Humanoid Kid Size League
Humanoid Medium Size League
The Rules & Setup for Osaka 2005

1 The Design of the Robots

1.1 Structure

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

- A humanoid robot has to be able to walk using two legs. No wheels are allowed to assist its walk.

- A humanoid robot shall consist of two legs, two arms, one body, and one head.

1.2 Proportions and absolute dimensions

H is the actual height of the humanoid. If the center of mass of the robot is at a height lower than $H/2$, then in the following H is assumed to be $H = H_{com} \times 2$, where H_{com} is the height position of the center of mass.

- Each of the two feet must fit into a rectangle of the maximum size $H^2/20$.

- The robot has to fit into a cylinder with the diameter $H/2$.

- If the arms are stretched in the vertical direction, the distance from the left end of the hand to the right end of the hand is lower than $1.2 \times H$.

- By no means (e.g. stretching the arms over the head, etc.) can the robot be actuated in a way that it is longer than $1.5 \times H$

- H has to be smaller than 1.8 m.

1.3 Sensors

- Vision sensors are not permitted on the legs.

1.4 Control

- The robot has to act autonomously during all competitions.

- During the competitions there should not be any exchange of information between the outside and the robot. Only communication between the robots and to send the start and stop signals is allowed. This includes a temporarily restricted feedback within 1 second.

- No cables are allowed to connect to the robot with any kind of external devices during the competition.

2   Leagues

- Robots that are smaller than 60 cm ($H < 60cm$) will play in the Humanoid Kid Size league **HKid**. In addition, they will participate in the 2-2 competition.

- Robots bigger than 60 cm ($H > 60cm$) will participate in the Humanoid Medium Size league **HMedium**.

3   Balls

- In the league **HKid**: the Sony Aibo Ball

- In the league **HMedium**: Standard FIFA size 5 football, orange color (same as RoboCup MidSize League)

  Remarks:

  – Aibo ball. This ball is delivered by Sony – together with the Aibo robot and they are sold in one set. For those teams who need the set of the ball, please contact the chairman of the league and the organizing committee will help you to get access to the product.
  – This year in the KidSizeLeague als the orange Aibo competition ball may be used under the following conditions:
    * Technical challenge: The team gets to pick whether they want to use an orange or pink ball. This should be easy since only one team is affected.
    * Penalty kick: The striker team gets to choose whether to use an orange or pink ball. This gives the advantage a little bit to the kicker, but the kicker has to do most of the work.

∗ 2 vs 2 game: If both teams agree on an orange/pink ball, then the game will be played with that ball. If the two teams can not agree on a ball, then the referee will flip a coin to determine the ball that is being used.

4   Performance Factor

For this year (2005) only one performance factor remains, that is the performance factor for the commercial platform. For teams who use in one competition robots that are purchased as a whole from a company that is not part of the team, or who have a robot that can be purchased as a product, the performance factor in this specific competition has the value 1.2.

5   Goals

The colors of the goals are blue and yellow in the **HKid**. In the **HMedium** a yellow goal will be provided.

- The **HKid** goal will be 80 cm high and 120 cm wide, 40 cm deep.

- The **HMedium** goal will be 120 cm high and 180 cm wide, 60 cm deep.

6 Penalty Kick

6.1 Setup

- The robots have to be positioned as outlined in the figure below, that is: The striker robot starts from a position that is at least 1.5 times its height away from the center of the white circle. Seen from the goal the striker robot starts from a position that is behind the ball. The goalie robot has to be positioned in the middle of the goal line.

- The ball is placed after the robot is set up at its position and ready except for the start signal. The ball is placed in a random position within the white circle.

- Teams are only allowed to transmit the start signal when the referee blows the whistle.

- Right after the referee blows the whistle, the striking robot has 60 seconds to kick the ball once or several times. After the start signal the goalie robot is allowed to move along the goal line. The goalie is not allowed to move forward or to fall until the ball is touched by the striking robot.

- After the striking robot has touched the ball the goalie is allowed to move forward or to fall.

- After the goalie has touched the ball the striker is not allowed anymore to interfere actively with the movement of the ball.

- Goal: A goal is achieved if the ball crosses the goal line completely.

- No goal: After 60 seconds or after the goalie robot has touched the ball and if the physical movement of the ball obviously not results in reaching the goal, the trial will be considered finished.

