RoboCup Small Size League (SSL) Hardware Challenges 2021

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Motivation

A key distinguishing characteristic of the Small Size League is its tight integration of software and hardware, which is crucial to success. A purely simulated tournament may reflect the best in software, but it excludes hardware development and omits hardware-software integration. To address this gap, the SSL hardware challenges outlined in this document will be conducted alongside the virtual SSL soccer tournament for RoboCup 2021. The rules for the SSL Hardware Challenges require significantly fewer resources than a full-size SSL field setup, and takes into account the constraints identified by the SSL teams.

Constraints

For all hardware challenges, the following rules apply:

- All challenges will be playable on a field with 4x3m or larger.

- Human interference is not allowed unless specified otherwise.

- Normal division B rules apply, unless specified otherwise.

- Teams need to run an autoRef in their lab for rule checking and evaluation.

- The challenges will be performed live, using a video stream. Teams need to provide a camera that covers the whole field.

Evaluation

For each challenge, teams are ranked in order of performance. The exact scoring depends on the challenge.

The algorithm for combining the scores/ranks of the challenges will be published a month before the competition at latest.

A member of OC/TC will be assigned to each challenge and act as the referee. The TC may provide a tool that helps with evaluation of the challenge. The referee has the final decision of the result.

Challenges

There will be four independent challenges. Teams are not required to participate in all challenges, but skipping one challenge will have a significant impact on the final score.

Challenge 1: Scoring with static defenders

Objective

The objective of this challenge is to score a goal from a number of static situations as fast as possible. This will test the capabilities of the robots to score goals and play passes with static defenders as fast and precisely as possible.

Procedure

There will be ten different situations in random order that teams have to handle. The situations include the positions of the opponent robots and the ball. They will be announced a month before the competition at latest.

For each situation, the following procedure applies:

1. The team places up to **6** opponent robots and the ball according to the given situation.
2. Up to **3** robots of the team are placed on the middle line.

3. A STOP command will be issued for exactly **5s** to allow the team to prepare their robots.

4. Immediately afterwards, a **Normal Free Kick** command will be issued and the timer will start.

5. The team has **20s** to score a goal. Afterwards, the trial is over.

Rules

The following rules apply for this challenge:

- Normal Division B match rules apply. If the team performs a foul or the ball leaves the field, the trial is over.

- No human interference is allowed during each trial.

- The opponent robots must be shaped like normal robots. A robot hull is sufficient, but it should stand stable.

- The goal must be **0.7m** wide. Teams should provide a visible goal with the correct dimensions to make evaluation easier.

- Teams need to calibrate ssl-vision for a half field with **3x4m**. This means, the full field would be **6x4m** (standard field size). The goal is on the 4m side. The actual field size can be larger, but the ball will be out of field, when leaving the ssl-vision-calibrated field (checked by an autoRef).

- The penalty area must be **0.8x2m** in size.

Evaluation

The exact algorithm for the evaluation will be published one month before the competition at latest.

Challenge 2: Scoring from contested possession

Objective

In this challenge, the objective is to score a goal as fast as possible in a situation where a static defender is protecting the ball from its own goal while also touching the ball. A single attacker needs to get the ball into possession without pushing the defender, get it around the defender and score a goal.

Procedure

There will be three different situations in random order that teams have to handle. The situations include the position of the defender, the attacker and the ball. They will be announced a month before the competition at latest.

For each situation, the following procedure applies:

- The team places the defender, the ball and the attacker according to the given situation.
- A **FORCE START** command will be issued and the timer will start.
- The attacker has **30s** to score a goal. Afterwards, the trial is over.

Rules

The following rules apply for this challenge:

- Normal Division B match rules apply. If the team performs a foul or the ball leaves the field, the trial is over.

- No human interference is allowed during each trial.

- The opponent robot must be a real robot, but it does need to be able to move.

- The goal must be **0.7m** wide. Teams should provide a visible goal with the correct dimensions to make evaluation easier.

- Teams need to calibrate ssl-vision for a half field with **3x4m**. This means, the full field would be **6x4m** (standard field size). The goal is on the 4m side. The actual field size can be larger, but the ball will be out of field, when leaving the ssl-vision-calibrated field (checked by an autoRef).

