AI Hubots	Division	Team	Production
	Junior/Senior	1-2 people, teams	Preproduction

1. Description

AI Hubots is a humanoid game that are programmed to drive along a given line in a stadium, removing obstacles along the line and reaching the destination quickly. For line recognition, the robot must judge itself in a given situation using a camera and can use sensors for obstacle recognition. This event is played face-to-face only.

2. Robotics

2.1 Robot Class Humanoid

2.2 Robot's Configuration

2.2.1 The robot must be pre-built before the competition, will not be given extra time to build it.

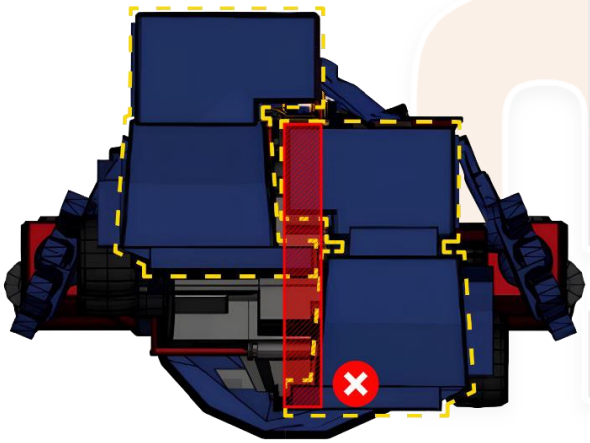
2.3 Power

2.3.1 Autonomous, self-powered mobility that cannot use combustion engines.

2.3.2 There are no power and voltage restrictions.

2.4 Driving

2.4.1 The bipedal gait must be articulated without linkage. No crossing of the feet in an upright position is allowed.



<Figure 1> Disallowing crossing of feet on an upright robot

2.5 Programs

2.5.1 The robot must move on its own, and is not allowed to be steered by a controller.

2.5.2 Elementary league can be programmed to work with block coding.

2.5.3 Middle and high school teams may use pre-coded header files in C or modularized files in Python. However, the main program for performing the mission required for the competition must be coded directly at the competition site, and violation of this rule will result in disqualification.

2.6 Spare robots

2.6.1 Robot Preparation Competitor may have a spare robot in addition to the main robot, and both the main and spare robots must be verified by the referee prior to the competition.

2.6.2 The use of spare robots Spare robots may be replaced only after verification by the referee before the start of the competition is declared.

2.7 Camera Module

2.7.1 The robot should be equipped with a camera module for situational awareness.

2.7.2 There are no restrictions on communication standards or pixels.

2.7.3 The camera is plugged into the robot's power source.

2.7.4 Can't use your smartphone camera.

2.8 Sensors

2.8.1 Use of sensors You can use sensors for obstacle recognition.

2.8.2 Number of sensors 1

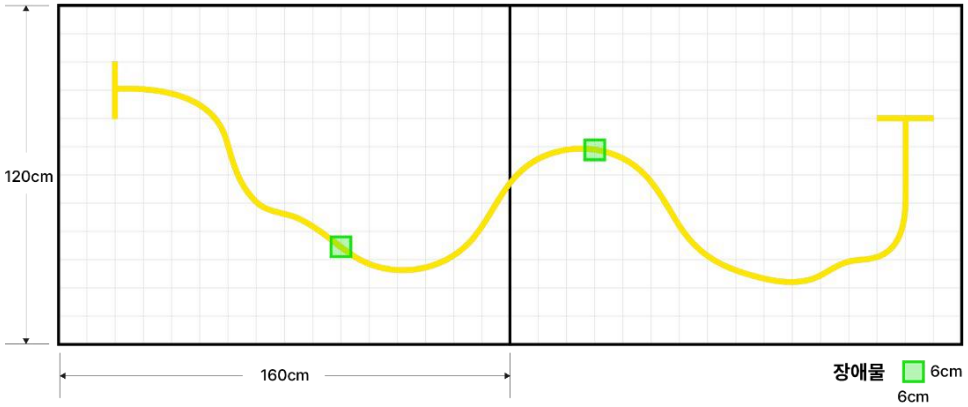
2.8.3 Type of sensor No restriction

2.8.4 Sensor usage restrictions Cannot be used for anything other than obstacle recognition.

3. Stadiums

3.1 Authorized venues Use authorized venues as defined by the International Robotics Olympiad Committee.

3.2 Dimensions and configuration of the playing field Each competitor will use one or more back-to-back playing surfaces measuring 160 cm x 120 cm (±10% margin of error).



