Simulink® for Natural Interaction Device (NID)

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1. Introduction

Simulink for NID is a set of Simulink blocks which enables to make an interface between Simulink and NID.

2. Disclaimer

The author of *Simulink for NID* and the organization which the author belongs to, do NOT take any responsibility for any loss or damage of any kind incurred as a result of use or download of *Simulink for NID* and related 3rd party software. NID manufactures and NID SDK vendors/organizations do NOT sponsor or endorse this project.

3. Required software

3-1. MATLAB® products

- MATLAB R2010b 32bit/64bit or later
- Simulink

Furthermore, these products are optional.

- Computer Vision System Toolbox (highly recommended)
- Simulink Coder (to generate *.exe)

3-2.Operating System

Microsoft Windows7 32bit/64bit

3-3.C MEX Compiler

Install Microsoft Visual Studio 2010 Express Edition (VC++) and Microsoft Windows SDK 7.1 and set as C MEX Compiler.

3-4.NID SDK

Either OpenNI™ or Microsoft Kinect™ SDK for Windows can be used with Simulink for NID 0.4.0 or later.

3-4-1. OpenNI

OpenNI (http://www.openni.org/) is an open source SDK for Natural Interaction Devices. OpenNI consists of the following modules and all modules can be downloaded from http://www.openni.org/Downloads/OpenNIModules.aspx

- OpenNI Binary for Windows x86 32bit/x64 64bit Development Edition
- OpenNI Compliant Middleware Binary (PrimeSense NITE) for Windows x86 32bit/x64 64bit Development Edition
- OpenNI Compliant Hardware Binary (PrimeSensor Module) for Windows x86 32bit/x64 64bit

Note that the above OpenNI Compliant Hardware Binary does not work with Microsoft Kinect. Note that development of Simulink for NID has been tested mainly with the following versions of OpenNI stuff.

- *OpenNI: Stable Build 1.5.2.23 Development Edition for x86/x64*
- *PrimeSense NITE: Stable Build 1.5.2.21 Development Edition for x86/x64*
- *PrimeSensor Module: Stable Build v5.1.0.41 for x86/x64*

3-4-2. Microsoft Kinect SDK for Windows

Microsoft has provided the commercial version of Kinect SDK for Windows (http://www.microsoft.com/en-us/kinectforwindows/) since February 1, 2012. The Kinect SDK enables Simulink to support Kinect Microphone Array by using the From Audio Device block of DSP System Toolbox (formerly, called Signal Processing Blockset).
Note that Simulink for NID does not support beta version of Kinect SDK for Windows.

4. Installations

Step1: Make sure that MATLAB R2010b or later is installed in Windows 32bit or 64bit.

Step2: Make sure that VS2010 (VC++) is installed and setup as the MATLAB C MEX compiler.

Step3: Install either OpenNI or Microsoft Kinect SDK.

Step4: After rebooting the PC, connect a NID to PC USB port. The NID should be recognized by the PC.

Step5: Run slnid/setup_openni.m or slnid/setup_kinectsdk.m. If everything is installed properly, C MEX file (sfun_nid.mexw32/.mexw64) and simulinkfornidinfo.m should be generated in slnid/Lib directory.

5. Samples

There are several demo models under slnid/Samples directory. To run the demo models, please remind the following prerequisites:
- To simulate demo models, it needs to connect a NID to the PC. Model update and code generation can be performed without connecting the NID.
- Models with cvst prefix need Computer Vision System Toolbox.
- Models with spb prefix need DSP System Toolbox.
- If you had Simulink Coder, you could generate an executable (.exe) from the model. Depending on the blocks used in the model, you may need to set Windows PATH to matlabroot/bin/win32 (or win64).
- Sample models in Samples/11b directory work in MATLAB R2011b or later.

6. FAQ

Q: How do I find information about blocks of Simulink for NID?

A: Those are links to detailed description of each block.

NID IMAQ block: Lib/doc_en/slnid_imaq.html

NID Image bock: Lib/doc_en/slnid_image.html

NID Depth block: Lib/doc_en/slnid_depth.html

NID IR block: Lib/doc_en/slnid_ir.html

NID Motion block: Lib/doc_en/slnid_motion.html

NID Skeleton block: Lib/doc_en/slnid_skeleton.html

Those links are also referenced by clicking Help button of each block parameter dialog.

Q: How can I improve simulation performance with Simulink for NID?

There are several tips which are valid for not only a use case with Simulink for NID:

- Use Simulink Accelerator at simulation

- Use Embedded MATLAB instead of M File S-Function

- Generate exe file from model by using Simulink Coder

Those techniques make Simulink model run as native program (either dll or exe) on PC, so it should be faster than normal simulation.

Q: Does Kinect Microphone Array require Simulink for NID?

A: No. Only Kinect SDK for Windows is needed to acquire Kinect Microphone Array data by using the From Audio Device block of DSP System Toolbox.