- Neither the goalie robot nor the striking robot are allowed to touch or cross the line around the goalie area.

- If the goalie robot violates the rules in any way, then the referee will let the trial continue. If the striker robot scores a goal, then the goal counts. If the striker does not score a goal, the trial is retaken. If the
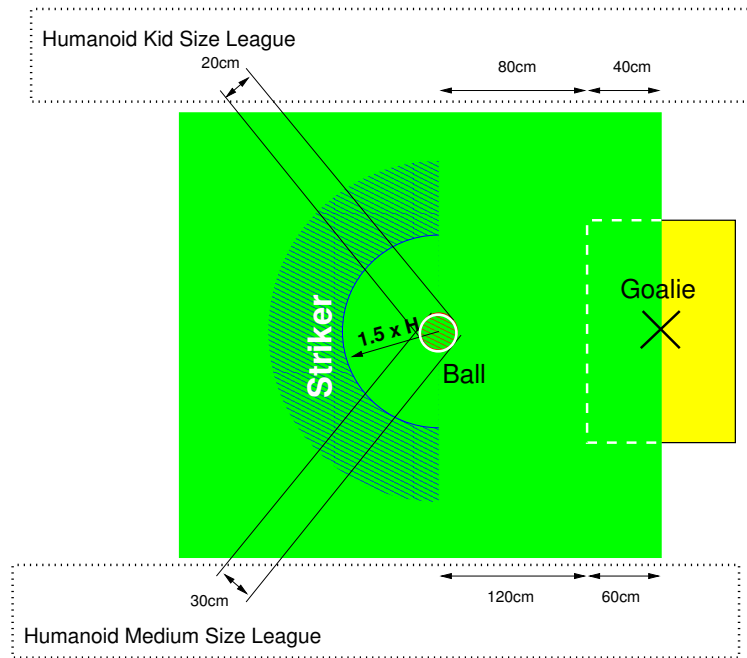
goalie robot violates the rules resulting in three consecutive restarts, then a technical goal will be awarded to the striker.

If the striker violates the rules in any way, then the referee will let the trial continue. If the striker robot is unable to score a goal, then the trial is declared as "no goal." If the striker is able to score a goal, then the trial is retaken. If the striker violates the rules resulting in three consecutive retakes, the trial will be declared as "no goal".

- Both teams conduct 5 trials.

- Each goal counts as one point (no performance factor within this competition).

- In the finals and in the case of a draw after 5 trials, each team makes one more trial. This is repeated until the winner is determined. If after 5 trials the result is still a draw (e.g. 0-0) the winner is determined by drawing a lot.

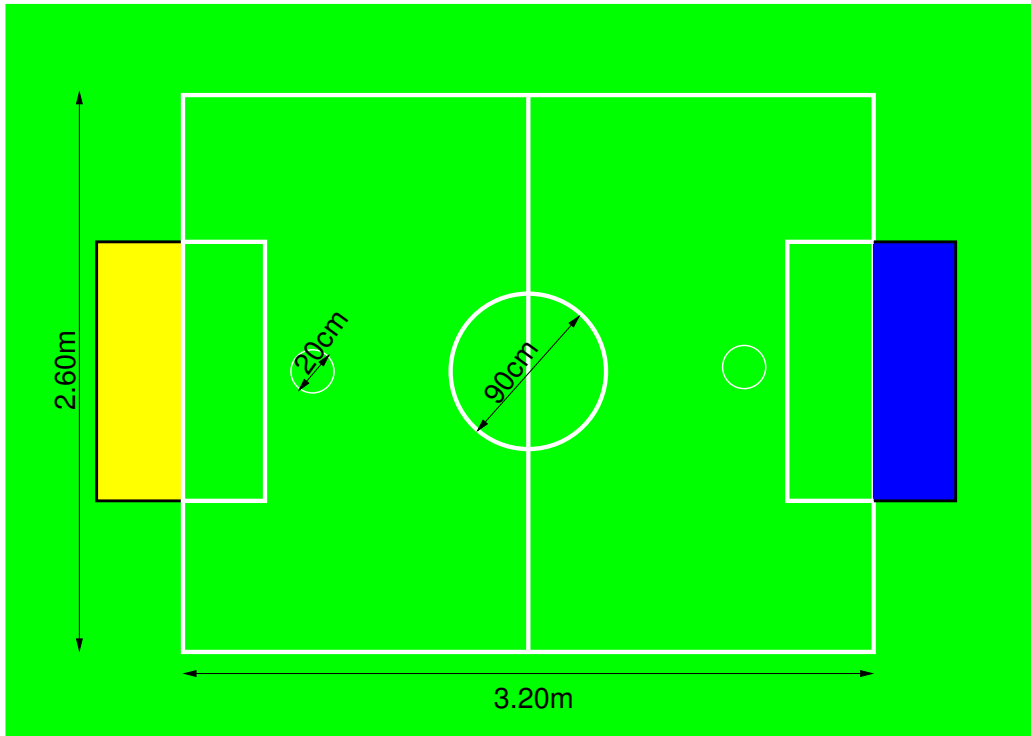## 6.2   Determination of the winner (Penalty Kick)

