Starkit Team – Pre-Qualification Document and Team Research Report

Standard Platform League, Robocup 2020 Bordeaux

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Abstract. This document contains general information about the *Starkit* team that plays in RoboCup Standard Platform League. Since the team is pre-qualified for RoboCup 2020 Bordeaux, in addition to information about the team, information on the use of the code, a research report, and a link to the code release are presented. Features such as potential to play competitive games, contribution to league, and diversity are also mentioned.

Keywords: Robocup, Standard Platform League, Starkit Team, Moscow Institute of Physics and Technology.

1 Team Information

The Starkit team [1] was organized in the autumn of 2018 in the Moscow institute of physics and technology (MIPT), Russia. Founder of the team is an honorary graduate of MIPT – Azer Babaev.

We have two teams – Humanoid League (HL) team and Standard Platform League (SPL) team.

Both teams basically consist of students that have to learn a lot of new specific information to participate in the Robocup competition since it is a new field of research in our institution. Our external goal is to participate and preferably to win RoboCup competitions. Our internal goal (inside MIPT) is to obtain knowledge in humanoid robotics and artificial intelligence and to teach new generations of students in this field.

1.1 Team Name

Starkit.

1.2 Team Leaders

Team founder – Azer Babaev.
Team leader – Sergey Semendyaev.
Team captains – Aleksey Kozinov, Vladislav Molodtsov.

1.3 Team Members

Roman Gorb, Dmitry Karpov, Yaroslav Kulakov, Nikita Mikhailov, Konstantin Morozov.

1.4 University Affiliation

Moscow institute of physics and technology, laboratory of wave processes and control systems.

1.5 Potential

Potential to play competitive games at RoboCup 2020 is demonstrated by previous results. The Starkit team took 1st place in the Challenge Shield competition at RoboCup 2019 Sydney. Also the team has good financial support from the founder, therefore, it gives us the ability to take an active part in competitions, including the RoboCup German Open, and to maintain quite a lot of robots (now we have 11 NAO V6).

1.6 Contributions

We have an active position in RoboCup events.

The team leader, Sergey Semendyaev, is a member of the RoboCup 2020 organizing committee in the Humanoid League [2].

During 2019, our team as a whole (in the HL and SPL leagues) won several competitions:

– Robocup Asia-Pacific 2019 – 1st place in Humanoid KidSize
– Robocup 2019 – 1st place in SPL Challenge Shield
– Robocup German Open 2019 – 3rd place in Humanoid KidSize
– Robocup Russia Open 2019 – 1st place in Humanoid KidSize

Our team was an active organizer of Robocup Asia-Pacific 2019 Moscow. We made and provided the field, gates, Wi-Fi router, and we were the TC/OC of the competitions in the Humanoid league of RCAP 2019 Moscow.

Also, we plan to organize a tournament in the Humanoid soccer league in Russia on the basis of our institute in the spring of 2020.

In general, our activity is aimed at popularizing RoboCup in Russia. We gave a lot of interviews to newspapers and magazines. Our interviews were shown on Russian television. An article in the popular Russian magazine “Popular Mechanics” was dedicated to our team and robosoccer. Also we have published an article in a scientific journal [3].

1.7 Diversity

Region – Russia.

Unique characteristics – the only team from Russia participating in SPL (and HL).

We represent the Moscow institute of physics and technology – one of the best universities in Russia.

Commitment

The Starkit team commits to participate in RoboCup 2020 in Bordeaux (France) and to provide a referee knowledgeable of the rules of the Standard Platform League.

2 Code Usage

To qualify for RoboCup 2019, we used the native software of the NAO robot from Softbank Robotics. But it was difficult for us to achieve any noticeable success in game playing, since we were newcomers. For more advanced programming, we wanted to use the B-Human framework [4] and it finally happened. Further in the text, by the framework we will mean exactly the B-Human framework.

Since the formation of the team in 2018, we have spent a year launching robots in the game. Initial attempts to do this on our own were unsuccessful, because we did not have the framework adapted at that moment for NAO V6 robots. In the spring and summer of 2019, we collaborated with the SPQR team [5], which helped us launch the framework, and since then, our efforts have been aimed at improving knowledge within the framework.

3 Team Research Report

This team research report describes our work for RoboCup 2019.
It is publicly available at –
https://github.com/robocupmipt/TeamResearchReport.

3.1 Framework Research

We started developing our own framework since the formation of the team. The framework was completely based on the official SDK. We did this until April 2019. At this point it was written: vision, which determines the position of the ball using the Haar transformation; handler of commands from the game controller; module for writing motion – using the graph of final states. But this venture failed, since the NAOqi module commands were processed for a rather long time and were often interrupted with errors. After that, it was decided to play with the framework of another team, changing it a bit.

