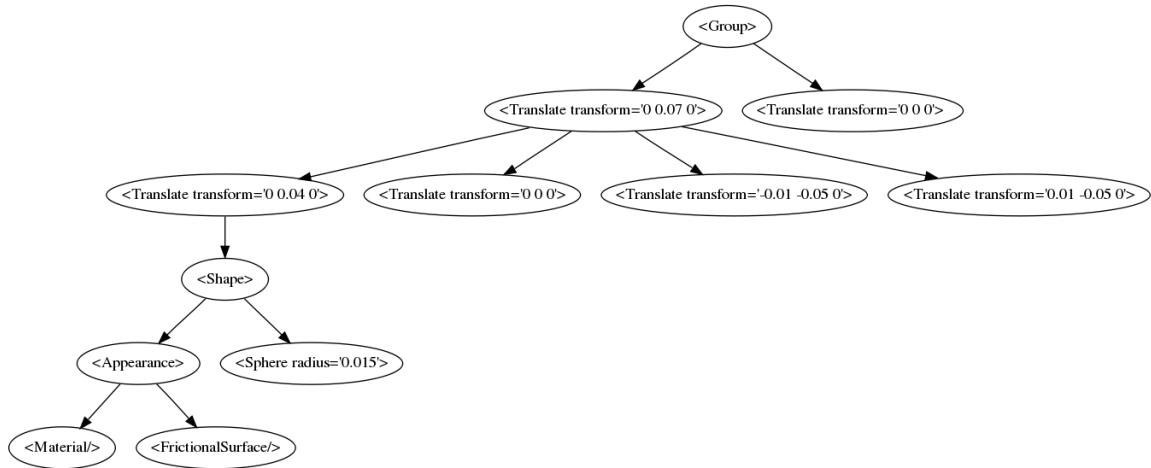
Assignment 3 (High jumping):

- Run the example program “deform.x3d” located on your desktop under “Examples”.
- Now, apply a force field, as the one you tried in assignment 1, to the deformable surface (early in the x3d file) that makes you “jump” faster when touching the surface.
- Show the result to the lab leader.

H3D is using a scene graph to organize the node representations. In these next assignments you will draw the scene graph of one H3D file to make it clear. In H3D the top node's name is "Group". Apart from analyzing the scene graph you will also add some nodes of your own.

Assignment 4 (The scene graph):

- Execute my.x3d. You should see a fancy human model. Study my.x3d in notepad and compare it to the scene graph figure below:



Assignment 5 (Where did the hat go?):

- Obviously the human in the above example lost her hat in the process. Make sure to put it back on her head again! Of course, a hat is an object which consists of two cylinders.
- You should also give her something to stand on, so she is not just floating around in the air.
- Try out different values on the stiffness and frictional attributes in the node "FrictionalSurface" every here and there in the example file and feel the result thereof.
- Show the completed assignment to the lab leader.

*In the next assignment you will get the opportunity to learn how haptics can be used in games.
There is no assignment except for trying it out.*

Assignment 6 (Hole in one or strike?):

- Now, you will get the opportunity to play some more advanced demo games that are used to illustrate what you can do when it comes to haptic based game playing. Try several out and see if you can beat each other!
- The games are found here: All programs → NVeNT Games
