

THE VRML MODEL AND VR SIMLUATION FOR A SCARA ROBOT

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Summary: In this paper is presented the use of Virtual Reality for virtual reality prototyping and testing the viability of designs before the implementation phase. Also, this example illustrates the use of the 3D Joystick for manipulating objects in a virtual world.

1. Introduction

Virtual Reality (VR) is a system which allows one or more users to move and react in a computer generated environment. The basic VR systems allow the user to gather visual or sound information using computer screens, stereoscopic displays or headphones. Some advanced systems – also known as haptic systems - can offer tactile information. Interaction between users and VR systems is ensured by standard input devices (keyboard, mouse) or multimodal devices (wire glove, the Polhemus boom arm, omni directional treadmill).

A virtual laboratory offers access to a virtual environment using for this simulation software. In figure 1 is presented the scheme block for a virtual laboratory.

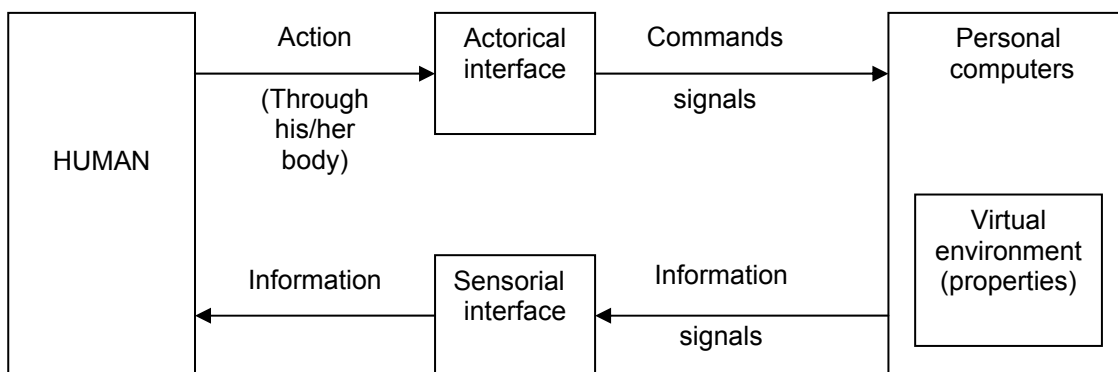


Figure 1. The scheme block for a virtual laboratory

The human operator through an actorial interface interacts with the virtual environment. The sensorial interface “collects” the information about the state and movements of the virtual environment and sends it to the operator.

The authors present in this paper the use of Virtual Reality for virtual reality prototyping and testing the viability of designs before the implementation phase for a SCARA robot, located in the Control Robot Lab of the University of Oradea. Also, this example illustrates the use of the 3D Joystick for manipulating objects in a virtual world.

2. THE VRML MODEL FOR SCARA ROBOT

The SCARA robot - from which it has been realized the model - is located - as it was mentioned above - in the Control Robot Lab.

To realize the VRML model for SCARA robot it was designed each element of the existing SCARA robot in CATIA V[®]. After that, each element of the SCARA robot was saved as a CATIA.part.

The CATIA V[®] has the possibilities to save the parts as a *.wrl files, (so, each element of the SCARA robot was saved in this format: Baza.wrl, Part10.wrl, Part11.wrl and Part12.wrl) which is the file format for Virtual Reality software.

To obtain the VRML model for SCARA robot it was used the Matlab R13 facilities: the V-Realm Builder 2.0 software, which is VRML software. Then the robot elements saved as wrl files was imported and the VRML model of the SCARA robot was designed.

In V-Realm Builder 2.0

In figure 2 is presented the VRML model of the SCARA robot.

