ROBO410 Research Memorandum

Team G

Date: 10/07/2012

Title: LabVIEW Robotics Environment Simulator

1. **Introduction**

Before we begin controlling the physical unicycle, we would like to have the ability to run our control algorithm in a simulation to see how well it performs. Since we have access to the LabVIEW robotics package, we would like to utilize the robotics environment simulator included to have a visual representation of the unicycle, and believe that it would be very nice to have a visual simulation for presenting our project.

1. **Robotics Environment Simulator - Overview**

The main function of the simulator is to see how a robot will behave in an environment without needing to constantly recompile code on the physical robot. Simulation of this sort allows developers to validate their designs quickly and effectively. The LabVIEW robotics simulator is based on the Open Dynamics Engine, an open source, high performance library for simulating rigid body dynamics [2]. Parameters inside the simulator can be controlled via special simulator function blocks in a manner similar to real parameters are controlled.

1. **Import a Custom Model**

To add a custom model to the simulator, you must use the CAD Model Importer. The importer takes models of types \*.ive, \*.dae, and \*.wrl, and converts them into a 3d useable model in the simulator environment. For our purposes, the easiest way to get a model into one of these formats is to work with the free program, Google SketchUp. With this program, you can export as a COLLADA file (\*.dae) that can be imported into the simulator environment [3]. You must then choose how to physically model each component of your imported model. Components can be modeled as a box, a sphere, or a cylinder. The physical model is what the open dynamics engine will use to calculate the dynamic behavior of the model, so it’s crucial that the model is as accurate as possible. You also need to add joints by dragging one component in the component list to another component and then choosing a type of joint. It is very important to have a defined joint between two components. Otherwise, the components will fall apart once they are in the simulation environment [1]. Joints positions are able to be controlled within the simulation environment using function blocks, so it is important to remember to include them in your model. When you are finished with the physical model and the joints, you can export your model and it will be added to the list of robots able to be added to the simulation environment.

1. **Using the Simulator**

Once the model is imported into the simulation environment, the model’s joint positions can be measured or controlled using the function blocks in a similar manner to how physical motors are measured or controlled. The simulator may not be accurate enough to rely on for creating a control algorithm, but could be very useful as a visual aid in explaining how the robot works.

**Citations**

[1] “Overview of the LabVIEW Robotics Simulator”, National Instruments, October 3rd, 2012. [Online]. Available: <http://www.ni.com/white-paper/>

[2] “Open Dynamics Engine”, ode.org, October 3rd, 2012. [Online].

Available: <http://www.ode.org/>

[3] “3D Model COLLADA (DAE) Export”, Google, October 3rd, 2012. [Online].

Available: <http://www.ni.com/white-paper/>