

LEGGED ROBOT MARATHON RACE

1. OBJECTIVE

To design a Legged Robot to travel on a designated track by either walking, running or hopping on a flat terrain for a total distance of approximately 28.9 x 6 metres.

2. SPECIFICATIONS OF ROBOT

- 2.1 The robot must have at least one leg. There is no limit to maximum number of legs used. The maximum length and maximum width of the robot is restricted to a 0.6m x 0.6m square area in the starting zone. There is no height restriction on the robot. There is no restriction on the dimension and geometry of the robot once it started each race attempt (ie: once any part of the robot crosses the starting line.)
- 2.2 The robots must be completely autonomous. It should contain both the controller and power units. The robot must not weigh more than 10 kg. In addition, the power unit attached to the robot must not exceed 1 kg. Spare power units must be identical.
- 2.3 Radio-frequency (RF) control is strictly prohibited in the robot design except for start/stop operation of the robot (i.e., remote push button to start and stop the operation of the robot.)
- 2.4 Each leg of the robot must consist of minimum two limb segments and demonstrate relative motion between the limbs to realise a walking motion.
- 2.5 The limbs of the robot must include some means of controlled motion to realise the walking, running, and/or hopping action for the robot. The following are some examples NOT considered as a legged robot:
 - Rotating wheel with spokes or any other structure sticking out radially to represent 'feet'.
 - Traction belt with studs or roller chain with 'feet' mounted in any orientation.
 - Robot, with feet or any floor contact point, mounted with motion-assisted roller wheel(s) is strictly prohibited
- 2.6 Locus for every feet of the robot cannot be higher than its associated pivoting joint.

3. SPECIFICATIONS OF RACE TRACK

- 3.1 The race-track is a raised platform of a fixed width of approximately 0.6m wide and is approximately 28.86m in length (1 lap.)
- 3.2 The track comprises of straight and circular segments connected together. Each circular segment consists of a circle quadrant of radius (with reference to the retro-reflective tape) 0.5m or 1.5m. The entire track is constructed with 1/4-inch plywood with circular and/or straight segments raised about 50 mm off the ground (if 50 mm track is not available, the entire track will use 100 mm height). The top surface will be painted in mat black. It is designed to support a robot with a maximum weight of 10 kg. The joint between 2 track segments is **NOT** expected to be perfectly level and it may be uneven. Track segments at the same elevation are joined with a maximum step at the joints of 5 millimetres. There is a 50 millimetres wide retro-reflective tape (3M Scotchlite - Industrial Grade) in the middle of each path for navigation purpose.

Fig.1 shows the top view of a sample competition race-track. The actual competition track which consists of 28 curve segments and 10 straight sections. The starting position and orientation will be determined by the judges in a random manner.