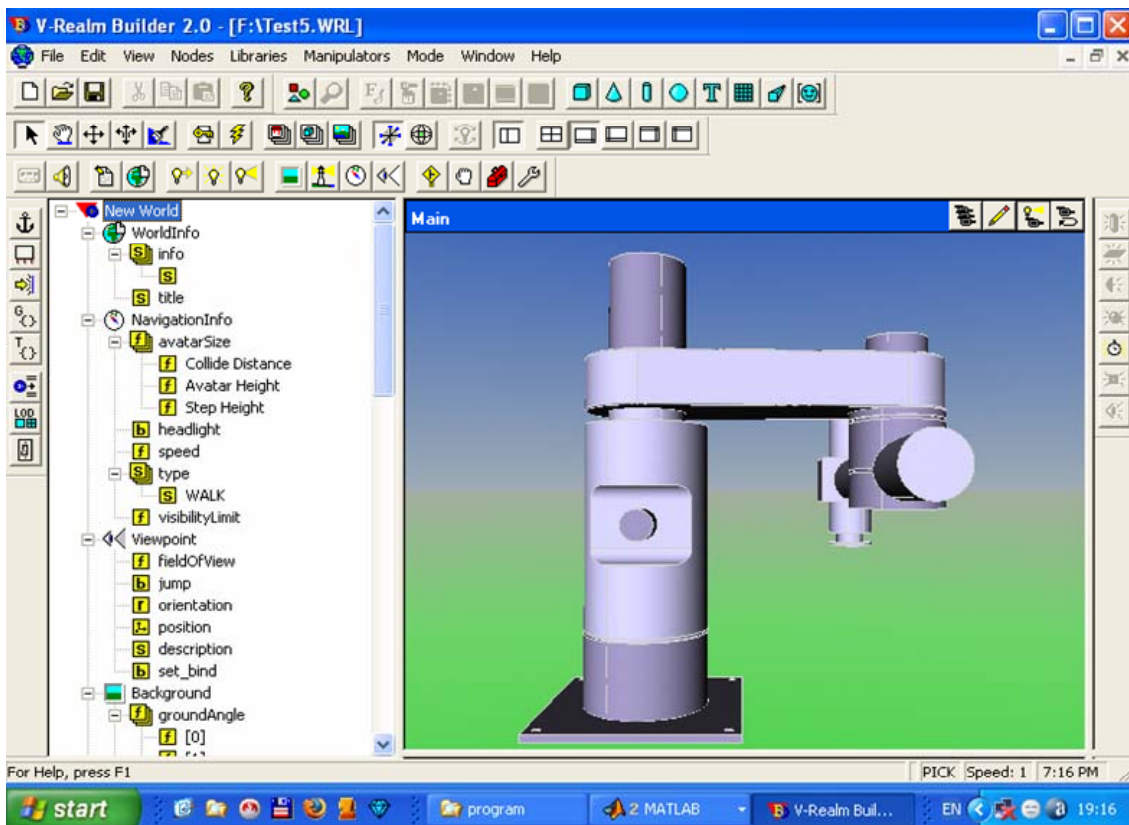


Figure 2. The VRML model of the SCARA robot

In V-Realm Builder 2.0 program it was defined the viewpoints, the background properties, the properties for each element, its position and orientation, etc.

In figure 3 is presented the V-Realm Builder 2.0 captured screen with all the views of the VRML model of the SCARA robot.

