Technical Challenges for the RoboCup 2007 Legged League Competition

February 2, 2007

1 Introduction

There are three technical challenges that will be held at the RoboCup 2007 Legged League Competition. The three challenges are:

- The Open Challenge (Section 2)

- The Passing Challenge (Section 3)

- The *New* Obstacle Avoidance Challenge (Section 4)

For placing first in a challenge a team will receive 24 points, each position thereafter will receive 1 less point. I.e 1st = 24pt, 2nd = 23pts, 3rd = 22pts ... 24th = 1pts. In the case of a draw, each team will receive the average of the points allocated to these positions. E.g if three team tie for 2nd, they will receive $\frac{23+22+21}{3} = 22$ points. If a team does not compete in a challenge the will receive 0 points, also if a team competes but fails to score a point (or receive a vote) they will receive 0 points. The team with the highest total score after all challenges is deemed the overall challenge winner.

All challenges will use the 2007 field and the 2007 rules will apply.

2 The Open Challenge

Time: 3 minutes

This challenge is designed to encourage creativity within the Legged League, allowing teams to demonstrate interesting research in the field of autonomous systems. Each team will be given three minutes of time on the RoboCup field to demonstrate their research. Each team *must* distribute a technical description of their research (1-2 pages) before the round-robin starts. **In 2007 we will be strict on this rule.** Teams who do not submit a description or propose a non-technical challenge will be ineligible to compete. The winner will be decided by a vote among the entrants. In particular:

- Each team *must* distribute a technical description of their research before the round-robin starts.

- Each team may use any number of Sony AIBO robots. Teams must arrange for their own robots.

- Teams have three minutes to demonstrate their research. This includes any time used for initial setup. Any demonstration deemed likely to require excessive time may be disallowed by the organizing committee.

- Teams may use extra objects on the field, as part of their demonstration. *Robots other than the AIBOs may not be used.*

- The demonstration must *not* mark or damage the field. Any demonstration deemed likely to mark or damage the field may be disallowed by the organizing committee.

- *Changed in 2007.* The demonstration **may use** off-board sensors or actuators as long as the AIBO is still the focus of the challenge.

- The demonstration may use off-board computing power connected over the wireless LAN. This is the only challenge in which off-board computation is allowed.

- The demonstration may use off-board human-computer interfaces. This is the only challenge in which off-board interfaces, apart from the Game-Controller, are allowed.

The winner will be decided by a vote among the entrants using a Borda count (http://en.wikipedia.org/wiki/Borda_count). Each entering team will list their top 10 teams in order (excluding themselves). The teams are encouraged to evaluate the performance based on the following criteria: Technical strength, novelty, expected impact and relevance to RoboCup. At a time decided by the designated referee, within 30 minutes of the last demonstration if not otherwise specified, the captain of each team will provide the designated referee with their rankings. Each ranking is converted to points: ten points for the top ranked team, nine for the team ranked second and so on down to one point for the team ranked tenth. Any points awarded by a team to itself will be disregarded. The points awarded by the teams are summed and the team with the highest total score shall be the winner.

3 The Passing Challenge

Times: 15 second + 2 minutes

This second challenge is similar to the passing challenge from last year. It is intended to encourage teams to develop passing and catching skills. In this challenge each team will be required to provide three robots, all robots must be in the same coloured uniform (the decision on red or blue uniforms can be made by each team).

Each robot will placed on the field inside a circle of radius 35*cm* (Figure 1). **Note:** the radius of the circle has increased by 5cm. The centre of the circles will be no closer then 80cm and no further then 200cm apart. The triangle formed by the circles will not be equilateral, i.e. the distances between robots will be different.
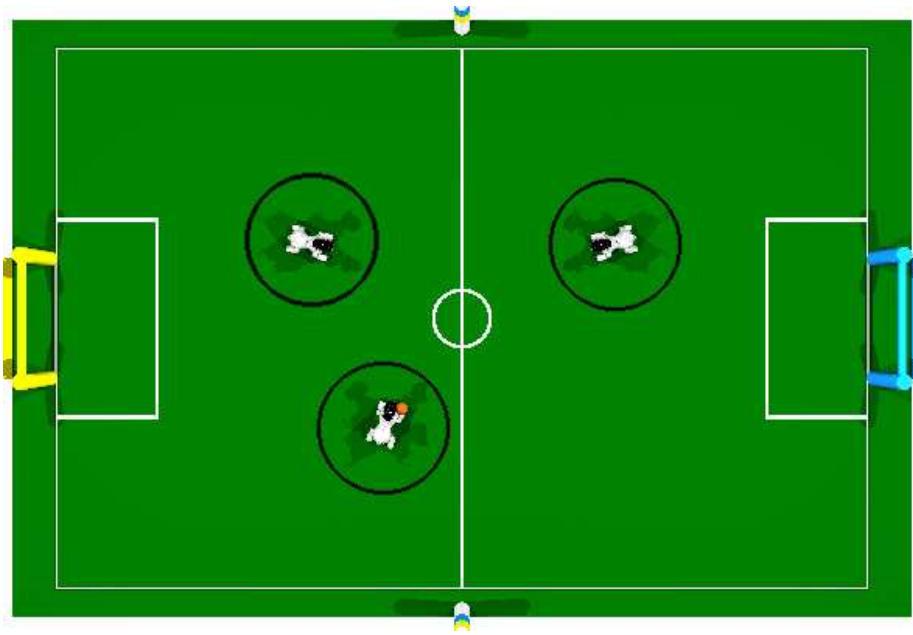

Figure 1: An example placement of the robots for the passing challenge. The circles will be drawn on the field but will not be visible to the robot.

