Lift and Carry - HuroCup Laws of the Game

Version: 13.0.2 Date: Tue May 12 2015 01:27:18 GMT-0500 (CDT)

HuroCup Laws of the Game
Lift and Carry

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Abstract

The following rules and regulations govern the lift and carry event of HuroCup, a robotic game and robotics benchmark problem for humanoid robots.

Latest Version of the Rules for HuroCup

The latest official version of the rules of the game for HuroCup is always available from the HuroCup Facebook Page.

Changes to the Lift and Carry rules of HuroCup

There are no significant changes to the laws of the game for Lift and Carry in the 2015 competition.

Lift and Carry

The goal of this competition is to provide an event that requires robots to use active balancing and push recovery. The robots will be fitted with a small basket. The small basket does not count as a modification to the robot as described in the Allround - HuroCup Laws of the Game competition.
The robot must start at a random spot around the field and then reach a specific location on the uneven terrain. Once the robot has reached the target location it must then continue and leave the playing field without falling over.
Once a robot has successfully completed a run, extra weight is added to the robot and it has to complete another run from a different random location.
The robot that can successfully carry the most weight is declared the winner of the event.

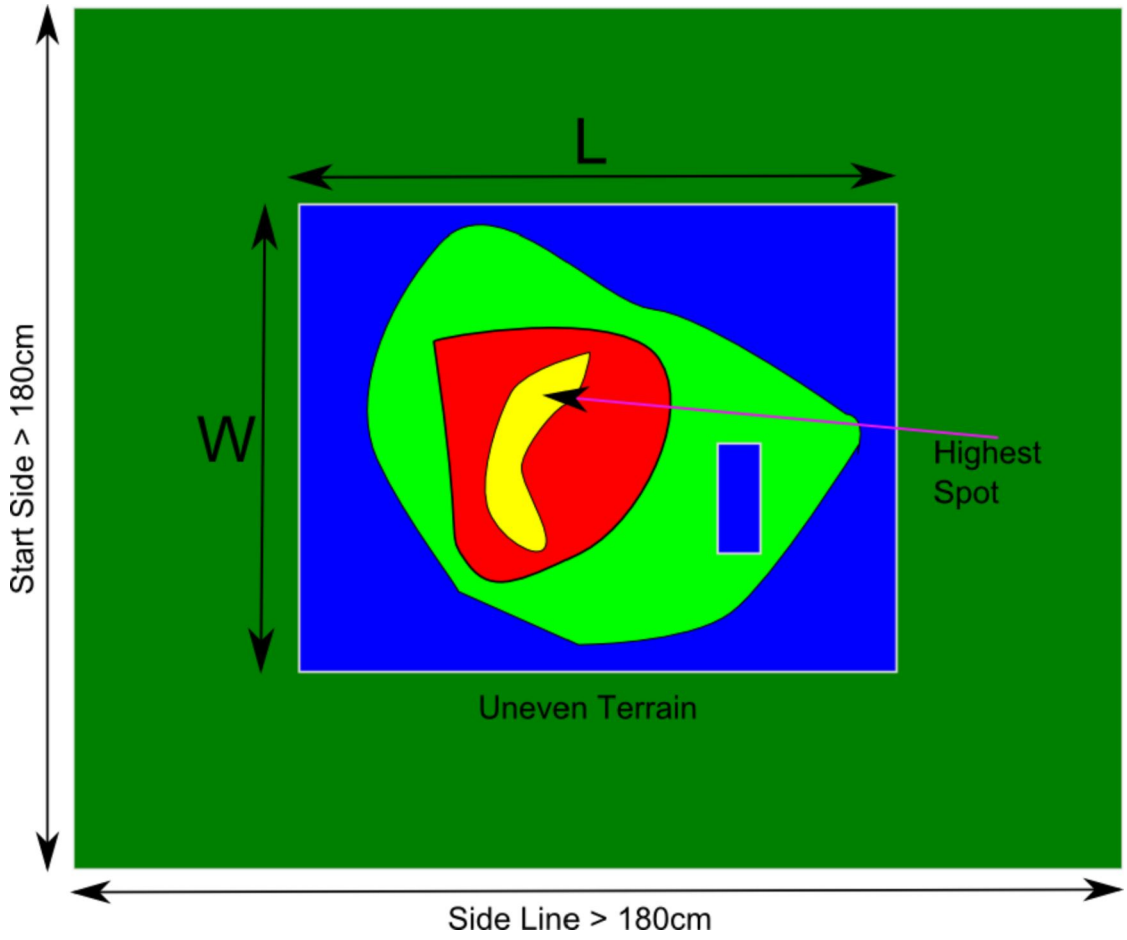
HuroCup Lift and Carry - Laws of the Game