- Depending on the number of participants in each league there will be one or two groups for round robin in each league. The winner of each PK gets three points; in case of a draw both teams get one point each.

- The best teams from each round robin group participate in the finals.

Humanoid Kid Size League
20cm
80cm
40cm

Goalie

Striker

1.5 x H

Ball

120cm
60cm
30cm

Humanoid Medium Size League

Above outline of the setting for the penalty competition for the **HKid**, **HMedium**. The ball is positioned at random within the white circle. The striking robot can be placed at any position in the blue area. The goalie starts from the middle of the goal line.

7

7   2-2 Games

7.1   Setup of the field

The field setup for the Humanoid Kid Size League is as outlined above.

7.2   Conductance

The FIFA rules apply, except for the following changes

- The games last $2\times$ 8 minutes.

- Before each game there are at least 10 minutes for setup.

- Each team has up to 2 players, one of them is the goalkeeper robot.

- If the ball rolls over the touch of the base line, the ball is either thrown in according to the FIFA rules or, if the robots can not do this, it is placed on the touch line at the place, where it rolled over the touch line. If the ball rolls over the base line then the ball is placed at the corner of the field

that is nearest to the place where the ball rolled over the base line. The robots are allowed to play the ball from there.

- If one robot touches the ground with other parts of its body than using his feet, it has to stand up within 30 seconds. Otherwise the game will be interrupted and all robots will have to be brought into standing positions and the opposing team can makes an indirect free kick from the last ball position.

- The robots are not allowed to score a goal from kick off and free kick. If the ball is shot into the goal from kick off (free kick), it is not counted as a goal. The game will be interrupted and the opposing team has the turn to kick off the ball. The team that does the kick off should not touch the ball more then 10 seconds and only after the referee gives the start signal the opponent team is permitted to touch the ball.

- Free kick: The robot who performs the free kick has to be positioned next to the ball. All other robots have to be positioned at least 60cm apart from the ball.

- After a kick off or free kick if the same striker robot that did the kick off kicks the ball into the opponent goal and during the whole time if the ball was not touched by any other robot, the goal is only accepted if the distance between the position where the ball was kicked off and the position where the ball was touched last by this striker robot are at least 20 cm apart from each other.

- One player can be exchanged during the game time. Batteries can only be exchanged during the break. Exchanging batteries during the game time is also counted as the same manner of exchanging one player. The exchange has to be requested from the referee and the referee has to agree. The replacement robot has to be placed on the touch line, if it is a goalie robot it can be placed in the goal area.

- The robots must have color markers that can be exchanged. The color markers have to be visible from all sides. Except for the color markers, the robots should be black. Shiny parts and reflections should be avoided. The colors of the color markers are cyan and magenta. The goalkeeper robot has to be marked so that the referee can easily distinguish the goalkeeper from the striking robot.

- Goal and penalty area are of the same size. The opponent robot is not allowed to hamper the goalie within this area and has to leave the area within 60 seconds of entering it. Otherwise the game will be interrupted and will have to be restarted with a free kick of the team of the offended goalie robot.

- No offside offense.

- If the striker is hampered by a defending robot in an unfair way while the striker is in the goalie area, a penalty kick is conducted according the rules for the penalty kick competition. All players except the defending goalie robot have to be positioned behind the robot that conducts the penalty kick.

