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Dragster Robot

Competition rules (Robotics@ISEP'2024 Open version)

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Date: January 2024

I. General Information

The aim of the Dragster Robot competition is to promote robotics and engineering education within a framework of competition based on principles of fair play. In addition, the aim is to make it easy and inexpensive to create the competition tracks, so that they can be implemented even in institutions with fewer resources.

Although the competition's target audience is students from ISEP - Instituto Superior de Engenharia do Porto, the competition is open to participants from higher education institutions, vocational schools, primary and secondary schools, and individual participants.

This version of the rules (Robotics@ISEP'2024 Open version) is the final version of the rules that will be in force during the Robotics@ISEP'2024 Open and was developed based on the rules for the same competition, developed by the Portuguese Robotics Society (SPR).

Any questions regarding this competition should be sent to robodragster@lists.sprobotica.pt or mss@isep.ipp.pt.

II. Competition specification

1. The competition involves developing a robot that can travel along a straight track, approximately 10 m long, at the highest possible speed, and that, if possible, is able to stop at the end of the track.

2. The competition consists of a set of four rounds, in which all participating teams compete against each other in each round, organized as follows:

    a) Round 1, with a weight in the final classification of 10 %.

    b) Round 2, with a weight in the final classification of 20 %.

    c) Round 3, with a weight in the final classification of 30 %; and,

    d) Round 4, with a weight in the final classification of 40 %.

3. There is no limit to the number of participating teams, and each team can have a maximum of 4 members.

4. Before the start of the competition, a technical inspection will be carried out on the robots of the participating teams to:

    a) ensure that the robots' specifications, in terms of dimensions, are met and,

    b) to check if there are two or more robots that are identical in terms of hardware and/or software.

5. It is not permitted to take part in the competition with two identical robots. If the jury finds that there are two, or more, identical robots, they will be disqualified.

    a) Identical robots are robots that have a similar structure (hardware) and use similar algorithms (software).

    b) It is up to the judging panel (see Section VI) to assess whether two or more robots are identical.

    c) During the technical checks, which take place before the races, the judging panel can request access to the electrical schematic and list of hardware components. In

this case, participants must provide these elements, under penalty of disqualification.

d) During the technical checks, which take place before the races, the judging panel may ask for access to the source code running on the robot's control systems. In this case, participants must show the code, under penalty of disqualification.

6. Each race is started with a light signal from the “traffic light” (see point IV-3).

a) At the start, no part of the robot may cross the transverse line that marks the start of the lane, except for the sensor used to detect the traffic light change, as shown in Figure 1.

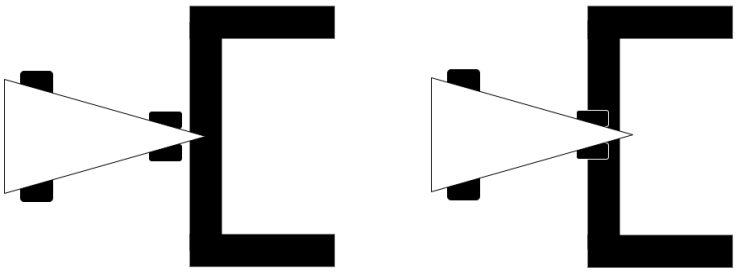

Figure 1: Valid (left) and invalid (right) position of the robots on the starting line.

7. Each race is graded as follows:

a) The robot is considered to have finished the track when its front end has crossed the line marking the end of the track, as shown in Figure 2.