Q: When I try starting simulation after OpenNI::Resolution parameters of NID IMAQ block was changed, it causes MATLAB crash. How should I solve this problem?

A: This is a known issue while using Skeleton features of the latest OpenNI (ver. 1.5.2.23). It did not occur with previous versions of OpenNI (e.g. ver. 1.3.4.2), To avoid the issue, you need to re-start MATLAB after the parameter is changed.

Q: When I try executing Simulink Coder generated *.exe from the model, it did not work. How should I solve this problem?

A: In case of Kinect for Windows SDK, you need shut down MATLAB before executing Simulink Coder generated *.exe from the model which contains Simulink for NID blocks.

7. Revisions

Version 0.5.1 (August 7, 2012)

- Added new block parameters on IMAQ block to be able to change Kinect sensor angle during simulation and configure Skeleton smoothing parameters. (For more detailed information, see Samples\win\nid_cvst_kinect_sdk_sensor_angle.mdl)

Version 0.5.0 (July 11, 2012)

- (Unofficially) support for OpenNI SDK in Mac OS X and Linux (Ubuntsu)
  Note that we have tested only Mac OS X and never tested in Ubuntsu. Make sure that installation of OpenNI SDK on the both platforms could be succeeded before using Simulink for NID since we can't support any installation issues.
- Fixed a bug about coordinates misalignment between skeleton and image (for Kinect for Windows SDK)

Version 0.4.2 (May 22, 2012)

- Support Microsoft Kinect SDK for Windows version 1.5
- Support Kinect SDK::Seated mode for Skeleton Tracking (configured in IMAQ block)
- Support Skeleton Tracking in Kinect SDK::Near mode
- Added "Max number of Skeleton Tracking" parameter on Skeleton block to support skeleton tracking for multiple people (max. 2 people) for both of Kinect SDK and OpenNI
- Support multiple instances of NID Device blocks (Image/Depth/IR/Motion/Skeleton blocks can be multi instanced in a model)
- Moved "OpenNI::Need PSI pose for calibration (of Skeleton tracking)" parameter from Skeleton block to IMAQ block to support multiple instances of NID Device blocks.
- Changed unit of Projective XY data ([pixel/1000] to [pixel]) in NID Depth and Skeleton blocks
- Added Samples¥nid_cvst_multi_instance_device.mdl

Version 0.4.1 (February 27, 2012)

- Added "Read sensor angle" parameter on IMAQ block for Kinect for Windows hardware to acquire the Kinect sensor angle during simulation.
- Added Samples¥nid_cvst_what_nid_see.mdl, nid_skeleton_eML.mdl and nid_skeleton_SL.mdl
- Corrected color of skeleton joints in Samples¥skeleton_viewer.m (for Kinect SDK)

Version 0.4.0 (February 06, 2012)

- Support Microsoft Kinect SDK for Windows version 1.0

Note that Kinect Sensor angle (can be set once at the first simulation step) and Near mode (for only Kinect for Windows hardware) are supported.

- Added two demos (nid_spb_cvst_kinect_sdk_what_is_nid.mdl and spb_kinect_sdk_audio.mdl) using Kinect Microphone Array

Note that Kinect SDK for Windows has to be installed to use the Kinect Microphone Array

Version 0.3.3 (November 23, 2011)

- Support Skeleton tracking without PSI pose calibration (need a version of OpenNI and PrimeSense NITE which support pose less calibration)
- Added "Need PSI pose for calibration" parameter in NID Skeleton block
- Improved usability of skeleton tracking calibration (retry pose detection automatically without moving out from the camera view or re-start simulation)
- Simplified Skeleton tracking image (color of skeleton joint markers is fixed as gray and no

change of background color while skeleton tracking is active)

Version 0.3.2 (November 01, 2011)

- Support 64bit version of MATLAB (Formerly, supported only 32bit version of MATLAB)
- Added nid_cvst_corner_detection.mdl and corner_detection_viewer.m by Naoya Maeda
- Added nid_cvst_pattern_tracking.mdl and pattern.pdf by Shuai Yuan
- Fixed a bug of NID IMAQ Resolution and FPS block parameter
- Improved skeleton_viewer.m

Version 0.3.1 (October 17, 2011)

- Support QVGA (320x240): 60FPS for NID IMAQ in addition to VGA (640x480): 30FPS

Note that QVGA (320x240): 60FPS is supported by only ASUS Xtion PRO series devices.

Version 0.3.0 (August 8, 2011)

- Added Real world coordinates parameter for Depth and Skeleton blocks
- Added nid_cvst_point_cloud.mdl, point_cloud_viewer.m and skeleton_viewer.m to the Samples
- Changed Depth image color to green from yellow
- Improved skeleton tracking capability

Version 0.2.5 (July 25, 2011)

- Initial public release