UNSW COMP3431: Robot Architectures S2 2009

Assignment #3

Localisation and Kicking

Due: Start of Lab, Week 13 (2pm, 20 October 2009)

1 Overview

This goal of this assignment is to give you broad familiarity with localisation and manipulation in robots. In particular, in this assignment you will write behaviours to move to a particular location on the field, and to move a robocup ball around the field.

Students will perform this assignment in small groups of up to 4. 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). Please work in different groups to the groups from Assignment 1. If you have a problem forming groups, please talk to the lecturer in charge as soon as possible.

1.1 Use of others' software

As in assignment 1, 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/Action.py
PyCode/Behaviour.py
PyCode/Constant.py
PyCode/Debug.py
PyCode/Global.py
PyCode/hFrameReset.py
PyCode/hMath.py
PyCode/hPauseMotion.py
PyCode/hPWalk.py
PyCode/hWalk.py
PyCode/hPSensor.py
PyCode/Indicator.py
PyCode/Packet.py
```

```
PyCode/pDoNothing.py
PyCode/pInitial.py
PyCode/pReady.py
PyCode/pSet.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.

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 and 3 of this assignment require you to develop behaviours on the robot. The compiled code should have been tested on the robot before the class starts.

During the lab each team will make memory sticks from their 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 4 should be an electronic file emailed to the lecturer in charge. It should be in an easily readable format, *e.g.* plain text, html, PDF or postscript.

2 Localise (5 marks - graded in lab)

This section is based on the 'localisation challenge' from the international robocup competition.

Before the challenge the lecturer in charge shall choose appropriate landmarks, five points on the RoboCup field and one restart point (and angle). The selected points shall be written to each teams memory-stick as a text file in the topmost directory: `points.cfg`. The format of the file has one target point per line, the x coordinate followed by the y coordinate. The coordinates are in standard rUNSWift field-based coordinate system for the red team.

The corrdinates are in centimetres, with the origin in the corner of the field at the red/yellow end of the field.

```
250 120
370 380
450 250
20 20
120 50
```

Figure 1: A sample list of coordinates (not yet checked to make sure they're valid...)

Points are guaranteed to be at least 15cm from the nearest obstacle, and at least 100cm from any other point.

The robot performing the challenge must start paused. The referee will place the robot at a point on the field (same for all teams) and then activate the robot by touching its head sensor. The referee will then leave the field area.

Upon activation, the robot shall start moving to one of the target points. When it thinks that it is close to the target point, the robot shall pause itself and indicate to the referee that it believes it is near a target point (usually by wagging its tail). At this point the referee will pause the timer, place a small marker underneath center of the robot, and then re-activate the robot and re-start the timer.

The run ends when the robot has had two minutes, or when it has stopped five times. At the end of the second stage, all robot position markers more than 50cm from any field point are disregarded, and if there are multiple markers within 50cm of a single point then only the closest is kept. Teams are then awarded $150 - d$ points for each visited marker, where d is the distance from the marker to the point in centimetres. They are then awarded $5 \times (120 - t)$ points, where t is the total time used in the second stage measured in seconds.

Teams will be ranked as follows: First, they will be ranked by the number of markers they reach (within 50cm). When two teams reach the same number of markers, the score determines their rank.

Another way of looking at the scoring is as follows:

- You start with 600 points.
- You lose 5 points per second.
- You get 100 points for reaching a marker (within 50cm).
- At 5 points per second, this means you need to reach that 50cm circle within 20 seconds to make it worth your time.
- For each 1cm improvement in accuracy you get another point. At 5 points per second, this means you need to increase your accuracy at 5cm/s to make it worth your time.

3 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.

Initially the robot will start at the opposite end of the field from the ball. The timer will start when the robot crosses the centre-line, and stop when the ball crosses the centre-line. If the ball is kicked out then it will be returned to the initial position.

4 Report (5 marks)

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