

Rules of procedure for SICK Robot Day 2018

General

This year the task consists in picking up balls from a (slowly) driving autonomous vehicle and transporting those to one's own storage box, so that after the given time (10 minutes) as many of them as possible are located there. 2 participants are playing at the same time, respectively, so that there are 3 vehicles altogether in the arena at any given time.

The arena

The area enclosed by the ring fence („the arena“) is rectangular and about 13 x 7 m. On both sides there is a storage box on each side, which is assigned to one participant as a collecting box for balls (see storage box 1 and storage box 2 in Figure 2). The storage box is black and its size is 40 x 30 x 17cm.



Figure 1: Storage box

The participants start right in front of their storage box (see S1 and S2 in Figure 2)

The ring fence is about 50 cm high and is unicoloured, but there will be advertisements attached. The ground of the arena is a flat gymnasium floor with the usual markings for various sports. The guiding line for the autonomous vehicle is attached to the floor and can be crossed without further ado. To protect the loading stations, free-standing obstacles with a height between 0,5-1m are set up at a distance of 0,7-1m from the ring fence. The feet of the obstacles can reach up to 10 cm on both sides into the arena.

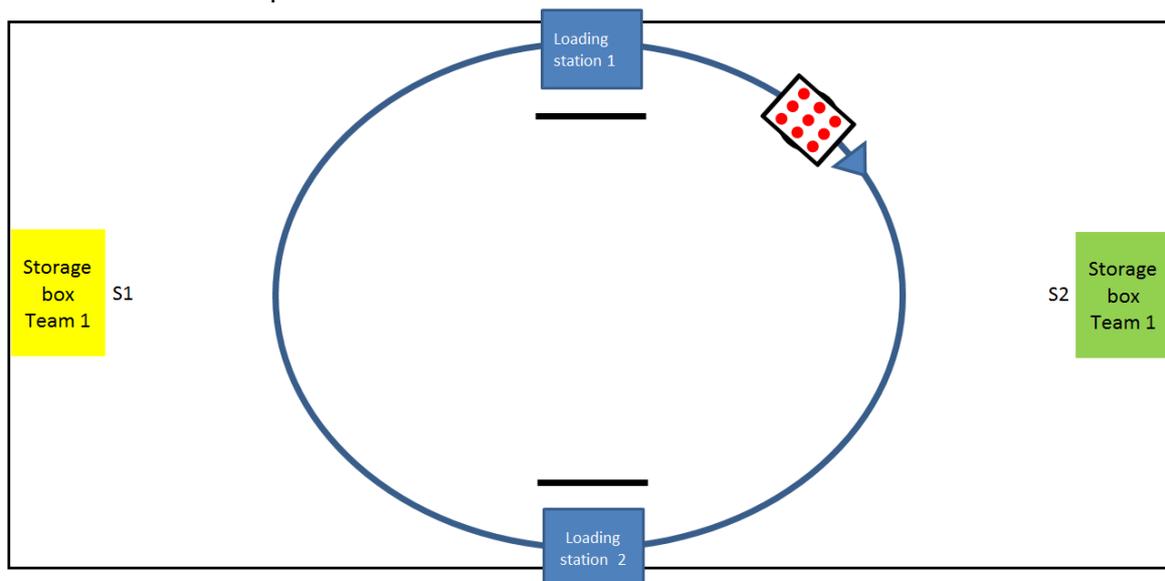


Figure 2: The arena

The Vehicles

Since there are three vehicles (autonomous vehicle and two participants) in the arena at the same time, it is absolutely necessary to comply exactly with the stipulated dimensions: the vehicles' bodies must be at least 25 cm high, so that they can be reliably recognized as obstacles by other vehicles. For the same reason the vehicle's bottom may not be farther than 15 cm from the ground. The height of vehicles is not limited.

The width of a vehicle may be maximally 60 cm.

Every vehicle must possess an easily accessible emergency stop button.

The Procedure

Each vehicle takes part in 2 runs, from which the better one is counted. A run takes exactly 10 minutes. The running order is assigned by drawing lots (it is guaranteed that the mix of competitors will be different in the two runs). All this will be announced in the schedule. The starting point within the arena will be drawn as well.

The two robots participating in the respective run start close in front of their storage box. After the start signal they may drive freely within the arena and should try to pick up balls from the autonomous vehicle loaded with those (the transporter, cf. next section) and transport them to their own storage box. For that the following rules hold:

- the path of the transporter may be crossed, but the transporter itself may not be impeded. When the transporter finds a vehicle (or any other obstacle) in its path, it will decelerate in order to avoid a collision. The path has to be cleared, however, as fast as possible. If the transporter comes to a halt for more than 30 seconds, the party responsible scores one penalty point for every further half minute (or parts thereof), after 2 minutes the obstructive vehicle will be disqualified (for this run) and removed from the arena.
- Collisions of vehicles are generally forbidden and lead to instant disqualification for the ongoing run. If two vehicles run across each other the one coming from right has got the right of way. In direct encounters collision avoidance shall always be performed to the right.
- The transport box (see Figure 3) is excluded from the collision rule. This may be touched unpunished when removing balls as long as the transporter is not impaired in its function. The touchable area is marked green shaded in Figure 6.