- The penalty area must be **0.8x2m** in size.

Evaluation

The exact algorithm for the evaluation will be published one month before the competition at latest.

Challenge 3: Dribbling

Objective

To test the dribbling capabilities of the team, one robot of the team must navigate through a field with static opponents, while keeping the ball. The goal of the challenge is to complete the parcours within the minimum time. The timing will start as soon as the robot starts to move.

Procedure

The team has **three trials** to complete a predefined parkour. The procedure for each trial is as follows:

- A **FORCE_START** command will be issued and the timer will start.

- The team has **2min** to finish the parkour. Afterwards, the trial is over.

- If the robot has finished the parkour and came to a complete stop, the timer is stopped.

The parkour will look similar to

- A Zigzag line.

- Obstacles will be on a straight line.

- Last gate needs to be passed three times.

- Exact spacing will be published a month before the competition at latest.
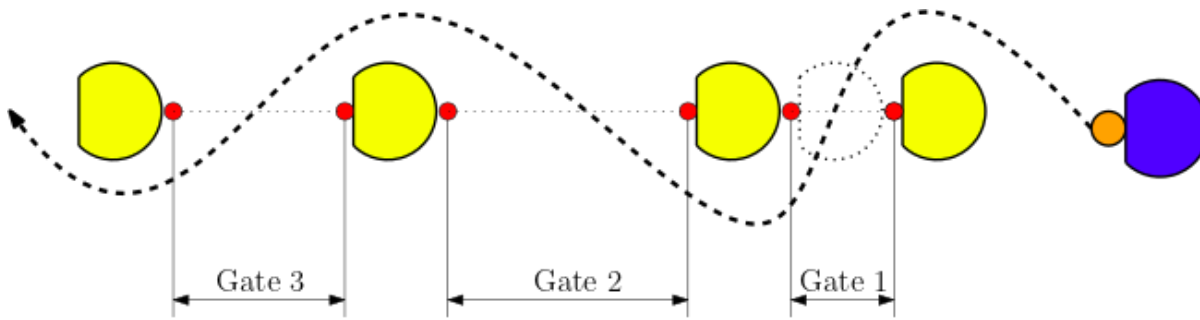
Rules

The following rules apply in this challenge:

- The standard match rules do not apply. This means:
- The robot is allowed to dribble the ball for more than 1m in this challenge.
- The ball can not go out of the field.
- If the robot loses the ball, the robot is allowed to retrieve the ball again and continue. The time will not be paused.
- The robot is not allowed to touch the obstacles, else the trial is considered failed.
- Teams are allowed to limit their field to 3x4m, but they don't have to.

Evaluation

The fastest trial per team is taken for overall scoring.

Challenge 4: Pass endurance

Objective

This challenge focuses on pass endurance and efficiency of robots. For best results, a team must be able to kick and receive the ball precisely, fast and often. This is not only challenging for the software, but also for the mechanics of the robot.

Within a limited time, the team is asked to perform as many passes as possible. The team that performed the most passes wins.

Procedure

- The team places all robots on the middle line and the ball on the center point.
- A FORCE_START command will be issued and the timer will start.
- After **5min** a HALT command will be issued and the challenge is over.

Rules

Teams are free in how they perform the passes, as long as the following constraints are met:

- A valid pass must be at least **1.5m** long.

- The shooter of the previous pass (valid or invalid) can not be the receiver of the current pass (this means you need **at least 3 robots**).

- A pass must be directed at least **10°** away from where the last pass (valid or invalid) came from (so two robots can not pass back and forth without changing positions).

- The ball must not exceed 6.5 m/s (as defined in the tournament rules).

Additionally, the following rules apply:

- The number of robots is limited to **6 robots**.

- The minimum field size is **4x3m**, but teams are allowed to play on a larger field if they wish to do so.

- Even in an event of an invalid pass, the sequence of passes used to validate the rules will assume that all passes were valid. This means that whenever a rule refers to the term previous pass, it can be both a valid or invalid one.

- Teams are allowed and encouraged to recover the ball from the field boundary.

- Any human interference, including exchanging robots, reduces the final number of passes by **10**.

Evaluation

The team with most passes wins. If teams have the same number of passes, they will share the better position.