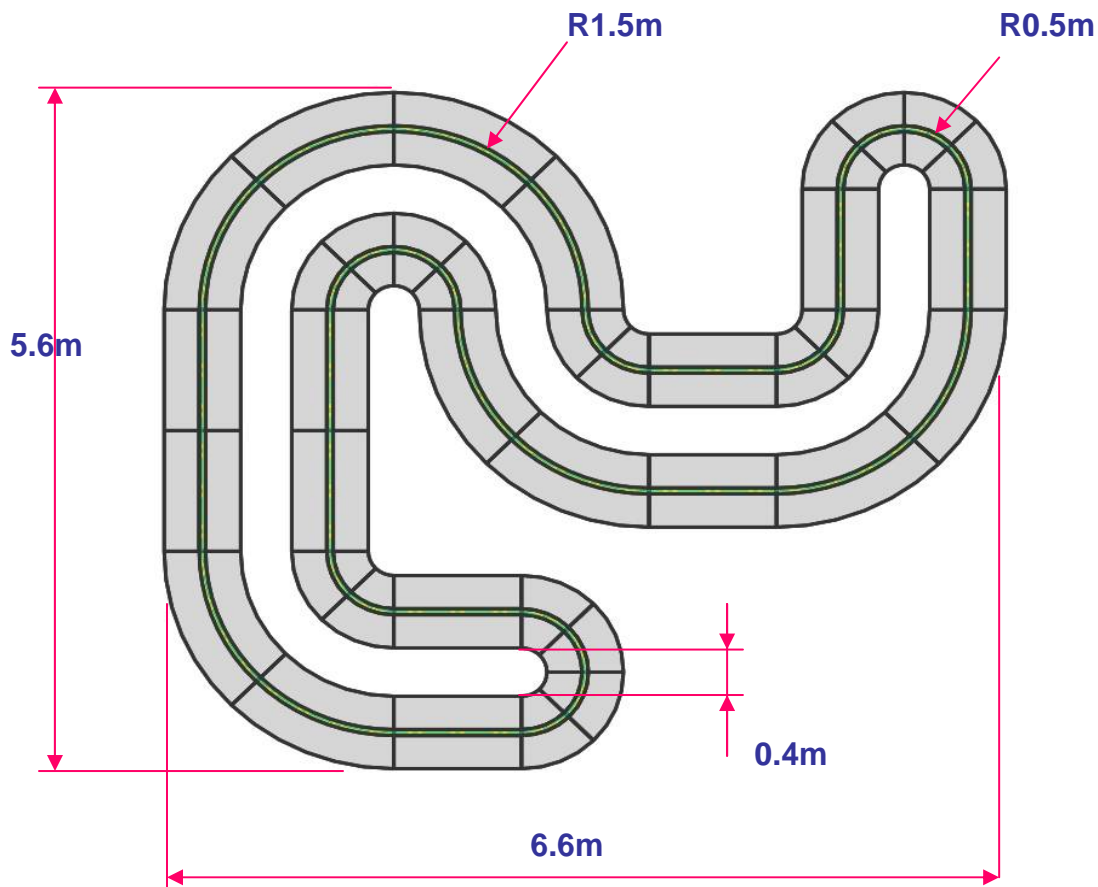


Fig. 1 The Legged Robot Race Track

4. FORMAT OF COMPETITION

- 4.1 Each robot is to run 6 laps around the closed track together with an opponent robot. The starting position for both robots will be made known at the beginning of the competition. The time taken to complete 6 laps will be recorded.
- 4.2 If one of the robots catches up till within 1m from the opponent robot, the opponent robot shall be deemed knocked out from the competition and shall be removed immediately from the track. The overtaking robot shall continue to complete the 6 laps for the timing record.
- 4.3 There will be 2 phases in the competition:
 - a) The Preliminary Matches (only 3 laps instead of 6 laps.)
 - b) The Knock-out Championship Matches (6 laps for each match.)
- 4.4 The Preliminary Matches

All robot entries will be randomly paired by drawing of lots. Provisions will be given to pair robots with the same number of legs, starting with the least number. The odd number robot may run with robots with higher number of legs or by itself. Every match will consist of 3 races. Both robots competing in the race will be timed. If a robot comes close to overtaking and knocks-out its opponent (refer to 4.2), it is deemed to have won all 3 races.

All the timing will be tabulated to determine the top 8 ranking for the next round of matches. If there are clones among the top 8 ranking, only the best clone will advance to the next round and the lower rank will be moved up.

The top 8 ranking will proceed to the Knock-out Championship Matches using Table of 8. (Note: If the total number of entries exceeded 30, table of 16 will be used to include more robots)

4.5 The Knock-out Championship Matches

The Table of 8 shown in Fig. 2 will be used. The pairing of opponents will go according to the ranking during the Preliminary Matches. Figure 2 shows the competition matches in a Table of 8.

