Assignment 2: Control: Walk and Kick
CS 393R: Autonomous Robotics
Assignment due: Thursday, September 19, 2013

Your task: Score! Walk up and kick a ball using PID control.
The first task is to program your Aibo to walk towards a ball (up to 8-10 body lengths away) using PID control. Note that the ball can be anywhere with respect to the robot's starting position, so you may need to search for it.

• Use PID to control the whole robot by giving commands to one of the walking engines. You should not be controlling individual joints with PID, nor should you be developing your own walk engine.

• You may want to use the angle of the direction toward the ball (in the body frame of reference) as the error signal. If the head moves around, this could be difficult to determine. But it is easy to bring the head facing forward in its default position.

• Try different variants of the PID control (P, PI, and PD) to see which works best.

• Leave plenty of time to experiment with tuning!

Second, on getting close enough to the ball, locate the goal, and position the robot so that it can kick the ball toward the goal. Note that the goal can be anywhere with respect to the robot's starting position, so you may need to search for it.

Third, kick the ball toward the goal. Ideally, score. Note that kicking can cause stability issues for the Naos, especially with particular robots. **Whenever your robot is kicking, you or your partner must be right behind it to stabilize it in case it starts to fall.**

The ball may be far enough from the goal that multiple kicks are needed to score - your robot should keep chasing the ball and kicking it towards the goal until it scores without any human interaction (except to stabilize it). It is acceptable to dribble the ball to get into better position, but you should not dribble the ball into the goal - this does not count as a kick!

Assignment 3 will feature a penalty shot competition, so keep this in mind when designing your approaching and kicking strategies.

Write a short but professional memo (one memo from each team, co-authored by all team members), concisely but clearly describing what you did, what problems you encountered, how you overcame them, and how successful you were in the end. Make sure to compare your PID controller against what you did for Assignment 1. Also be sure to briefly describe the contributions that each team member made to the final outcome.

Checklist: (grades will be calculated out of 12 points, so there are 2 points of extra credit available)

[____] (1 point) PID formulation (specify error signal and how it is obtained)

[____] (1 point) Find the ball

[____] (1 point) Walk successfully towards ball using PID control.

[____] (1 point) Stop/slow down when close to the ball.

[____] (1 point) Find the goal.

[____] (1 point) Position robot so that the ball and goal line up.

[____] (1 point) Kick ball towards goal.

[____] (1 point) Persistence: Kick as many times as necessary to make the goal..

[____] (1 point) Stop kicking when the ball is in the goal.

[____] (0-2 points) Kicking success: four tries, 0.5 points for each goal scored. If your robot wanders off, the ball goes out, or the robot appears stuck, that's a miss.

[____] (1 point) If the robot detects that the ball is at a very skewed angle with respect to the goal, then kick the ball into a better position and score.

[____] (2 points) Clarity and quality of your memo. Email it (along with a compressed folder of your behaviors and motion files) to Peter and Jake by class on Sept. 19