RoboCup Humanoid League 2004 Rules Argument version.

Last Updated: Mar 7, 2004.

Argument version.
Fair copy By Foot-Prints keiichi okamoto hfd01454@nifty.ne.jp

1. Definition of humanoid

1.1 Structure

A humanoid robot that is eligible to participate in RoboCup Humanoid League shall meet the following requirements:

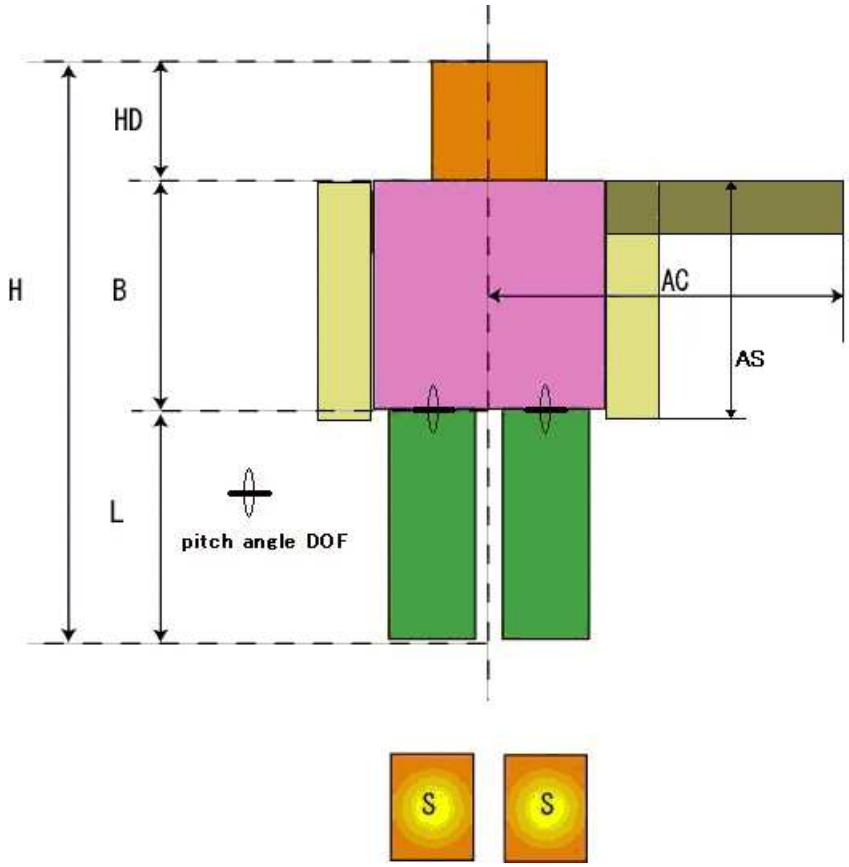
A) A humanoid robot shall be able to walk using two legs. No wheel/s shall be allowed to assist its walk.
B) A humanoid robot shall have the approximate body proportions as described in figure.
C) A humanoid robot shall consist of two legs, two arms, one body, and one head.

1.2 Proportion

Hmax is a maximum permitted height of the humanoid
H is the actual height of the humanoid
L is the length of the leg
AS is the length of the arm measured from the shoulder
AC is the maximum width of measured from the center of the body
HD is the length of the head, including the neck.

$0.4 * H < L < 0.6 * H$
$2 * AC < H$
$0.1 * H < HD$
$S < (H/3 * H/3)/2$

A tolerance of 10% is applied to the relative proportions as well as to Hmax, except for the H-120 league where Hmax is 180 cm.
The foot of the robot shall not overlap while standing, and a rectangle shaped surface (S) of each foot must satisfy: $S < (H/3 * H/3)/2$.
The humanoid should be able to stay in equilibrium on one leg during one minute (this will force the number of degrees of freedom of the legs of the robot)
Figure 1. Humanoid Size



1.3 Specific Dimensions

This section provides concrete examples of the specific proportion of the humanoid robot for each class.