The following laws describe the specifics of the lift and carry event. For general specifications relevant to all HuroCup events (e.g., robot dimensions, playing field and lighting, responsibility of the referees) please refer to General - HuroCup Laws of the Game.

[LC-1]: Field of Play

[LC-1.1]: The lift and carry competition is played on a field with a minimum dimension of 1.8m by 1.8m. See Figure Lift and Carry Field. An uneven terrain is placed in the middle of the playing field.

[LC-1.2]: The uneven terrain consists of sheets of hard material such as corrugated plastic, corrugated cardboard, or wood.
[LC-1.3]: The length of the uneven terrain is approximately $L.
[LC-1.4]: The width of the uneven terrain is approximately $W.



Dimension	Comment	Kid Size	Adult Size
$L	Length of Uneven Terrain	3m	3 m
$W	Width of Uneven Terrain	3m	3 m
$H	Height of Sheets	15mm - 25mm	15mm - 25mm
$CD	Diameter of coins	30mm - 60mm	30mm - 60 mm
$CT	Thickness of coins	< 8mm	< 8mm

Lift and Carry Field
The field of play for the lift and carry competition. The task for the robot is to cross the uneven terrain repeatedly with an increasing load.

[LC-1.5]: The thickness of a single sheet is $H.

[LC-1.6]: The uneven terrain is constructed by placing random cut-outs of the sheets on top of each other. The cut-outs may contain holes. The exact shape of the uneven terrain is determined by the local organizing chair.
[LC-1.7]: Several coins or washers of diameter $CD will be placed at random on the playing field. The thickness of the coins or washers is less than $CT.

[LC-1.8]: The sheets are colour coded, that is sheets at different heights have different colours as shown in Figure Uneven Terrain.

Uneven Terrain
A sample uneven terrain playing field for the lift and carry event.

[LC-2]: Number of Robots

[LC-2.1]: A single robot competes in a match.

[LC-3]: The Players

[LC-3.1]: Please refer to General - HuroCup Laws of the Game for detailed information about the players.

