

## 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.

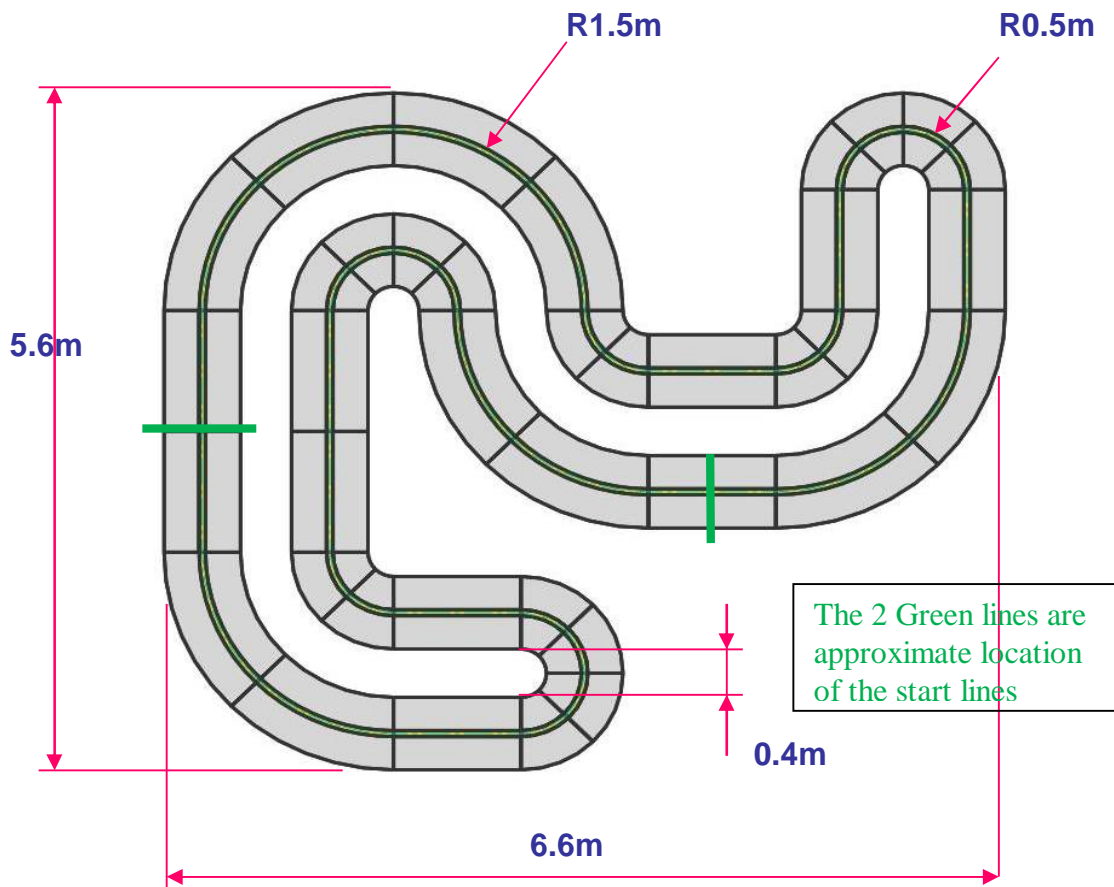


Fig. 1 The Legged Robot Race Track

#### 4. FORMAT OF COMPETITION

- 4.1 2 robots will be drawn to run against each other, starting at 2 designated start lines at least 14m apart along the track. Each robot is to run 2 laps around the closed track. The starting position for the robot will be made known at the beginning of the competition. The time taken to complete the 2 laps for each robot will be recorded.
- 4.2 Each team will be given 5 minutes to complete at least two 2-lap runs in opposing direction, i.e. one in clock-wise and the other in anti-clock-wise direction. Each team shall start from the same assigned start lines for the run. The robot must complete at least 1 2-lap run and register a valid running time to qualify for a prize.
- 4.3 In the event the faster robot catches up with the slower robot till within 1m, determined by one straight segment or one large curve segment or 3 small curve segments, the slower robot shall be “knocked-out” of the race and retire to the cage-in area. Only robots managing to clock at least 1 valid time without being “knocked-out” shall qualify for a prize.
- 4.4 The robots with the fastest running time will be declared the winning entries, subject to the general competition prize guidelines.

#### 5 RULES OF COMPETITION

- 5.1 Robot will be “caged” at least 30 minutes before the start of the competition. Once the competition starts, no individual is allowed to access the robots in the “caging” area.

- 5.2 The sequence of robot runs 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
- any part of the robot completely touches the ground or the robot falls off the track before fully crosses the Finishing line. Or
  - 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.
- 5.5 The race and race time both starts by the blow of a whistle. A valid Recorded Time is measured from the time when the whistle is blown until the moment when any part of the robot crosses the Start/End line at the Start Zone after 2 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 demonstrate 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.
- 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.
- 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.