Apart from the start signal and potentially a stop signal no wireless communication with the vehicles is permitted. After the start of a round no persons may linger inside the arena. This also holds for team members.

A round is finished after exactly 10 minutes. Assessed is the number of balls located in one's own storage **at that point in time** (minus penalty points). Participants disqualified in the respective run always get 0 points, regardless of the number of balls collected.

The Transporter

The autonomous vehicle („the transporter“) is loaded with balls and follows a track that is defined by labels attached to the floor with approximately constant speed of about 0,2 m/s. The transport box is mounted on the transporter and has 9 places for balls.

It starts fully loaded (i.e. with 9 balls) and is restocked when passing any one of two dedicated points (the “loading stations”).

Balls may be picked up at any position of the transporter.

The dimensions of the transporter as well as the transport box can be found in the following illustrations:



Figure 3: The transport box

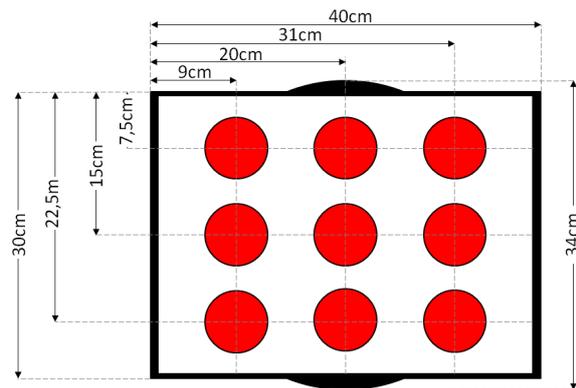


Figure 4: Dimensions of the transport box. All measurements have a tolerance of $\pm 1\text{cm}$



Figure 5: The transporter

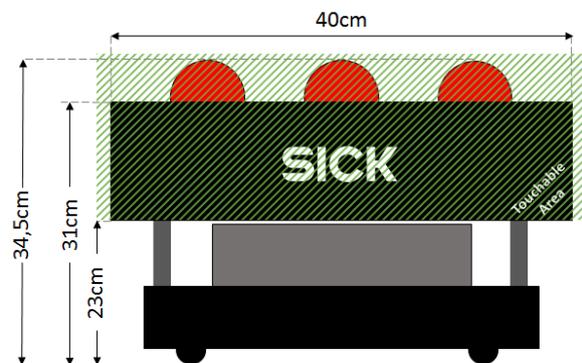


Figure 6: Dimensions of the transporter. All measurements have a tolerance of $\pm 2\text{cm}$

The Balls

The balls are made of ferromagnetic material and painted red, with a diameter of 6 cm. The weight of the balls is about 200 g.

Practice runs and training material

On the day of the competition practice runs may be performed on the course. During these all calibration jobs have to be carried out.

You can order the (unpainted) balls (www.ball-tech.com, Hohlkugel Stahl 60 mm Durchmesser, Artikel-Nr. 610060). After the registration every participating team gets a red-painted sample ball from SICK.

FAQ:

Question: May I run after my robot, so that I can react faster in emergency situations?

Answer: No. Stepping into the arena during a race is prohibited. This holds for participants as well. The only exception is a fast sprint in order to activate the emergency stop. But this will result in disqualification anyway.

Question: Does a collision with an opposing vehicle lead to a disqualification, even if the own vehicle tried to give way?

Answer: If a clear culprit for the collision can be identified (according e.g. to the rule concerning right of way) of course only this one will be disqualified.

Question: May data gained from a sensor not located on board of the robot (e.g. a camera on a high tripod, rotary arm or ladder; a camera mounted on a balloon, blimp or helicopter) be used for building a map?

Answer: Definitely no.

Question: May marks that the robot can detect (e.g. RFID tags) be attached to targets and goals?

Answer: In no case.

Question: Are there conditions that make a run end earlier than the stated 10 minutes?

Answer: Only if both vehicles get disqualified or break down.

Question: Are we allowed to have appliances to facilitate the process of handling balls on board of the robot that exceed the compulsory vehicle dimensions?

Answer: For picking up the balls it is allowed to use movable parts (e.g. an arm) on the robot assembly. During this process, these parts may exceed the vehicle dimensions specified in the rules.

In principle, vehicles must, however, be able to comply with the specified dimensions. The respective parts must therefore not be rigid, but foldable back.

Question:

What happens to the balls that accidentally fall on the field of the arena?
Are they being removed or are they considered as new obstacles?

Answer:

Balls that have fallen down are additional obstacles in the arena and must also be treated as such. The balls will only be removed if the transporter is blocked.