The location of the circles will be made available on the morning of the challenge. It will be the **responsibility of each team** to make sure they have set the correct points.

Initially the robots will be placed inside a circle and in the 'set' state for 15 seconds, this will enable them to localise. The robots will then be placed into 'playing' and given two minutes to pass the orange ball around.

A pass will be regarded as successful when:

- The passing robot releases the ball from inside its circle *and*

- the catching robot stops/controls the ball inside its circle. Stops/control will be left to the referees discretion. Examples are :

- The ball comes to a complete stop.

- The ball is caught and held by the robot.

- The robot is capable of hitting the ball from one circle to another without the need for stopping or grabbing the ball.

A pass will be deemed *partially* successful if:

- The passing robot releases the ball from inside its circle *and*

- the catching robot touches the ball inside the circle but the ball then travels outside the circle.

A pass is deemed unsuccessful if :

- Either robot makes contact with the ball *when* the ball is outside a circle *or*

- the ball exits the field.

A robot is deemed to be inside a circle if two legs are inside the circle. The ball is inside the circle if some part of the ball is inside the circle or on the line. That is, the line is regarded as inside the circle.

Robots may pass between each other in any order, but will be rewarded for passing to a different robot then that which passed to it. Scoring of the challenge will be as follows :

3 pts For a successful non "return" pass that directly follows a successful pass reception.

1 pt For a successful pass.

0.5 pt For a *partially* successful pass.

If two teams score the same number of points, the result is a draw.

All normal game rules apply in the challenge, except:

- When a ball leaves the field it will be replaced back in the closest circle.

- A robot may "ball hold" when the ball is not in the circle. This allows a robot to retrieve a ball and then return to a circle to pass.

If a rule is violated then any pass resulting from this violation will receive no points.

4 The *New* Obstacle Avoidance Challenge

Time: 2 minutes

The third challenge pays homage to some of the previous challenges held in the Four Legged League. The purpose of this challenge is to successfully solve a series of problems.

In summary robots must navigate from one goal to the other goal while avoiding obstacles and performing tasks.

This challenge will require the team to use *two* robots, one red and one blue. The blue robot will start in the blue goal while the red robot will start in the yellow goal. The task of each robot is to reach the opposing goal. "Reaching" means to have at least two feet in the opposite goal (that is two legs behind the goal line).

Along the way the two robots will face a series of obstacles. The obstacles may include:

- Each other !

- Stationary robots - Robots (of either colour) will be placed at random locations in the standard UNSW stance. One of the robots may be placed as a goal keeper (i.e. inside a penalty area).

- Moving robots - Robots (of either colour) may be moving around the field. For example running between two beacons or moving between two points.

- A robot in a different uniform - At least one of the robots (stationary or moving) will be wearing a different uniform (color and/or pattern).

At the middle of the field the two robots will be asked to perform a simple co-operative task. In this case both robots will have to 'cross' the halfway line at the same time. The rule will be defined as 'the two robots can not be in the same half of the field for more than **3** seconds'.

The basic scoring of the challenge will be as follows :

3pts for each robot that successfully enters the opposing goal.

1pt bonus if **both** robots are in the opposing goals at the same time.

upto 3pts for the successful co-operative crossing of the halfway line. The full 3pts are awarded if you cross at the same time. You will receive a 1pt penalty (from the 3 pts) for each complete second that passes with two robots in the same half. For example you will get 1pt if the two robots are in the same half for 2.5 seconds.

-1pt for touching *any* other robot (including your partner). You can loose points for touching the same obstacle on more than one occasion, as long as 3 seconds of non-contact has occurred.

The important scoring element is that the challenge does not stop, the robots can repeat the process as many times as possible in the two minutes. For example, once the

blue robot has entered the yellow goal it can then turnaround and try and return to the blue goal. It should be noted that you can't score any points on a return trip unless you successfully entered the original target goal, however you can loose points for touching obstacles.

Additionally there are some 'mini' games that can be attempted during the challenge, these will result in bonus points:

2pts For moving within 15cm of a black and white ball which is randomly placed around the field **AND** signalling either by flashing lights, playing a sound or by wagging a tail. However, if either robot touches the ball at any stage during the competition any bonus point will be lost.

1pt For scoring a goal with the orange ball. One orange ball will be placed on the field. A bonus point will be awarded if this ball is in either goal at the end of the challenge. If the ball leaves the field it will not be replaced.

Teams can end in a tie, we will not be using time to differentiate between teams.