[LC-4]: The Referee

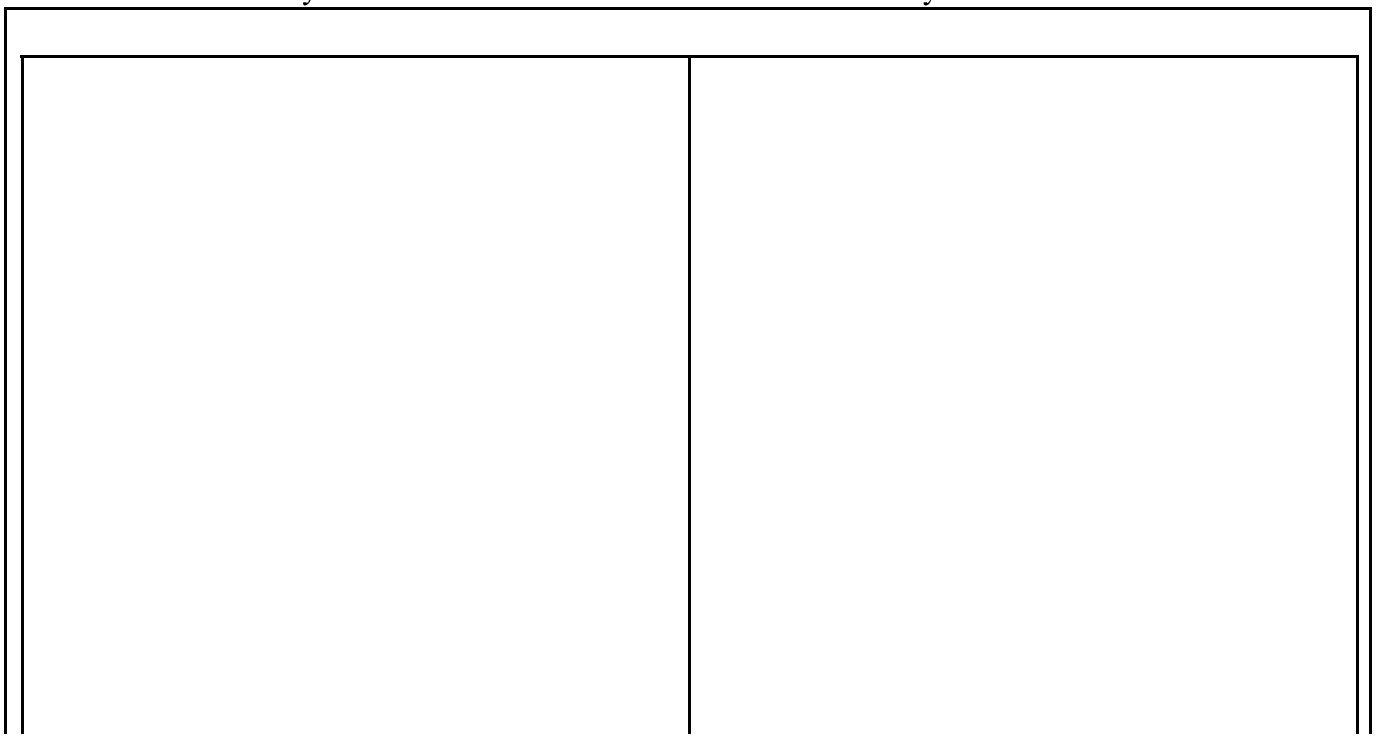
[LC-4.1]: Please refer to General - HuroCup Laws of the Game for detailed information about the referee and his or her duties.

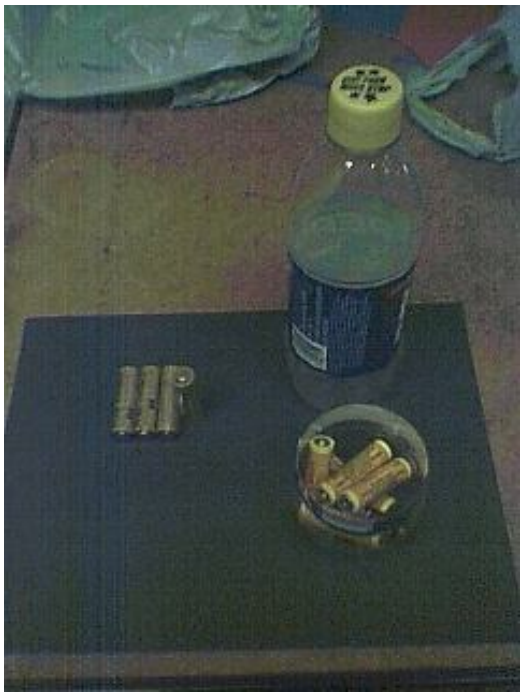
[LC-5]: The Assistant Referee

[LC-5.1]: Please refer to General - HuroCup Laws of the Game for detailed information about the assistant referee and his or her duties.

[LC-6]: Game Play

[LC-6.1]: A single robot is designated the runner. All other robots must be outside of the playing field.
[LC-6.2]: The only robot allowed to move during a run is the designated runner.
[LC-6.3]: The runner must be fitted with a small basket or bucket (see Fig. Lift and Carry Basket), which is able to hold as many batteries as the team wants the robot to carry.





