Starkit – Extended Abstract
Humanoid Soccer KidSize, RoboCup 2022 Bangkok

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Abstract. The experience of Starkit team planning to participate RoboCup 2022
Bangkok is summarized as well as problems and plans are discussed.

Keywords: RoboCup, Humanoid League, Starkit.

1 Previous Participation

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

2019 (German Open): We had a lot of problem with GameController because of
lack experience. Localization during the game was not good. This mean our robot
could not play whole period autonomously and we were needed to do a lot of pickups.
Also, we had problems with mechanics. All our robots were a little difference in
build, and we set up each motion 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 localization
consistency too soft. Sometimes robot was sure, that he understood its position, but it
was incorrect.

2021 (Worldwide): We learned a lot to play soccer game in Webots. We took first
place and became world champions. On these competitions we firstly introduced ro-
bots with stereo vision but in virtual environment and we plan to introduce it in real
life on RoboCup 2022 Bangkok if it will be possible due to COVID situation.

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

Mechanics. Now we implemented almost all mechanical features, but it did not tested properly. All mechanics will be ready and tested until RoboCup Bangkok.
1. We design all possible part 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 servo-motor 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 allow 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 falling softer.

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.

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

Stereo Vision. We have developed a stereo vision for robots and are planning to test it live on a real field of the RoboCup 2022 Bangkok competition.