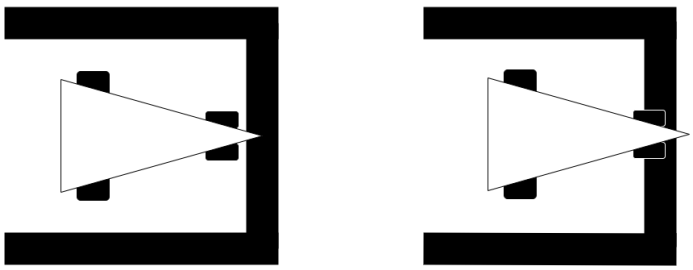

Figure 2: Robot did not cross (left) and crossed (right) the finish line.

b) The robot that finishes the track in 1st place is awarded 3 points.

c) The robot that finishes the track in 2nd place is awarded 1 point.

d) Each robot must complete the race always in its lane; if the robot does not complete the course, or leaves its lane, it is awarded 0 points.

e) A robot is considered to have left its lane if, at least, part of one of the wheels or part of the chassis crosses the lane limit marking line, as shown in Figure 3.

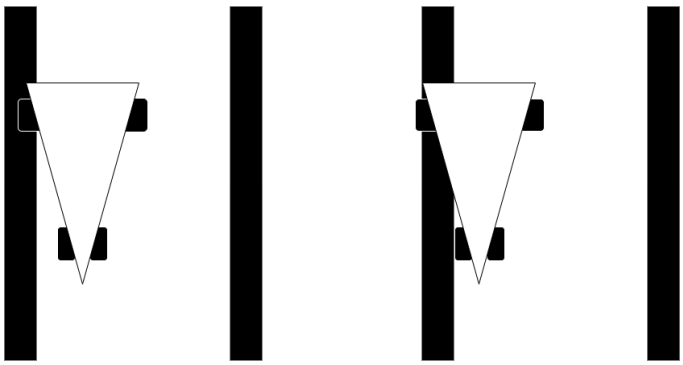

Figure 3: Robot in (left) and out (right) of its lane.

f) If a robot invades the lane where another robot is driving, and collides with it as a result, the robot that was driving in its lane will have the chance to repeat the race.

g) If, after finishing the track, the robot stops autonomously within a maximum of 0.5 m of the end of the track (no part of the robot may cross the line marking this limit), it will be awarded 1 additional point.

h) If, after finishing the track, the robot stops autonomously within a maximum of 1.0 m of the end of the track (no part of the robot may cross the line marking this limit), it will be awarded an additional 0.5 point.

i) In the event of a tie between two or more robots in the final ranking, the robot's time in each individual attempt will be used as the tiebreaker criterion. The robot that has achieved the lowest time in any of its races will be awarded the best classification.

8. In addition, the time taken to complete the course will be recorded for each robot that finishes the race. This record will be used to determine the track record and the record for the edition of the competition.

9. The organisation does not provide the test track; however, participants can test their robots before the start of the competition, and in between races, according to a schedule to be set by the event organisers.

10. During training times, participants must manage access to the track in a collaborative manner and based on fair-play rules.

11. The organisation provides each registered team with a table, one chair per team member registered for the event and access to an electricity point.

III. Robot specifications

1. Robots can have any shape, as long as their dimensions do not exceed the following values:

    a) 300 mm long.

    b) 250 mm wide.

    c) 200 mm high, except for the traffic light change detection system.

2. The robots must be electrically powered and driven.

3. Robots must be autonomous.

    a) Communication with the robot, or any type of teleoperation or remote control, is strictly forbidden during practice and competition rounds.

4. A robot may not intentionally endanger the life or physical integrity of participants in the competition.

5. A robot may not destroy objects within its reach as a result of intentional or improper operation.

IV. Race track specifications

1. The track where the competition will take place (see Figure 4) will be built on a site with rigid soil and, as far as possible, flat, and free from irregularities.

