

Starkit – Extended Abstract

Humanoid soccer competition Kid-Size League, Robocup 2020 Bordeaux

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1 Previous participation

2019 (Russia Open): This was our first competition in RoboCup Humanoid KidSize league. We had a lot of problems because of poorly understood the Rhoban team platform, but we managed to win this tournament.

2019 (German Open): We had a lot of problems with GameController due to lack of experience. Localization during the game was not good. This means our robot couldn't play whole period autonomously and we was needed to do a lot of pickups. Also we had problems with mechanics. All our robots was a little difference in build and we set up each motions for each robot. Moreover we had 2 broken servos in the head. We took third place.

2019 (Sydney): Our first time in world competition was unsuccessful, but we got invaluable experience. We rebuilt mechanics of the robot before the competition and didn't manage to set up and test everything in time. Our distance measurement and motions worked very bad.

2019 (Asia-Pacific): We managed to prepare 5 robots before first game and won this tournament. During competitions we found out bug with falling, which caused breaking shoulder roll servos. Moreover we think, that we penalized localisation consistency too soft. Sometimes robot was sure, that he understood its position but it was incorrect.

2 Problems

We highlight several major problems:

- All robots should have the same mechanics.
- We need to improve our localization.
- Our stand up is quite slow.
- Robots should play during whole period without pickups.
- We need to strengthen weak robot connections.

3 Plans and Results

3.1 Mechanics

Now we implemented almost all mechanical features, but it did not tested properly. All mechanics will be ready and tested until Robocup Bordeaux.

1. We design all possible parts from carbon. It allows to reduce the weight of robot with saving durability. Also carbon details faster to produce.
2. Robot limbs was reworked. Previously each limb was connected only with servomotor axis. Now we use needle bearings. With this improvement we solve several issues. First of all, broken head and arms servos, that was really big problem. Secondly, we reduce legs backlash.
3. Battery connectors firmly fixed. This allows faster and more safe battery swap.
4. We started to use spring washer instead of glue. This extends screws lifetime.
5. We designed new springy arms. Now robot can take the ball with arms. Also it makes the fall softer.

3.2 Localization

We introduced a new type of observation to particle filter using the detection of field marking white lines features. Comparing to the goal post observation, the «L»-shaped white lines corner observation has an embedded information not only about the distance from which it was observed, but also about the orientation of the robot required to be for exactly this visual appearance of line corner feature. The «T» and «X»-shaped line corners of the field marking gives two and four observations in one detection accordingly, leading for more information to be used by the particle filter improving its performance.

We have expanded space for new particle generation. Now robot can localize itself outside the main field markup.

3.3 Active Falling

We designed falling motion in way to get more comfortable pose for starting stand up motion. Home tests show that using this we cut down time of inactive because of falling on 30 percent when it falls forward and on 65 percent when it falls backward. We plan to do it omni-directional to improve side falling and standing up speed.

3.4 Dribbling

Now we developed quite simple dribbling algorithm. Robot approaches the ball and instead of kick goes to the opponent goal controlling ball using lateral step. We faced several problems:

- Robot needs to look at ball too often.
- We need much more complicated solver between kick and dribbling.
- When robot walks fast - ball rolls far and unpredictable.

We plan to solve all enumerated problems before RoboCup 2020.