1.3.1 H-40 Class Dimensions

- Hmax = 44 cm (in compliance with 10% tolerance)
  H = 40 cm (Assuming as an example that the humanoid's height is 40 cm)
- 16 cm < L < 24 cm
- 16 cm < AC < 24 cm
- 16 cm < AS < 24 cm
- HD > 4 cm
- Humanoid shall fit within cylinder of 24 cm diameter.
- S < 89 cm^2

1.3.1 H-80 Class Dimensions

@

- Hmax = 88 cm (in compliance with 10% tolerance)
  H = 80 cm (Assuming as an example that the humanoid's height is 80 cm)
- 32 cm < L < 48 cm
- 32 cm < AC < 48 cm
- 32 cm < AS < 48 cm
- HD > 8 cm
- Humanoid shall fit within cylinder of 48 cm diameter. B
- S < 356 cm^2

1.3.1 H-120 Class Dimensions

- Hmax = 180 cm
- H = 120 cm (Assuming as an example that the humanoid's height is 120 cm)
- 48 cm < L < 72 cm
- 48 cm < AC < 72 cm
- 48 cm < AS < 72 cm
- HD > 12 cm
- Humanoid shall fit within cylinder of 72 cm diameter. B
- S < 800 cm^2

1.4 Ball specifications

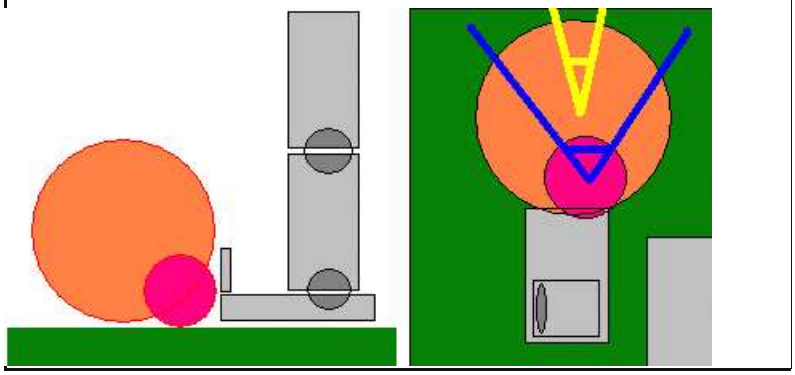
The ball specifications for the humanoid competitions are the following:

1.4.1 H-40 Class Ball

- Orange ball 83mm, weight 26 g (same as the 4-legged League).

@

May be discussion for H40 Ball size of the team meeting in RoboCup2004.



1.4.2 H-80 Class Ball

- Orange ball 83mm, weight 26 g (same as the 4-legged League).

1.4.3 H-120 Class Ball

- Standard FIFA size 5 football, orange color (same as RoboCup Midle Size League)

---

2. Competitions

2.1 Solo Games

A) Humanoid Walk

Humanoid shall be placed at the designated location in the field. It shall walk along the defined course in the field. It should start from one end of the field, walk to the other end, round the marker placed in the middle of the defense area, and come back to the initial position. Once the game has started, no human assistance shall be allowed to reposition the robot.

Href is the reference height referring to the value in the league name, e.g. 40 cm for H-40.

H is the actual height of the humanoid that is less or equal to **Hmax**

D is the distance from the start line to the marker.
W is the width of the allowed walk area.
MH is the height of the marker.
MR is the radius of the marker.

D = 5 * H
W = 3 * Href
MH = 100 cm
MR = 10 cm

H-40 Class:

D = 200 cm (Assuming as an example that the humanoid's height is 40 cm)
W = 120 cm
MH = 100 cm
MR = 10 cm

H-80 Class:

D = 400 cm (Assuming as an example that the humanoid's height is 80 cm)
W = 240 cm

MH = 100 cm
MR = 10 cm

H-120 Class:

D = 600 cm (Assuming as an example that the humanoid's height is 120 cm)
W = 360 cm
MH = 100 cm
MR = 10 cm

For the first one or two years, the marker could transmit IR. This allows a robot without vision system to perform this task.

The intention of this challenge is to evaluate the stable walking behavior of the humanoid. The course has two straight routes and one 180 degree turn. The 180 degree turn is included in order to evaluate orientation change capability. A minimum visual perception of the robot is needed, because the marker is red, and there is a yellow panel behind the start/end zone that will help the robot to orient itself.