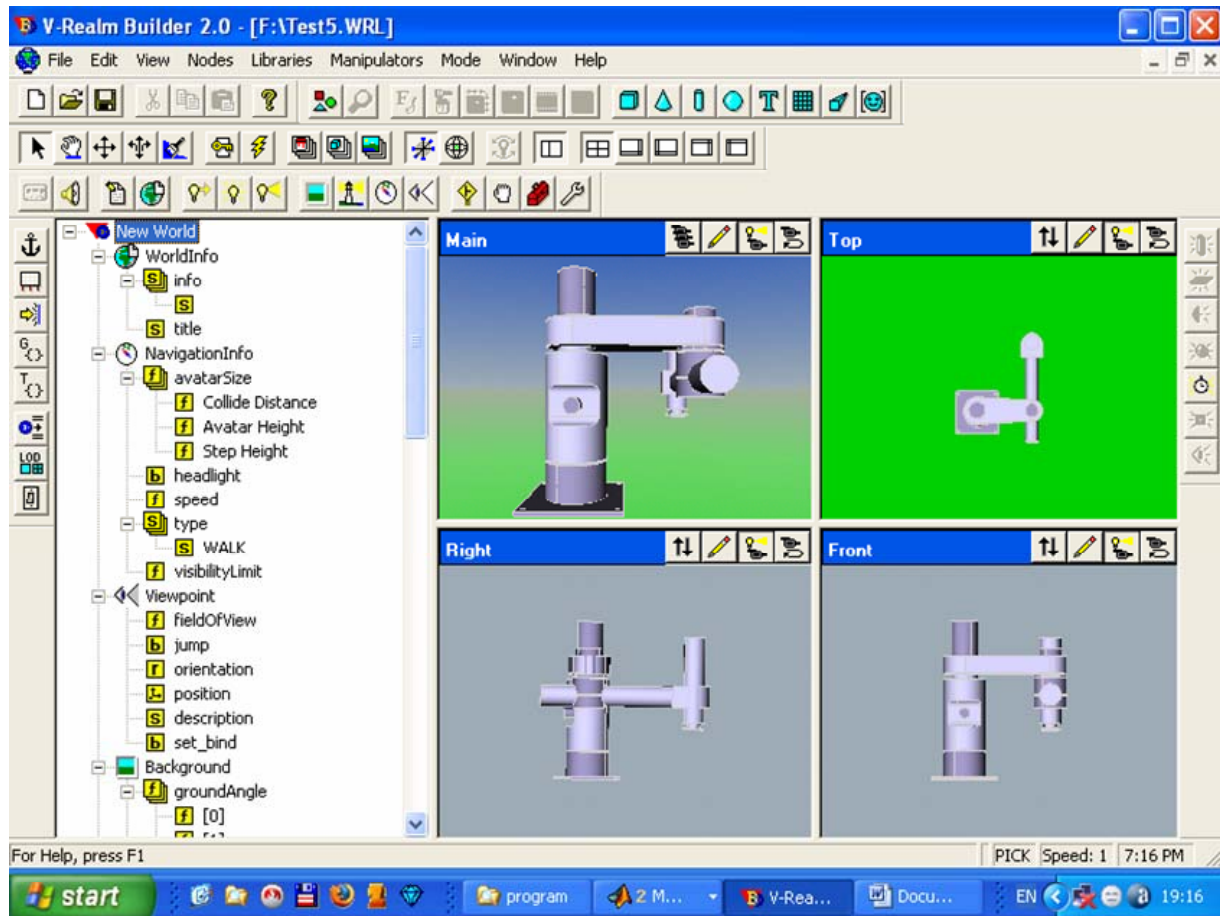


Figure 3. The views of the VRML model of the SCARA robot

3. THE SIMULINK MODEL FOR SCARA ROBOT

The VRML model represents a SCARA robot. It is manipulated by a simple Simulink model containing the 3D Joystick Input block as it can be seen in figure 4. This model uses all degrees of freedom of the Joystick for manipulating the mechanic arm, and the button to close the grip of manipulator jaws.

The 3D Joystick is an input device with 6 degrees of freedom. It is useful for navigating and manipulating objects in a virtual world. The Joystick is also suitable as a general input device for Simulink models. The Joystick is supported through the Joystick Input block which is included in the Virtual Reality Toolbox block library for Simulink.

As it can be seen from figure 4 the SCARA robot is represented by two blocks: the first one named VR Sinks is in fact the SCARA robot model without gripper, and the second one VR Manipulator Grip Control is the model for the gripper.