- If a robot persistently hampers in an unfair way or interacts in a damaging way to opponent robots, the referee can remove the robot from the field. It is not allowed to replace that robot. The game is stopped and restarted with a direct free kick for the opposing team.
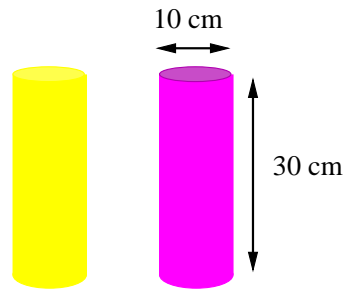
7.3 Tournament

The tournament is going to be done in a round robin and final game. In the round robin the winner of a game gets 3 points; in the case of a tie both teams get 1 point. The finals are conducted by the first and the second of round robin. If many teams want to participate, we will make two or more groups.
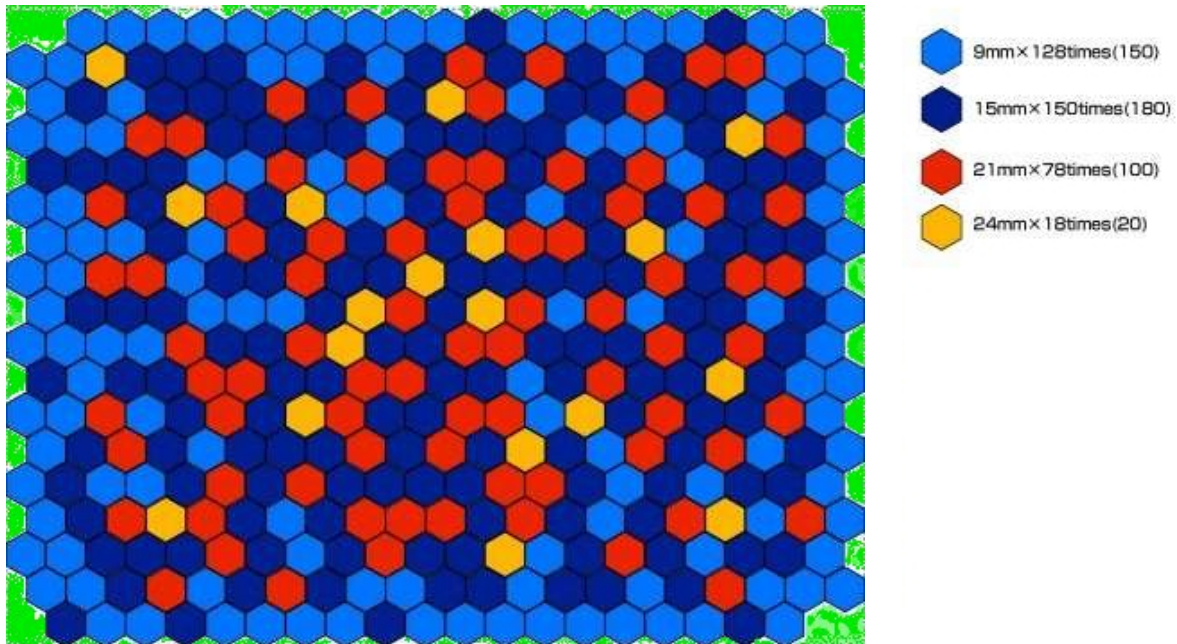
8 Technical challenge

8.1 Outline

The technical challenge consists of three subtasks: walk over rough terrain, walk around obstacles (poles) and finishing by kicking the ball against a fourth pole.

8.2 Design of the poles

The colors of the poles are yellow and violet. The height is 30 cm and the diameter is 10cm.
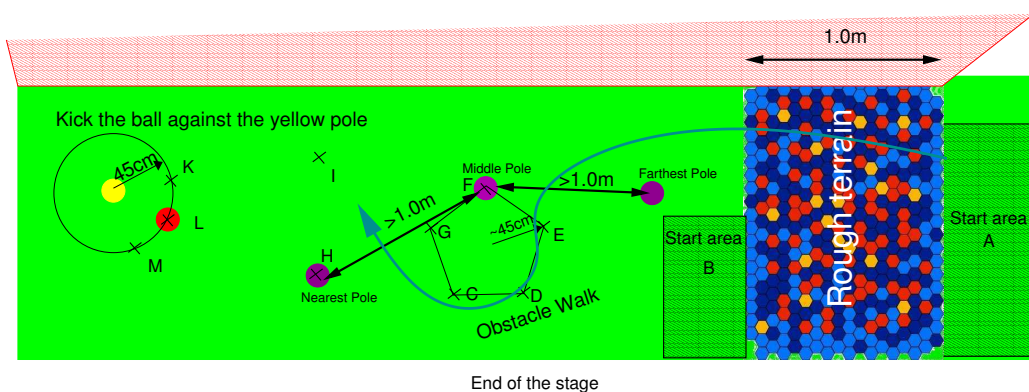
8.3 Rough Terrain

