UNSW COMP3431: Robot Architectures S2 2004

Assignment #2

Ball Grabbing and Kicking

Due: Start of Lab, Week 8 (11am, 16 September 2004)

1 Overview

This goal of this assignment is to give you broad familiarity with manipulation in robots. In particular, in this assignment you will write behaviours to chase, grab and kick a normal orange RoboCup ball.

Students will perform this assignment in small groups of 2 or 3. You are requested to work closely together on the project, developing the code together (rather than using the "divide and conquer" technique of splitting the project into parts, developing the parts separately, and then recombining).

1.1 Use of others' software

You may use the same base code as for the first assignment. In particular,

You already have access to the source code of a complete soccer playing robot, including behaviours to complete most of this assignment. For this assignment you are free to use any base-station code, any C++ code on the robot (accessed through the VisionLink module) and the basic python behaviour files on the robot listed here:

```
PyLib/*
PyCode/Behaviou.py
PyCode/Constant.py
PyCode/Debug.py
PyCode/Global.py
PyCode/HelpLong.py
PyCode/HelpShort.py
PyCode/HelpWhere.py
```

Note that parts of other files may be called by those files, and in particular Global.frameReset() calls HelpTrack.determineBallSource(). You should not add further references to other files, and you should look at the above code path to check that it does what you want if you use the global ball location variables.

You are *encouraged* to read the other python files, but please, no direct copying. You are also encouraged to build upon your code from assignment 1. You are encouraged to look at other RoboCup teams' approaches (please acknowledge any borrowed

ideas in your report), although again, no direct copying of code. Video of the 2004 final is available on the web here: `http://www.openr.org/robocup/movies/2004movies.HTML`, and mirrored on the course web page (`http://www.cse.unsw.edu.au/~robocup/2004-final.mpg`).

1.2 Other Requirements

All behaviours should work both with and without other robots on the field, and with the robot wearing either colour uniform.

1.3 Deliverables

Parts 2, 3 and 4 of this assignment require you to develop behaviours on the robot. These behaviours will be handed in as follows: Before the start of the lab when the assignment is due, each group should have checked into the Subversion repository (`https://roborouter.cse.unsw.edu.au/svn/robocup/`) a branch containing their code. This branch should use Subversion correctly so that the `svn diff` command returns a reasonably sized output. Each group should also have a checked out working copy of their code with no local modifications on one of the lab machines. The code in that working copy should be compiled and ready for installation on a memory stick. The compiled code should have been tested on the robot before the class starts.

During the lab we will make memory sticks from those working copies. The solutions will be compared and graded. Each of the behaviours should have its own python module usable by the `spip` script. The names of those python modules should be included in the report.

The report in part 5 should be an electronic file checked in to the same branch as your code. It should be in an easily readable format, *e.g.* plain text, html, PDF or postscript.

2 Grab Ball (5 marks - graded in lab)

In this part of the assignment you must program the robot to capture the ball. The ball will be stationary on the field. The robot must approach the ball and place its head and legs about the ball so that the ball cannot easily be dislodged. The robot should be able to move sideways and turn while keeping hold of the ball. *e.g.* if the ball was placed in the centre of the field, then the robot should be able to approach the ball and grab it without knocking it outside the centre circle. The robot should then be able to walk sideways to move the ball outside the centre circle while retaining its hold on the ball.

Modification of the walk used while holding the ball is acceptable. It is expected that you will need to modify the head control code inside the actuator control object to achieve a good grab.

The final deliverable for this section is a behaviour that grabs the ball, and then demonstrates four skills: walking left 20cm, walking right 20cm, turning over 90° left

and turning over 90° right. Your code is allowed to release the ball and re-grab between skill demonstrations if you choose.

3 Kick Ball (5 marks - graded in lab)

In this part of the assignment you must make the robot kick the ball. The ball will be stationary on the field. The robot must approach the ball and then kick it. There is no requirement for the robot to grab the ball before the kick (but that is certainly one possible strategy). The kicks will be graded on:

Safety Is the kick likely to damage the robot/field/user/ozone layer?

Reliability When the kick is attempted, does it often fail?

Speed How long does it take from when the robot is first within 20cm of the ball, to when the ball is again 20cm away from the robot after the kick? (*i.e.* the speed of the approach and grab is all included in the speed of the kick.)

Distance How far does the ball move from where it was kicked?

Parameterisation Is it possible to set the angle and strength at which to kick?

Reliability and speed have been shown to be more important than distance in RoboCup, so that will also be true in the grading criteria. UNSW has never had a fully parameterizable kick, but if you can make one, that would be great.

In previous years UNSW has developed kicks in three different ways: using scripted motions (`.pos` files), using the walking code normally (the standard paw kick), and using walking code with tweaks added (the 2003 turn kick). You can develop your kick using any of these three methods[1].

4 Time Trial (5 marks - graded in lab)

In this part of the assignment, the ball will be placed down the yellow end of the field and the robot must get the ball to the blue side of the centre line as fast as possible.

5 Report (5 marks)

Describe the approach used in each of the previous sections. Describe the strengths and weaknesses of that approach.

[1] A paw kick, walking at the ball so as to hit it straight forward with the robot's foot, is very fast. To get good marks with a paw kick, it should either a) be parameterised so that the kick direction can be chosen, possibly by controlling the direction of approach to the ball; or b) have a tuned/timed approach to the ball that maximises kick power.