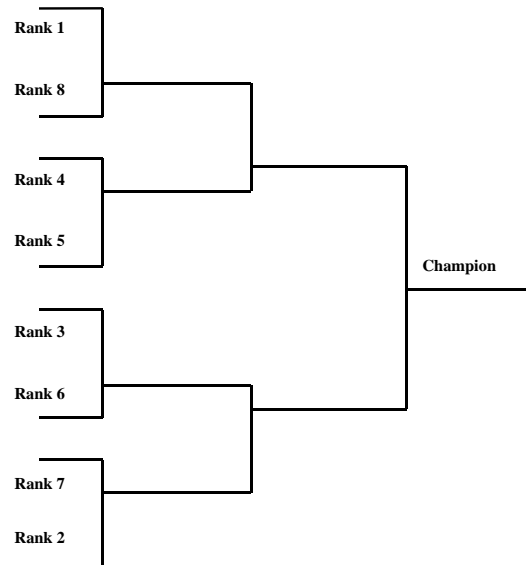


Fig. 2. Table of 8

Each Match consists of 3 races. The winner of each match is decided by number of winning races. 4 Winners of quarterfinal round will proceed to semi-final round after which 2 winners of semi-final round will proceed to the Championship round. The Champion is again decided by number of winning races.

5 RULES OF COMPETITION

- 5.1 Robot will be “caged” at least 30 minutes before the start of the competition. The caged robot should be the full robot **PLUS** all necessary power units of the same capacity and weight. Once the competition starts, no individual is allowed to access the robots in the “caging” area.
- 5.2 **Two** robots will be racing at any one time and the sequence will be determined by drawing of lots. The robot has to complete the entire competition race-track for each race. No change of batteries is allowed during the competition. No cleaning of robot parts and tracks are allowed.
- 5.3 Robot is to start from a stationary starting position, with the extremity of the robot aligned to the start line. It has to travel along the track either by walking, running or hopping, or any other motion not identified as wheeled motion.
- 5.4 Robot must keep within the designated track during the race. The result is void if

- a) any part of the robot completely touches the ground or the robot falls off the track before fully crosses the Finishing line. Or
- b) any part of the robot crosses to the other track.

If any of the above situations occurs, the participant, under instruction from the judge, must remove their robot immediately. The robot is then considered to have used up 1 of the 3 races.

- 5.5 The race and race time both starts by the blow of a whistle. In the **Preliminary Matches**, a valid **Recorded Time** is measured from the time then the whistle is blown until the moment when any part of the robot crosses the Start/End line at the Start Zone after 3 laps. Any robot moved before the whistle is blown will be considered a **False Start**. All robots shall only be given 1 False Start warning and subsequent False Start will imply the robot has lost a race.
- 5.6 No parts of the robot are to be left behind on the race-track. Winning is based on the best time of a completed race for each robot. If the robot failed to achieve any single complete run, it shall be retired from the competition.
- 5.7 During the competition, If the robot, under any circumstance, does not demonstrates any positive action to start or complete the race (eg: always crash or run out of track for no apparent reason) may be asked to retire by the discretion of the judges while the other robot still carry on the competition on its own.
- 5.8 Once the robot has started its race, the robot handler can only access the robot after it crosses the Finishing Line or the robot runs out of the track completely.
- 5.9 Modification of robot during competition is **STRICTLY PROHIBITED**. No extra parts are to be added to or removed from the robot once the competition time starts. The only replacement in the robot is the power unit which was declared during caging. **Replacement of power unit is not allow in a same Match**. Every robot must have their individual parts and no sharing is allowed.
- 5.10 All robots should be returned to the caging area or a designated location after its run. The teams are not allowed to take back their robots before the whole competition is concluded.
- 5.11 Any violation of the rules above would result in the run being invalidated.

6. CLONING

- 6.1 Clones will only be awarded one prize. Clones will be identified during the "caging" procedure.
- 6.2 Clones are robots with substantially identical physical appearance and walking mechanism. Scaling of the same mechanism is considered as cloning.
- 6.3 When in doubt, the decision of the Judges will be final.