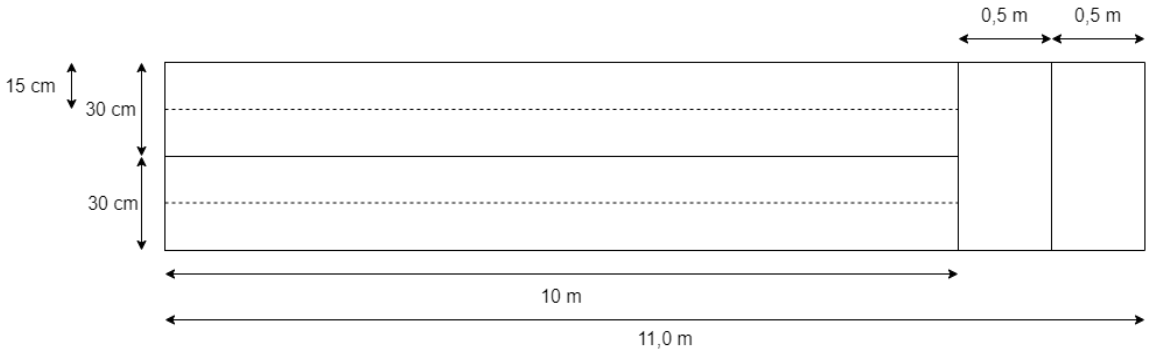

Figure 4: Approximate dimensions of the race track.

2. The track, which will be about 11.0 metres long, will consist of two parallel lanes (see Figure 5), about 30 cm wide, bordered by a black stripe (on each side), about 20 mm wide.

   a) The track (or each lane) can be constructed using: (*i*) IKEA drawing paper, sold in rolls under the reference MÅLA (https://www.ikea.com/pt/pt/p/mala-rolo-de-papel-p-desenhar-70461088/); (*ii*) ALBANO ALVES scenery paper, sold in rolls at Staples under the reference Rolo Papel Cenário 1 m x 10 m, 100g (https://www.staples.pt/pt/pt/rolo-papel-cenario-1-m-x-10-m-100g-creme-620152); (*iii*) other equivalent scenery paper; or, (*iv*) canvas.

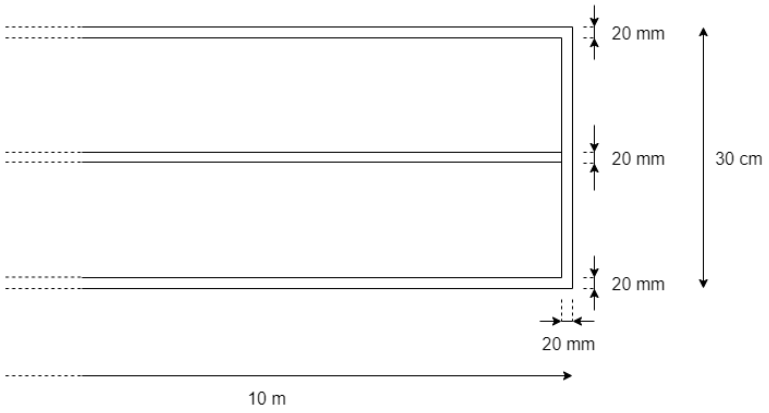

Figure 5: Detail of the markings for each lane of the race track.

b) The middle of the lane will be marked with a black stripe, approximately 20 mm wide.

c) The end of the lane will be marked with a black stripe, approximately 20 mm wide.

3. At the start of the track there is a "traffic light", mounted on the underside of a gantry (as shown in Figure 6), which will light up signalling the start of the race.