The rough terrain is a field of hexagons, each of which has a side length of 4 cm. For the layout please see the picture below. The length of the longer side of the

rough terrain is about 1.5m; the length of the shorter side is around 1m. Each color indicates the height of the tile. The height of the yellow tiles is 24mm; red tiles are 21mm, dark blue tiles are 15mm, light blue tiles are 9mm high.

8.4   Setup

End of the stage

The setup of the technical challenge is going to be as outlined above. The three violet poles are distinguished in the following way from each other: The *nearest pole* is the violet pole that is nearest to the yellow pole, the *farthest pole* is the pole that is most far from the yellow pole. The *middle pole* is roughly between these two poles, that is the distance between yellow pole and middle pole is smaller than the distance between yellow pole and the farthest pole, but greater than the distance between the yellow pole and nearest pole. For all trials and all teams the positions of the yellow pole and farthest pole both are identical. The position of the middle pole is one of the points C, D, E, F, G. The position of the nearest pole is either I or H. The position of the ball is one of the positions K, L, M. The robot is not allowed to walk around the rough terrain i.e. to enter the area that is marked red in the figure above. The distance between the poles should in any case be more than 1 m. The exact layout of the start areas A and B, the points C-M, farthest and the nearest pole and the yellow pole is set during a team leader meeting at least one day before the first technical challenge is conducted. All positions are marked with a black tape on the ground. The yellow pole can be placed in the middle of the kick off circle of one of the 2-2 game areas. The possible ball positions are then in the kick off circle.

8.5   The task

The robot has to be set up in start areas A or B. After the setup is finished the team is not allowed to transfer any information to the robot except for the start signal. At this time the referee draws a lot and in this way the positions of the middle pole, the nearest pole and the ball are determined. The team is not allowed to transfer this information to the robot. After the start signal is transmitted, the robot has to walk past the rough terrain without falling. If the robot is not able to walk over rough terrain it is allowed to start again from area B. Next the robot has to go through the gap between the farthest pole and the middle pole and after this he has to go through the gap between the nearest pole and the middle pole. In both passages the robot has to pass the gap either in the way that the middle pole is both on the right side or in that way that the middle pole is on the left side. Eventually, the robot has to kick the ball against the pole.

8.6   Conductance

Each team has 20 minutes to perform the tasks. Within these 20 minutes each team can start a new trial as often as they wish. The best trial that is achieved within 20 minutes is taken for the evaluation. Before each trial the referee sets the middle post and the nearest post and then put the ball into a new random position (drawing a new lot is not necessary). The referee gives the start signal and from this moment the robot is allowed to receive the start signal. The time is taken from start signal to the moment when the ball touches the yellow pole.

8.7   Evaluation

For the successful conductance of the single tasks

- has to walk over rough terrain without falling (8 points)

- has to walk around the poles in the described manner (8 points)

- kick the ball against a pole (8 points)

the team perceives points for each single task. If all tasks are performed successfully the time is taken.
The fastest team of those teams that perform most tasks (robots from all leagues together) gets 10 extra points, the second 8 points, third 6 points, fourth 5 points,

fifth 4 points sixth 3 points, seventh 2 points and the eighth 1 point. The result is divided by the performance factor for the commercial platform (1.2) if the platform is commercial. The maximum number of points is 34.

9 Best Humanoid

For finding the best humanoid robot the following criteria will be used:

- performance in the PK competition.

- performance in the 2-2 games

- performance in the technical challenge

- the best scientific paper.