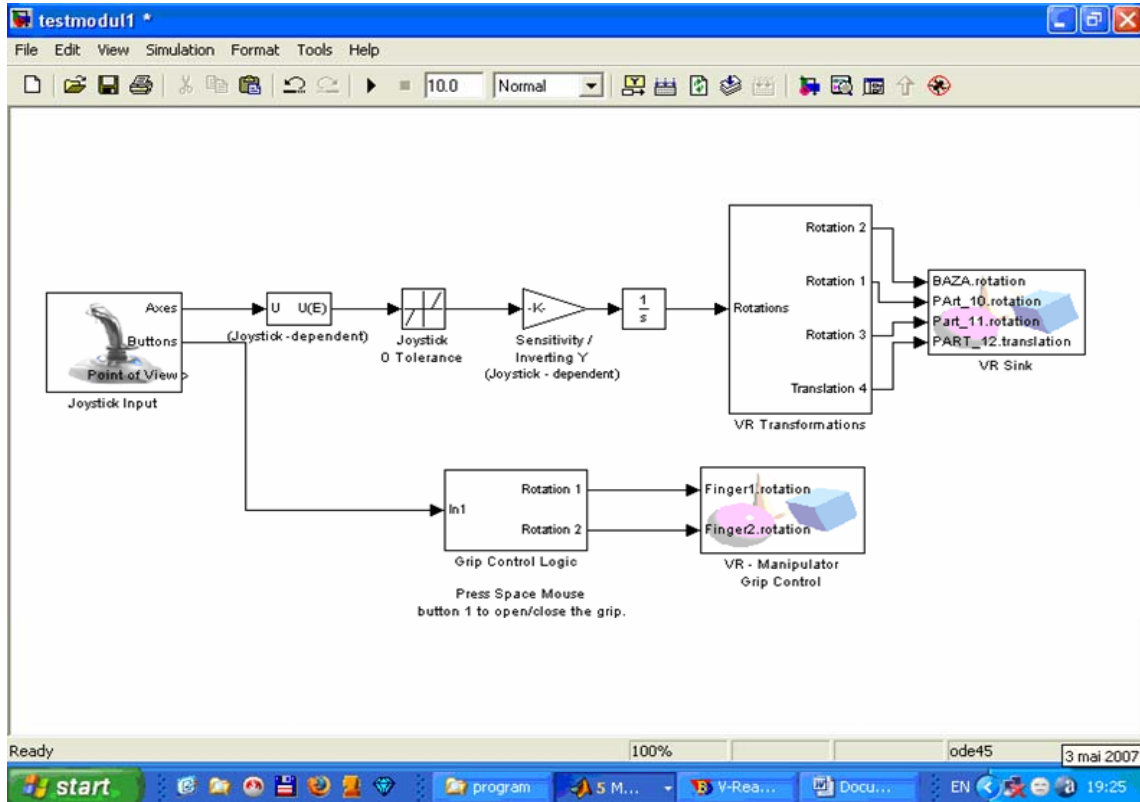


Figure 4. The Simulink model for SCARA robot

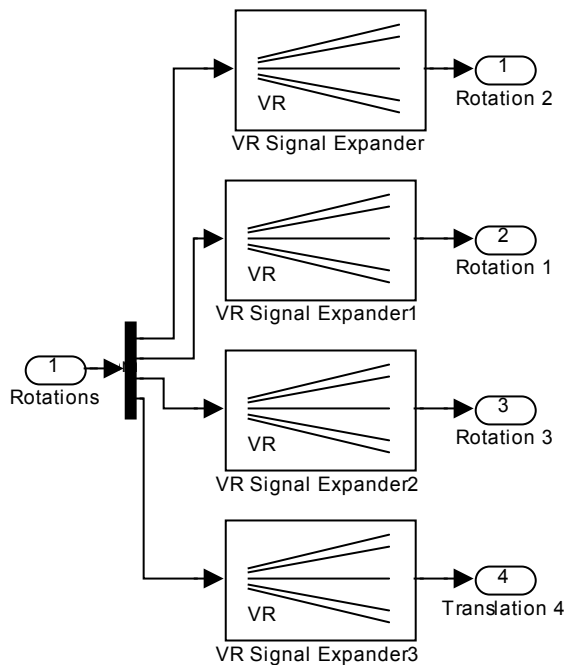


Figure 5. The VR Transformation block

In figure 5 is presented the VR transformation bloc. For all the fourth movements of the SCARA robot exists a VR Signal Expander (first three of them to generate the signal to move the robot rotations axes and the last one to generate the signal to move the robot translation axe).

In figure 6 is presented the Grip Control Logic block which generate the signals to move the fingers of the gripper.

