PR2 GPU Computer Configuration
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Overview

This document contains instructions for computer configuration of a PR2 with an nVidia Quadro 600 GPU installed into c2. These instructions have not been tested with all PR2 kernels, nVidia drivers or computer configurations.

Document Notes:
- Unless otherwise stated, you will have to run commands from this document as root.
- Familiarize yourself with nVidia develop driver installation instructions on the nVidia developer website before using this document.
- The supported version numbers of the installation files are listed in this document. Different versions of these tools have not been tested.

PR2 Starting Configuration

PR2 Computer:
- 2.6.31.10-rt kernel (linux-image-2.6.31-10-rt_2.6.31-10.153_amd64.deb)
- Kernel headers (linux-headers-2.6.31-10-rt_2.6.31-10.153_amd64.deb)
- RT headers (linux-rt-headers-2.6.31-10_2.6.31-10.153_all.deb)
- Ubuntu 10.04 (Lucid Lynx) 64-bit

Note: The PR2 kernel files should be already installed on your robot.

nVidia Drivers from the nVidia developer website:
- nvidia-current debian package from PR2 debian repo
- CUDA Toolkit for Ubuntu Linux 10.04 (64-bit), version 3.2.9
    - cudatoolkit_3.2.9_linux_64_ubuntu10.04.run
- GPU Computing SDK code samples, CUDA version 3.2
    - gpucomputingsdk_3.2_linux.run

Helper files from PR2 Support Website:
- cuda_toolkit.conf
- pr2_gpusdk_makefile.patch
- pr2_gpu_monitor.launch

Download the CUDA toolkit and GPU Computing SDK from the nVidia developer website, developer.nvidia.com.

Copy the "cudatoolkit" and "gpucomputingsdk" files onto your robot and make them executable.

Before you begin installing the nVidia drivers and CUDA toolkit, familiarize yourself with the installation instructions on the nVidia developer website, "README_Linux.txt".

Check to make sure the nVidia Quadro 600 is properly installed. On c2 of the PR2, type "lspci". You should see:

03:00.0 VGA compatible controller: nVidia Corporation Device 0df8 (rev a1)
03:00.1 Audio device: nVidia Corporation Device 0bea (rev a1)

Installing the Driver and CUDA Toolkit

Driver Installation

Run "sudo apt-get install nvidia-current" to install the nVidia driver. Make sure you have the driver version 260.19.06 after the installation (run "dpkg -s nvidia-current" to check version).

CUDA Toolkit

Next, install the CUDA toolkit by running the "cuda_toolkit_..." file as root.

Copy the file "cudatoolkit.conf" from the PR2 Support Website to the directory "/etc/ld.so.conf.d". Run "ldconfig" as root to set your LD_LIBRARY_PATH for the CUDA modules.

GPU SDK Installation

Finally, install the "gpu_computing..." file. Run the file to install it. Do not run the file as "root", you can install as a regular user.

You should have a folder in your home directory called "NVIDIA_GPU_Computing_SDK". Apply the patch "pr2_gpusdk_makefile.patch" to that directory.

~NVIDIA_GPU_Computing_SDK/ $ patch -p0 -i pr2_gpusdk_makefile.patch

In the folder "~/NVIDIA_GPU_Computing_SDK/C", type "make" to build the CUDA code samples. After the build, cd to "~/NVIDIA_GPU_Computing_SDK/C/bin/linux/release".

Verify Driver Installation

Run "~/NVIDIA_GPU_Computing_SDK/C/bin/linux/release/deviceQuery". You may have to run as root. Make sure you see at least one device supporting CUDA.

Check that the GPU is functioning. Run "sudo nvidia-smi -a" to get the temperature and utilization of the GPU.

```
==============NVSMI LOG=============

Timestamp                  : Thu Oct 21 18:53:06 2010

Driver Version             : 260.19.06

GPU 0:
        Product Name       : Quadro 600
        PCI Device/Vendor ID   : df810de
        PCI Location ID    : 0:3:0
        Display            : Connected
        Temperature        : 48 C
        Fan Speed          : 67%
        Utilization
           GPU             : 0%
           Memory          : 3%
```

You can run other utilities in the "bin/linux/release" directory to test GPU performance.

Sudoers Change

The "nvidia-smi -a" command may only work as root. Use "visudo" to edit the PR2's sudoers file. Add the following line to the end of the file:

```
# This commands is needed by nvidia_gpu_monitor
ALL ALL=NOPASSWD: /usr/bin/nvidia-smi -a
```

PR2 / ROS Integration

To monitor the GPU using the ROS diagnostics system, check out the "nvidia_gpu_monitor" package. Add the package to your ROS_PACKAGE_PATH and "make" it.

Add the following to your "/etc/ros/robot.launch" file to start the GPU monitor:

```
<include file="/etc/ros/cturtle/pr2_gpu_monitor.launch" />
```

Copy the file "pr2_gpu_monitor.launch" from the PR2 support website to the "/etc/ros/cturtle" folder.

Start the PR2 and make sure the GPU reports "OK" in the diagnostics. The "GPU Status" will be under the "Computers" tab.