As in the past years a point system is planned: Best PK performance 10 points, second best 8 points, third best 6 points. The result is divided by the performance factor. Winner from the 2-2 10 points, second best 8 points, third 6 points. The result again is divided by the performance factor. Points from the technical challenge are divided by 3.4 (no performance factors here). The scientific paper is either a paper submitted to the RoboCup symposium or the team description. The team can announce which paper they prefer to be used. Best scientific paper is evaluated by an independent jury and gets 10 points, second 8, third 6 points (No performance factors, of course). Finally, the sum is taken over all and the highest score winner will be the best humanoid.
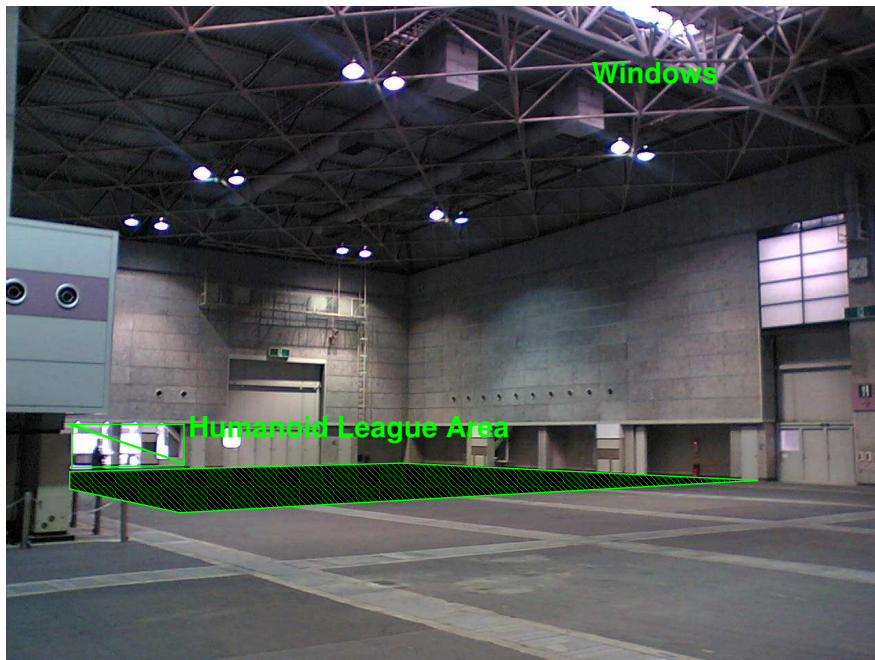
10 Trophies

We have to reduce the number of trophies this year.

- Technical challenge 1 trophy for the winner

- PK 1 trophy for each league.