A month was needed to check the available solutions. But even here, failure awaited us, since all available frameworks were written for NAO V5. And the new version V6 did not support the DCM module through which communication with the hardware level in the previous version of the robot took place.

The SPQR team came to the rescue. This team was our partner in the joint SPQR-Starkit team at RoboCup 2019. Further, until the end of June 2019, we together tried to launch the B-Human framework for NAO V6, while developing a strategy and a whistle detector.

3.2 Whistle Detector

One of the modules that we wanted to write, as an exercise in using the framework, is a whistle detector.

The principle of operation of the whistle detector is literally as follows. After recording the sound range, its Fourier transform is carried out, after which the frequency range from 20 Hz to 2000 Hz is selected, corresponding to the audible sound. All Fourier transform amplitudes are taken modulo. It also determines the frequency range corresponding to the whistle, at the moment from 1000 Hz to 2000 Hz. Then this range is divided into a segment of 0.5 seconds. And at the moment when at least on one segment the fraction of the Fourier transform amplitudes in the range corresponding to the whistle (taken from all amplitudes in the audible frequency range) is greater than a certain coefficient equal to 0.5, the whistle is considered detected.

In other words, to write W on the interval t, the whistle is considered detected if:

abs(fft(Wt)[Freq1:Freq2]/ abs(fft(Wt))[Sound1:Sound2]> alpha,

where Freq1 = 1000, Freq2 = 2000, Sound1 = 20, Sound2, = 2000, alpha = 0.5 and Wt is recorded for 0.5 sec.

The model is currently in debugging state.

3.3 Walking Sideways With Steps

Our efforts are also aimed at obtaining a tactical advantage through fast walking. For example, in some cases walking sideways with steps is more beneficial than standard walking. Due to the fact that when walking sideways the center of mass moves approximately in a straight line this makes walking more stable and faster.

3.4 V-REP Simulator

We are also developing in the V-REP simulator [6].

We have certain hopes for this simulator and perhaps we will try to use genetic algorithms in it for certain tasks, in particular walking.

Our team also has the urdf file of another team robot – based on the Sigmaban (Rhoban) robot. And development for NAO and Sigmaban can be conducted in parallel (see Fig. 1).

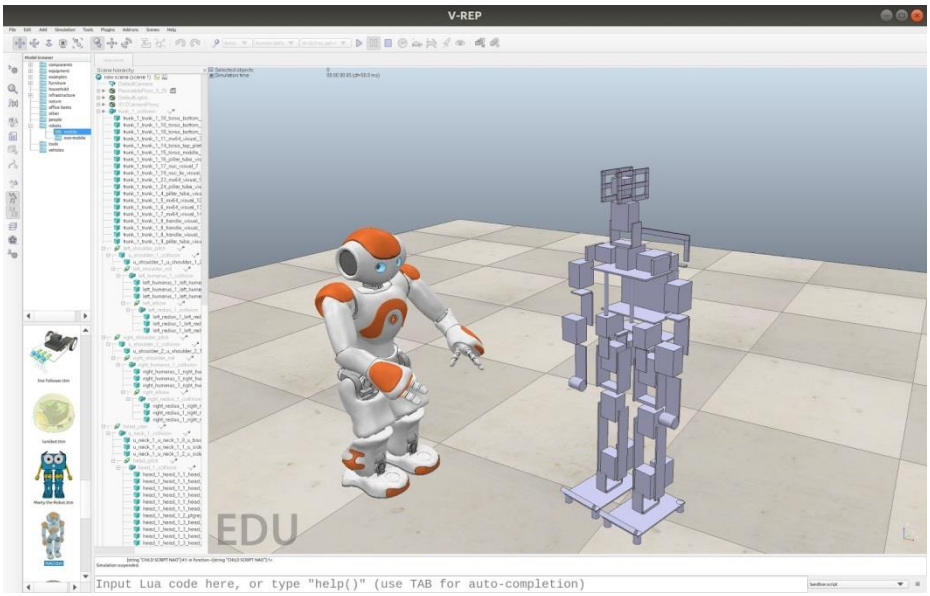

Fig. 1. Robots NAO and Sigmaban (Rhoban) in the V-REP simulator.

4 Code release

A link to a public code release –
https://github.com/robocupmipt/BHumanCodeRelease

5 Acknowledgments

The Starkit team sincerely thanks the SPQR team for their friendly help in learning the B-Human framework.

References

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