Lift and Carry Basket

A sample basket for use in the Lift and Carry Event. A suitable basket for the lift and carry challenge on the right and suitable weights (Standard AA batteries) in front. Such a basket must be fitted to the robot before the lift and carry event. A standard 591ml soft drink bottle is shown for comparison. The basket in the picture was constructed by cutting the bottom off the soft drink bottle.

[LC-6.4]: The runner will be placed at a random location on the edge of the uneven terrain.
[LC-6.5]: At the beginning of the competition, the referee will place no weights in the basket attached to the robot.
[LC-6.6]: The referee will signal the start of the competition by blowing the whistle.
[LC-6.7]: After the referee gives the start signal, the robot must immediately step onto to the uneven terrain. The robot is not allowed to move around the outside of the uneven terrain.
[LC-6.8]: After having stepped onto the uneven terrain, the robot must reach the highest spot on the uneven terrain. The robot has reached that the highest spot if it touches the highest spot with both feet.
[LC-6.9]: Once the robot has successfully reached the highest spot on the uneven terrain, it must then leave the uneven terrain. The robot has left the field if both feet touch the ground outside of the uneven terrain.
[LC-6.10]: Once the robot leaves the field after having reached the highest spot, the referee will add five weights to the robot and another run will start from a random location selected by the referee.
[LC-6.11]: A robot is not allowed to leave the uneven terrain without touching the highest spot first.
[LC-6.12]: The robot is not allowed to fall during a trial. The only parts of the robot that are allowed to touch the ground are its feet.
[LC-6.13]: Each robot may have at most one human handler associated with it.
[LC-6.14]: The human handlers are not allowed to interfere in any way with other robots, the referee, or other human handlers.

[LC-6.15]: A human handler may only enter the playing field or touch his/her robot with the permission of the referee.
[LC-6.16]: The end of the competition is signaled by the referee by blowing the whistle a second time. The referee terminates the competition if
1. the robot has left the uneven terrain with both feet,
2. the robot was unable to reach the highest spot and then leave the field within 2 minutes,
3. the robot does not immediately step on the uneven terrain at the start of the trial,
4. the robot leaves the uneven terrain before reaching the highest spot.
[LC-6.17]: At the end of the run, another robot will be designated the runner.

[LC-7]: Fouls and Misconduct

[LC-7.1]: The robot does not step directly onto the uneven terrain at the start of the run.
[LC-7.2]: The robot leaves the playing field without stepping onto the highest point first.
[LC-7.3]: The robot handler touches the robot without permission of the referee.
[LC-7.4]: Any infractions as listed by General - HuroCup Laws of the Game as far as they are applicable in this event.
[LC-7.5]: Any team that commits one of the infractions listed in this section will be penalized by having the run declared invalid.

[LC-8]: Method of Scoring

[LC-8.1]: Any robot that has not reached the highest spot and left the uneven terrain at least once is automatically awarded no rank and 0 points.
[LC-8.2]: Among the robots that have left the uneven terrain at least once, the robots are ranked (i.e., 1st place, 2nd place) based on the greater number of batteries successfully carried.
[LC-8.3]: Within a round, the time to successfully carry the maximum number of batteries will be used as a tiebreaker. That is if two or more robots have the same number of batteries carried successfully, then the time for the run with the most number of batteries is used as a tiebreaker.

[LC-8.4]: For more details about the point allocation, please refer to Point Allocation [Organization - HuroCup Laws of the Game].

[LC-9]: Tiebreaker

[LC-9.1]: In case two or more robots have the same number of points after all rounds in the lift and carry event, the sum of the number of batteries carried successfully will be used a tiebreaker.
[LC-9.2]: In case two or more robots have the same number of points after all rounds and are still tied after applying the previous tiebreaker, the maximum number of batteries in a single round will be used as a tiebreaker.