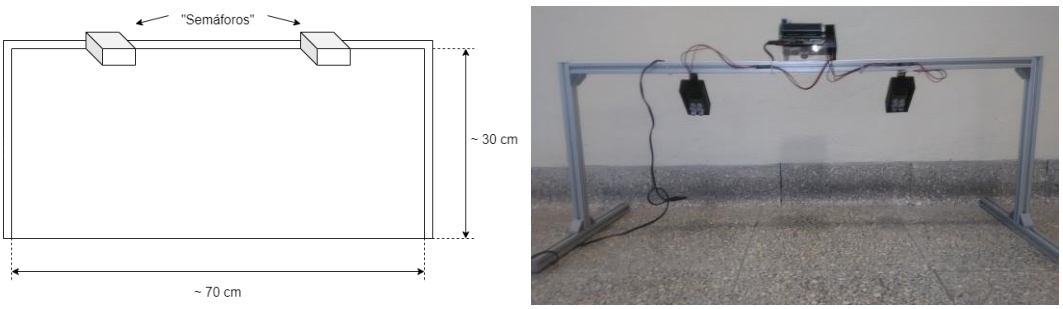

Figure 6: Approximate dimensions of the gantry that supports the "traffic light" signalling the start of the race (left), and photo of it (right).

a) The "traffic light" will be implemented using four LEDs (as shown in Figure 7, left).

b) The "traffic light" will switch on a white light to signal the start of the race (as shown in Figure 7, right).

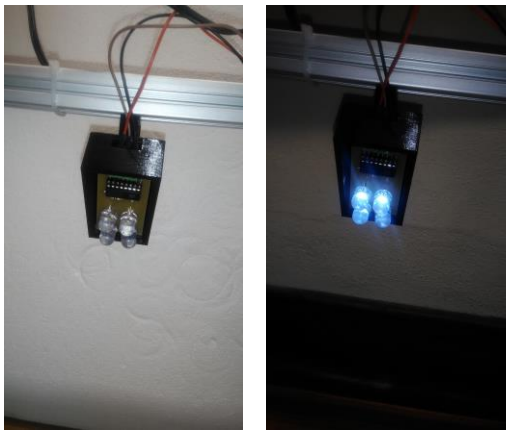

Figure 7: Look of the "traffic light" when switched off (left), and when switched on (right).

4. At the end of the track is an unobstructed area, with a maximum length of 2 metres, for the robots to decelerate and stop. At the end of this area, the organisation will try to provide material to cushion any impact from robots that fail to stop in the space provided. However, the race organisers cannot guarantee that robots that hit this protection will not suffer damage.

V. Specification of anomalous situations

1. The robots must be started autonomously after the starting “traffic light” has been switched on.

    a) After pressing the button to switch on the traffic light, the robot cannot be moved again.

    b) Failure to comply with the previous point will result in 0 points being awarded to the team that does so.

2. If one of the robots does not move at the start signal, the race is not interrupted, and the robot that did not start at the right time is awarded 0 points.

3. If one of the robots starts before the start signal (commits a false start), the race is not interrupted or repeated.

    a) In this case, the robot that made the false start is awarded 0 points.

VI. Panel of judges

1. The competition is conducted under the supervision of an odd-numbered panel of judges, preferably chosen from among the competition organisers.

2. Any doubts regarding the interpretation of these rules are decided by the panel of judges.

3. The panel of judges is responsible for carrying out technical inspections of the robots to check that they comply with the maximum permissible dimensions (see point III - 1.), recording the timings and, on the basis of these values, determining the robots' score in each race (as set out in point II - 7.), classifying the teams (as set out in points II - 7. and section V.) and ensuring that the participants comply with the rules set out in this document for the competition.

4. In the event of non-compliance with the rules of the competition, or a lack of fair play by one or more members of a team, the panel of judges has the right to impose a penalty in the form of subtracting points from the offending team.

5. In the case of behaviour by team members that affects moral standards, good manners, human dignity, religious sentiments or the safety of participants, the panel of judges has the right to impose a penalty in the form of the subtraction of points from the offending team or, in cases considered more serious, may even decide to disqualify the team.

6. The decisions of the panel of judges are final and cannot be appealed against.

Disclosure of personal data

1. The registration of a robot in this competition implies that the team members agree to the collection and publication of basic information about the robot and the team members, namely the name of the robot, the name of the team and its members, the name of the institution of the team members, and allow the collection of photos and videos at the competition venue and attached areas and their dissemination, by the event organizers and any partners, without the need to inform the teams.