Figure 2 (a). Walk Field

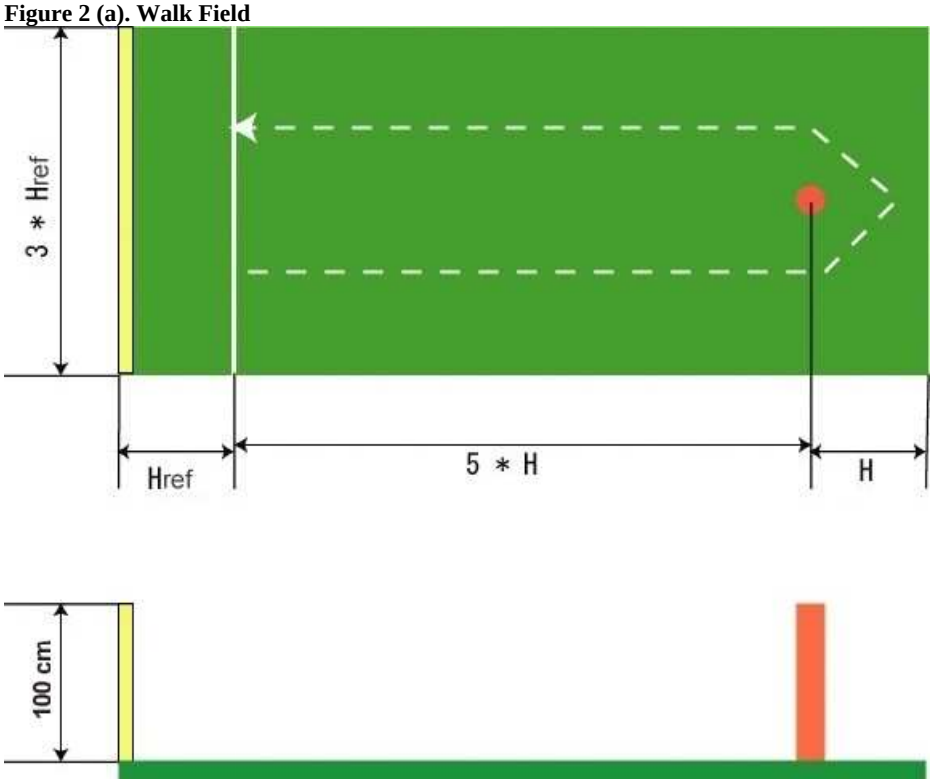
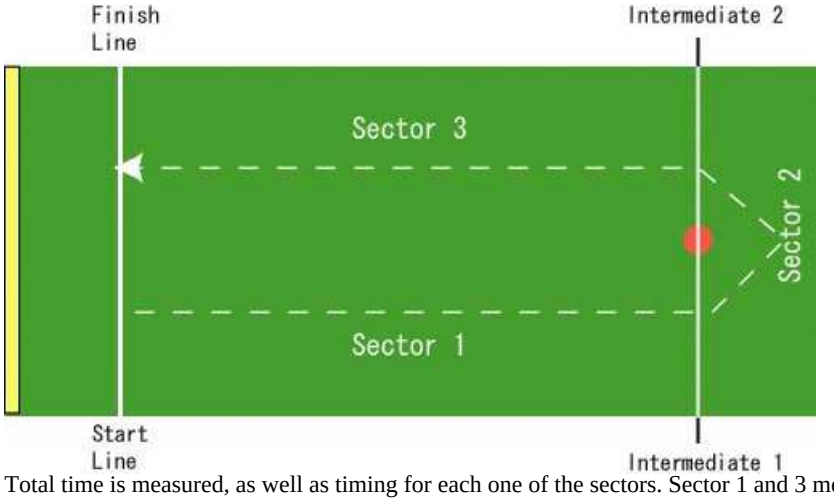


Figure 2 (b) Walk field time measurement points



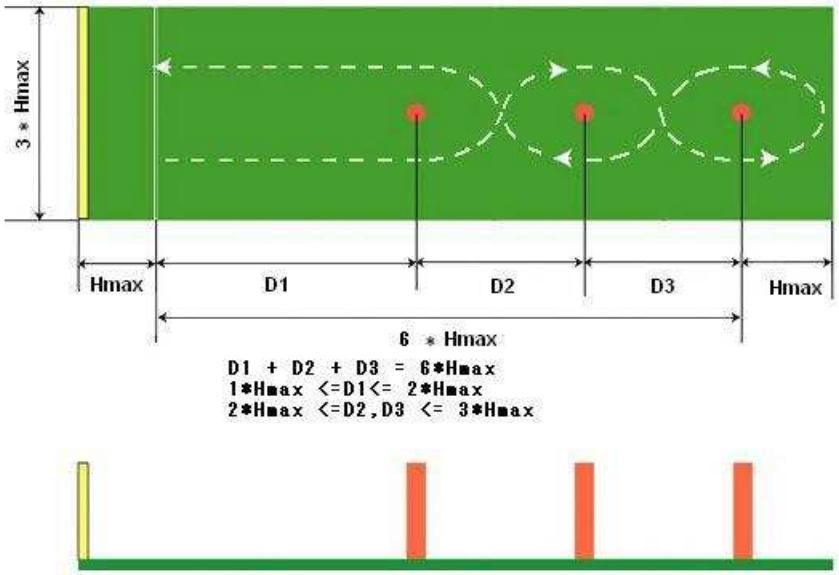
Total time is measured, as well as timing for each one of the sectors. Sector 1 and 3 measures the speed of the robot between the straight lines, and sector 2 measures the duration of the circular movement.