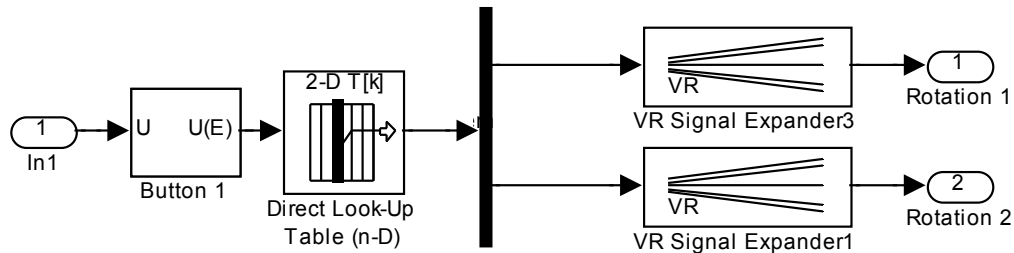


Figure 6. The Grip Control Logic block

In figure 7 is presented the VRML viewer to visualize and explore virtual worlds of the SCARA robot described with VRML. It can be see the world properties menu, the block properties and the VRML tree.

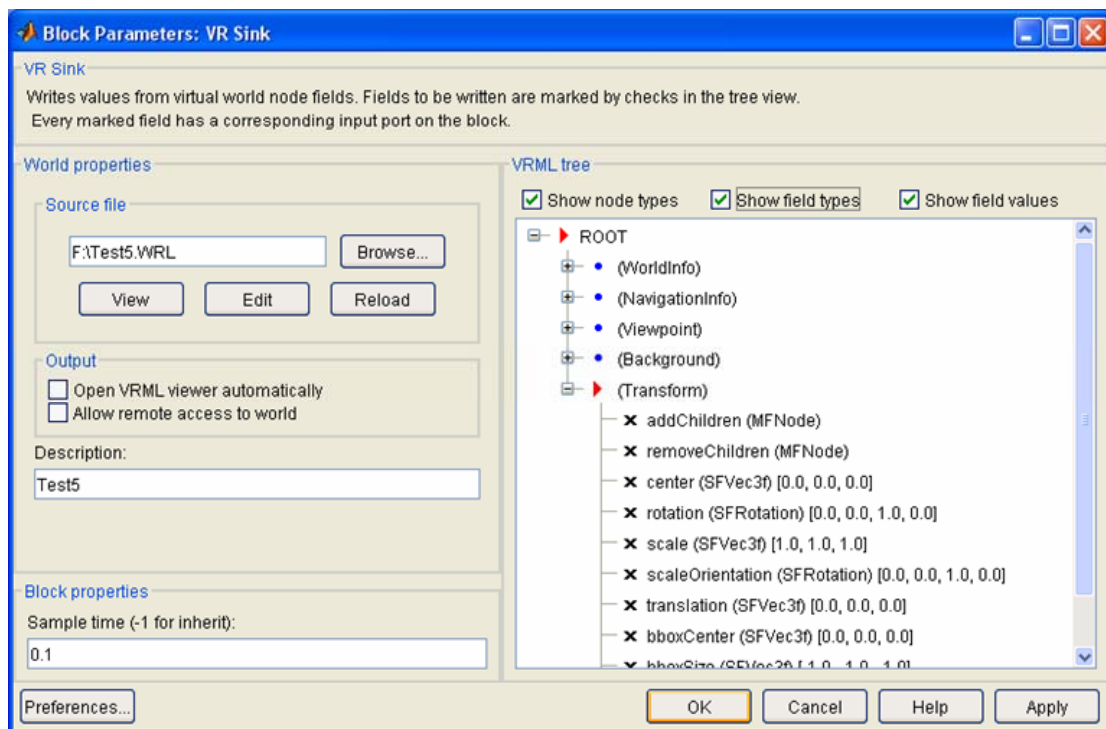


Figure 7. VRML viewer

The VRML model is structured as a tree starting from the base and ending with the gripper.

For each axes it is possible to define the type of the axes movement, and for each element it is possible to set-up the position and orientation in the VRML editor.

4. CONCLUSIONS

The information age we are living today, when the computer science, electronics and telecommunication has been spectacularly developed, allows for another kind of application that starts to be implemented with real benefits: virtual laboratories for robots remote control.

The Virtual Reality is useful to test the viability of designs before the implementation phase on a virtual reality prototype.

This way of world perception is nowadays one of the most attractive alternatives of man-environment interaction.

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