- 2-2, 3 trophies

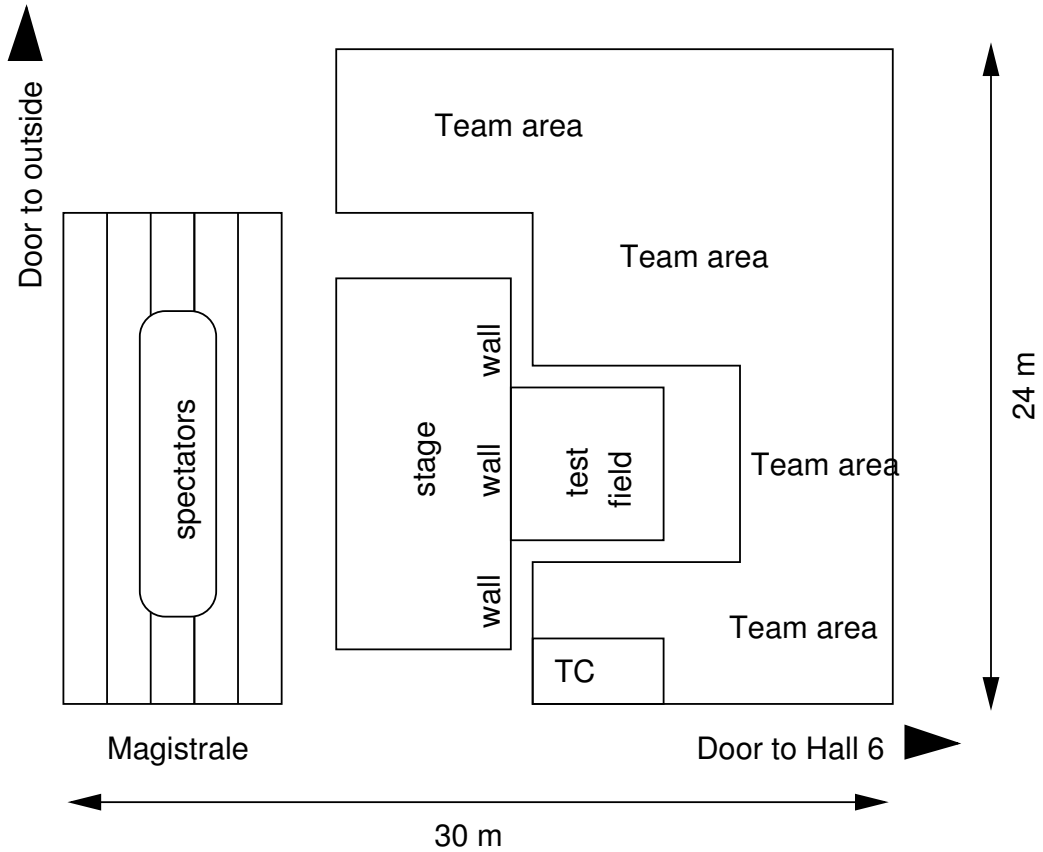- Best Humanoid 1 trophy

Thus, we would have 7 trophies.

11 Competition site

As usual it is a large hall. The light from the ceiling comes from light bulbs located roughly 8 m apart. The light from there is going to have an intensity of roughly 500 lux, maybe little bit less. See the pictures below from the competition site. The windows at the sides will be closed. The windows on the top remain open and result in a slight impact of the daylight upon the lighting conditions.
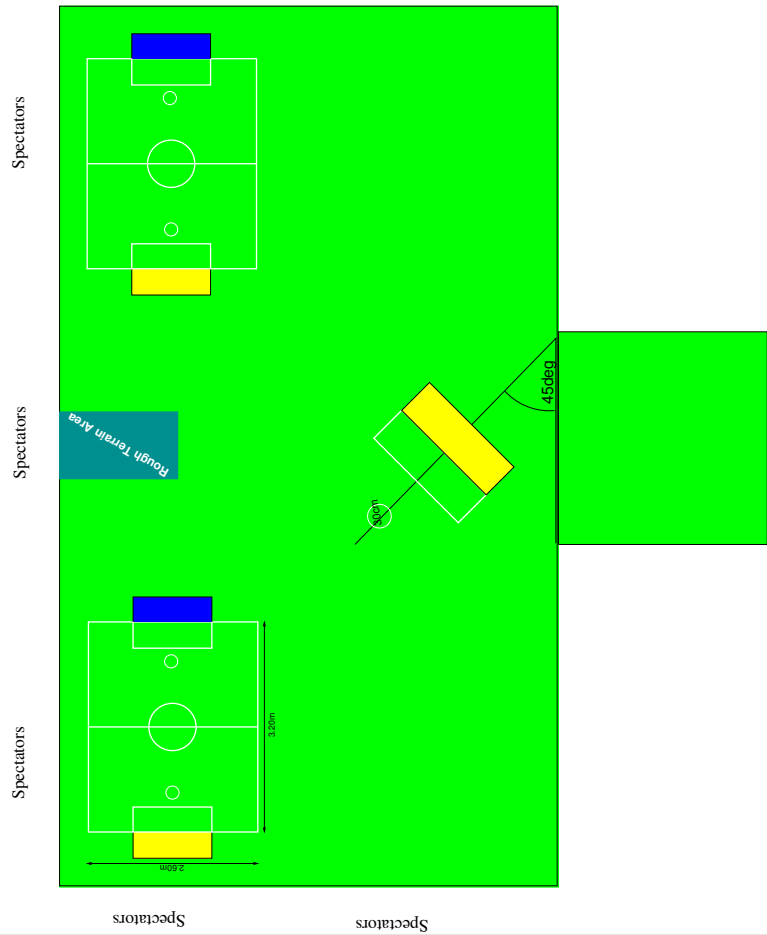

There will be additional light spots. The hall is officially open until 9pm. The humanoid league got an area of roughly 30×24 m. This includes seats for spectators.

12 Humanoid League Area

The team areas are closed for visitors. There will be 2 additional storage rooms that has locks.

13   Layout of the stage

14   Acknowledgement

Norbert Michael Mayer