B) Obstacle Walk Challenge

To demonstrate the robot is able to perform obstacle avoidance. An obstacle is the maker pole used for Humanoid

Walk. The referee will place 3 obstacles according to the following requirements.

D1 + D2 + D3 = 6*Hmax
1*Hmax <=D1<= 2*Hmax
2*Hmax <=D2,D3 <= 3*Hmax

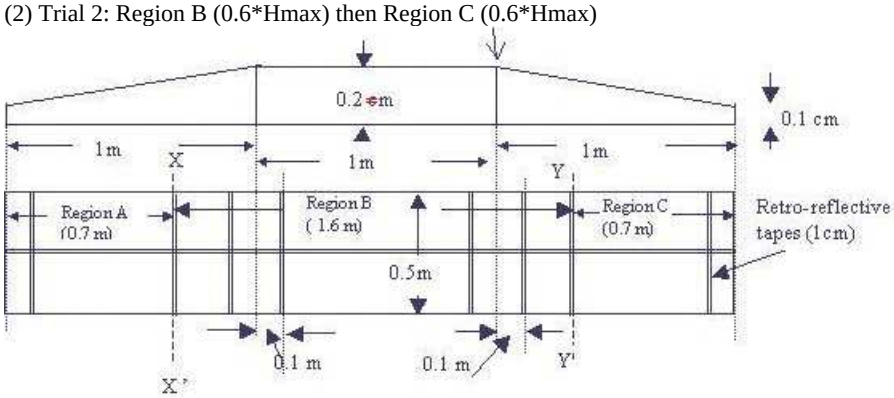


@

C) Balancing Challenge

The walking time attack game of this bridge.
Considering that all the robots (from H40 to H120) will share the same platform with threeslopes and each slope is about one meter,
I believe let each robot walk 0.6*Hmax on each slope is reasonable,
e.g. a 150cm tall robot will walk 0.6*150 = 90 cm in each region.
So, I guess we will have to let the robot walk in two trials separately,
one is walking up and another is walking down.

(1) Trial 1: Region A (0.6*Hmax) then Region B (0.6*Hmax)
(2) Trial 2: Region B (0.6*Hmax) then Region C (0.6*Hmax)

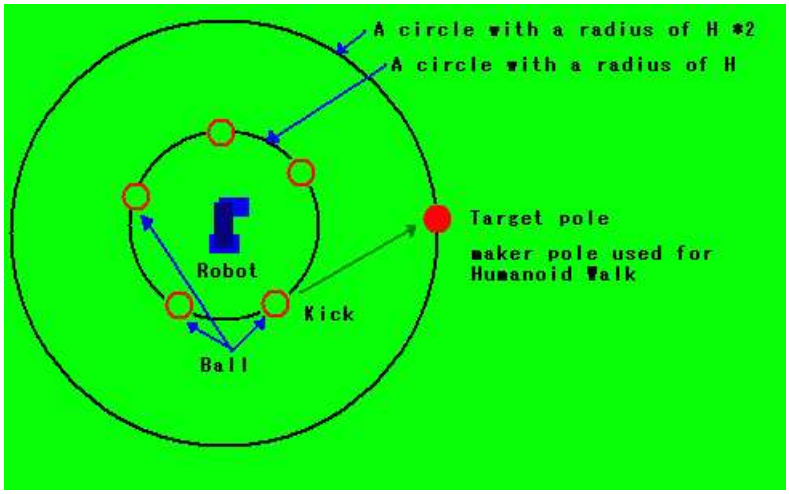


@

D) Passing Challenge

To demonstrate the robot is able to pass the ball deliberately from one to another.

(1) The team set up the robot;
(2) The referee puts the ball in any direction.
(3) The distance of the robot and the ball is the height of the robot.
(4) The target is a the maker pole (which is used for humanoid walk).
(5) The distance between the target and the robot is 2 * height of the robot.



@

2.2 Games

A) Penalty Shoot-out

Team A's robot is placed behind the ball. Team B's robot is placed in front of the goal. Team A's Robot shall walk and kick the ball to the goal.