<Figure 2> Example of stadium dimensions and configuration

3.2.1 **Stadium tolerance** Stadiums can have a tilt of no more than 2° (±10% tolerance) and bumps or gaps of no more than 0.3 cm (±10% tolerance).

3.2.2 **Robotic Fall Protection Structure** No separate arena perimeter wall to prevent robots from falling.

3.2.3 **Distance between arenas** The distance between arenas should be no more than 50 centimeters.

3.3 **The stadium field** floor is padded, white in color, and may be partially padded for advertising or the organizer's logo.

3.3.1 **Mission Map** Use a mission map printed on a 10-centimeter grid, secured to the playing field with sheet paper and tape. Distance scores are also written on the grid relative to the starting point for scoring purposes. Obstacles are placed on the course.

3.3.2 **Driving Course** The driving course is represented by a line and is a combination of straight and curved shapes.

3.3.3 **Line line is** yellow with a width of 2 centimeters (±10% tolerance).

<Figure 3> Mission example

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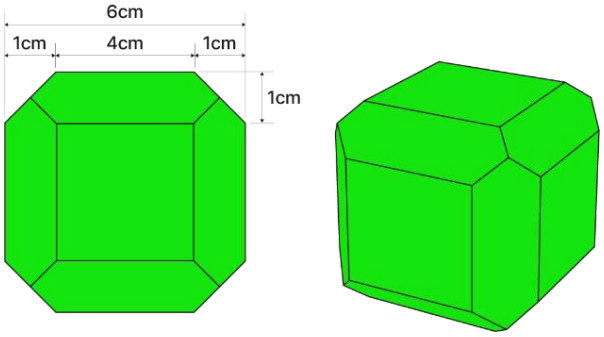
3.4 Accessories

3.4.1 Obstacle 6 cm x 6 cm x 6 cm (W x D x H, ±10% tolerance)



<Figure 4> Example of an obstacle

4. Match Progression

4.1 Match The match is a record match, with a total of two chances, with a correction period between each attempt.

4.2 Robot construction and practice time Robot construction and practice time is a minimum of 30 minutes and a maximum of 120 minutes, and will be announced on the day of the competition.

4.3 Arena will be allocated based on the number of participants and difficulty level of the competition.

4.4 Production and practice participants may practice in their assigned arenas until the end of the announced production and practice time, and may not begin practicing before their assigned arena.

4.5 End of Build and Practice Time When Build and Practice Time is over, stop your robot and follow the instructions of the moderator to your seat.

4.6 1st round conduct the first round after production and practice time.

4.6.1 Match Preparation All competitors must report to the designated location with their robot and wait as directed by the referees and officials at each venue.

4.6.2 After a match, all participants wait in a queue until all participants have finished playing, rather than playing on their turn and returning to their seats.

4.7 Modification Time After the 1st round, all competitors will be given time to modify or practice their robots. The modification time will be announced on the day of the competition.

4.8 2nd round will be played immediately after the correction period.

4.8.1 **Match Preparation** All competitors must report to the designated location with their robot and wait as directed by the referees and officials at each venue.

4.8.2 **Waiting after a match** All participants take their turn to play and return to their seats to wait.

5. Match

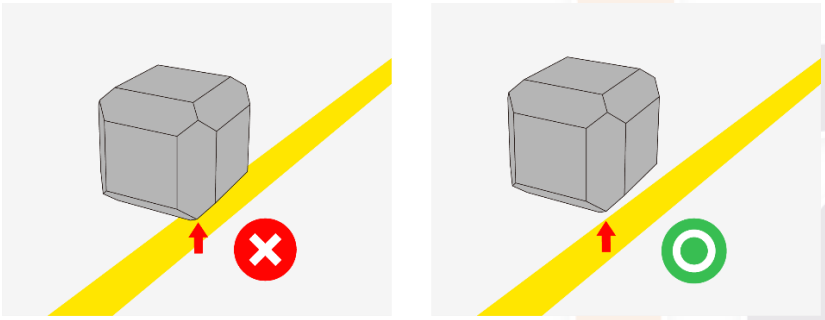
5.1 **Mission** The robot must travel the given line according to the mission provided on the day of the game. The robot must remove obstacles along the line as it progresses.