D1 is a distance from the initial position of the humanoid to the ball
D2 is a distance from the ball to the goal line.
GW is the width and GH is the height of the goal.

D1 > 0.5 * H
D2 = 3.0 * Href
GW = 3.0 * Href
GH = Href

Goalie robot can be placed within Href from the goal line.

H-40 Class:

D1 > 20 cm (Assuming as an example that the humanoid's height is 40 cm)
D2 = 120 cm
GW = 120 cm

Goalie robot can be placed within 40 cm from the goal line.

H-80 Class:

D1 > 40 cm (Assuming as an example that the humanoid's height is 80 cm)
D2 = 240 cm
GW = 240 cm

Goalie robot can be placed within 80 cm from the goal line.

H-120 Class:

D1 > 60 cm (Assuming as an example that the humanoid's height is 120 cm)
D2 = 360 cm
GW = 360 cm

Goalie robot can be placed within 120 cm from the goal line.

A session will finish, once the goalie robot (Team B) has touched the ball, or, as soon as the ball has stopped within the marked goal field. If the ball is free (not touched by Team B's robot), 60 seconds is allowed for the striker robot to attempt to score the goal. During this period, the session will finish whenever the goalie robot touches the ball. The

goalie robot is not alowed to move out of the goalie position area until after 5 seconds after the ball was initially touched by Team A's robot.

One game consists of 5 sessions for each team. If both teams have the same number of scores after 5 sessions, the session will continue until one team scores more goals than the other team. The roles between the teams are exchanged after each kick (e.g. striker and goalie).

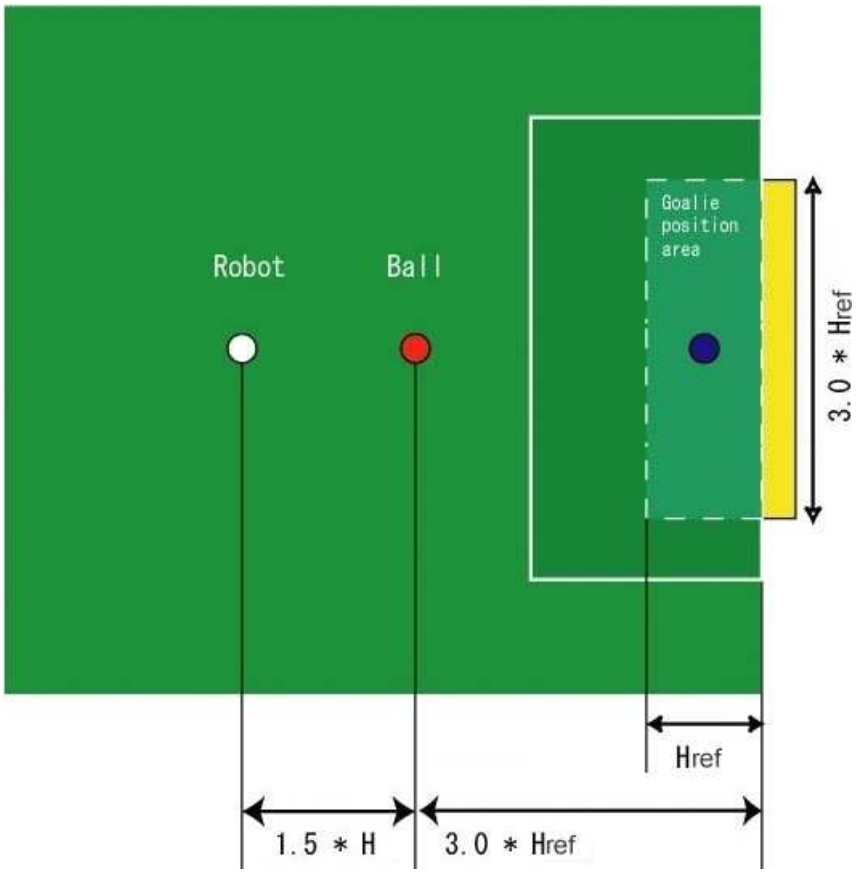


Figure 4, PK Shoot Field

@

2.3 Free Style

Five (5) minutes will be given to each team for them to show any demonstration with their humanoid robot/s. Evaluation will be given by a panel that consists of seven independent jury members. Each jury member shall rate each demonstration, within a scale from 1 to 10 points, for (A) technical merits, and (B) artistic impression. One highest score and one lowest score is discarded, and the total points from the remaining jury are assigned as a over-all score for the team.

2.4 Exhibition(no award)

All the robots walk together

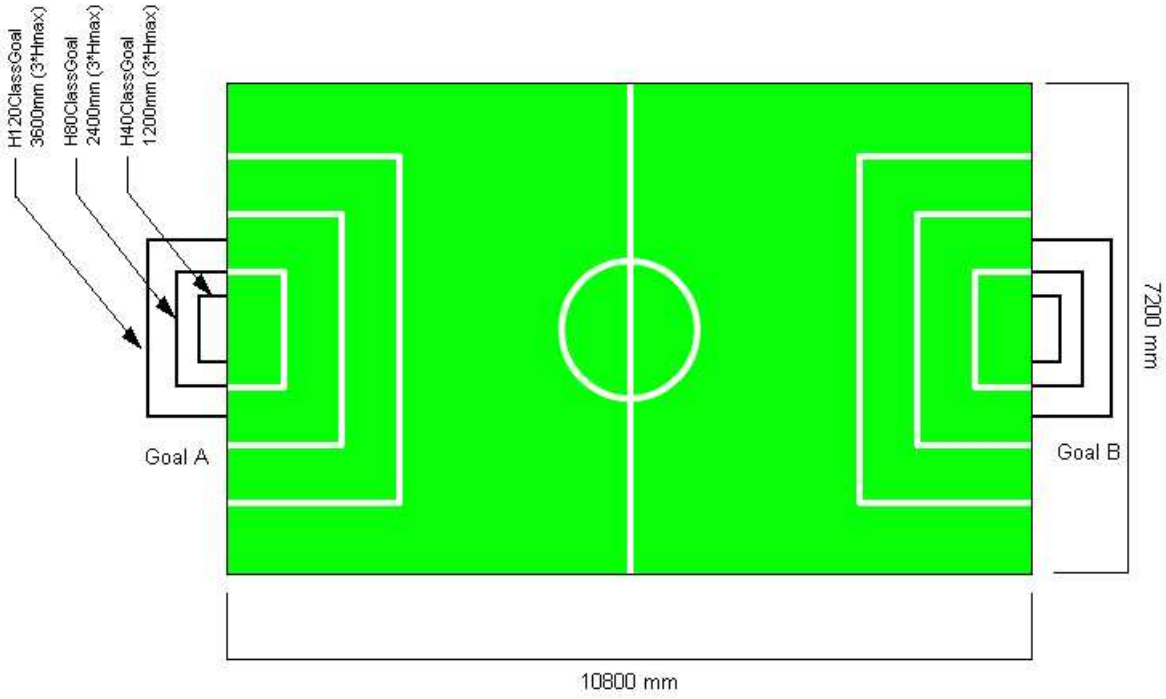
---

3. Environment

3.1 The Field

For the RoboCup 2002 and 2003, the main stage was used as filed for the Humanoid League. As suggested by the organizing committee of the RoboCup 2004, HL will have its own field in 2004.

-The field size is 7.2m by 10.8m
-Green carpet for the MSL will be used.
-The setting will be the same as the filed used in Padova



3.2 Type of robots

Definitely, we should eventually move towards fully-autonmous humanoids.
External power will not be allowed from 2004.

3.3 Lighting Condition

The organizer will simply ensure there is adequate ambient lighting (~500 lux). Uniformity of the lighting conditions throughout the length of a match will be guaranteed. This means teams must be prepared for potentially uneven lighting, shadows, and other challenges that arise due to the lack of the traditional spotlights.

3.4 Performance factors

External power will not be allowed.

remote brain	1.5
human remote control	3.0
commercial platform	1.2

4 Awards

(1). "Humanoid walk" classless 1st, 2nd, 3rd

(2). "Penalty Shoot" only 1st for each class

(3). "Technical Challenges (Balancing + Obstacle avoidance + Passing)" only 1st for each class

(4). "Free styles" classless 1st, 2nd, 3rd
This competition is to encourage teams to focus on any basic research issues for the roadmap to 2050 which are not belong to the current Technical Challenges, e.g. throwing ball, catching ball, 1 vs. 1, 2 vs. 2 and so on. We should encourage all the team to look at some basic research issues for the roadmap to 2050.

(5). "The best humanoid" The Best One.

(6). "Exhibition " no award

Roadmap

2004: more challenges in the Free Style competition, e.g., balancing, passing and obstacle walk.
2005: one versus one game, fully autonomous robots.
2006: two versus two game, challenges on multiple objects tracking and collision avoidance.
@