5.1.1 **Remove Obstacles** Obstacles are considered structures that impede travel on the course and should be removed.

1) Obstacles are not anchored.

2) When removing obstacles, the robot must use its hands to remove them, and walking forward to remove obstacles or using its feet to remove obstacles will result in an immediate TKO.
(However, if the robot's feet are not intentionally moving the object, and the object is not out of line, it will proceed normally) Revised 24.04.03 .

3) The criteria for removing obstacles is as shown in <Figure 5> below.



<Figure 5> Criteria for determining obstacle removal

4) If the referee determines that the obstacle has been removed, the referee may remove the obstacle from the playing field.

5.2 **Score** the distance to the point where the robot stopped.

5.3 Disclosure of the mission The mission, including the arena, driving course, and obstacle placement, will be revealed on-site before the match starts, and a separate mission sheet will be released for scoring.

5.4 Start Robot positioned at the starting line and starts on the referee's starting signal. The referee will give the start signal and start timing with the stopwatch.

5.5 Arrival The referee stops the clock when the robot stops.
(If you stop and move during the 10-second count, resume timing).

5.6 Start on the referee's signal to start the match.

5.6.1 False Start If the robot is activated before the referee's start signal, a false start will be declared and the match will be restarted.

5.6.2 Restarts A competitor will be given a total of one restart per match. A competitor who has two false starts in a match will be disqualified.

5.7 Time missions will be announced on-site on match day and will have a maximum of two minutes to complete.

5.8 End of match

5.8.1 Record The score and time of the distance traveled up to the time limit will count as a record. In case of ties, the time will be prioritized.

5.8.2 Line out, even a part of the robot is not in contact with the line, the match is over, and the record until the end of the match is recognized.

5.8.3 Technical Knock Out (TKO) If a robot is unable to run normally, the referee may declare a TKO, which is equivalent to stopping the robot without a 10-count. The best score available at the time of the TKO is recognized as the record.
(e.g., repeatedly moving through an area, or stopping progress at a point due to getting stuck or blocked by a structure, obstacle, etc.

5.9 Disqualification If a player violates the rules of the game or interferes with the progress of the game during a match, the match will be ended by disqualification and the player's score will not be recognized.

5.9.1 Robot Touch If a player touches the robot during a match without the permission of the referee, a Robot Touch will be declared and the player will be disqualified.

5.9.2 Repair Adding· removing· exchanging· changing, etc. is not allowed during the competition, and any team found with extra parts, tools, batteries, etc. for the purpose of repairing the robot while waiting for the competition will be disqualified.

5.9.3 **Failure to honor arena assignment** Any participant caught practicing or playing in a arena other than their arena will be disqualified.

5.10 **Rematch** In the event of an unforeseen event such as a power outage, a rematch may be held at the discretion of the referee and supervisors.

5.11 **Referee's Decision** The referee has the authority to preside over all situations and supervise the participants from the beginning to the end of the match. Deciding the outcome of a match is the sole authority of the referee and his/her declaration is final.

6. Match Record

6.1 **Score Items** Point-by-point scores and measured time records for the course

6.2 **Course point** scoring of the course is determined by the score at the point where the robot finally stops after the referee declares the end of the match. The highest score at the point where the robot is standing is recognized as the record.

6.3 **Time record** The referee's stopwatch time, taken at the time the robot comes to a complete stop, will be accepted as the record. (Line breaks and TKOs are not timed.)

6.4 **Final record** Among 1st/2nd run, better of the two rounds will be recorded final record.

6.5 **Prioritization of records** If they land on the same grid and have the same score, their timestamps are compared to determine their ranking.

6.5.1 **Prioritization by Round** If the driving results are the same in the same round, the ranking is determined by comparing the records of different round.

6.5.2 **In the event of a tie,** Better record upon first or second trial is approved. However, when tied, participant with better record on the first trial is gets priority.