

SYCU-Legendary - Extended Abstract for 2020 Bordeaux RoboCup Humanoid Kid Size

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Abstract. This extended abstract presents the history of our preparation and participation of RoboCup with some improvements based on previous competition as well as plans for future development towards 2050 goal.

1 Introduction

The history our preparation and participation of RoboCup Competition is as follows:
2018.04(Shaoxing, China): We attended 2018 RoboCup China Open and won the champion by overcoming the vision problems that we never met before.
2018.06(Montreal, Canada): We joined 2018 RoboCup Competition and ranked the sixth place when we deeply realized that we cannot use Rhoban robot as skidedlly as we should so we decided to invite Rhoban team to train us hereafter.
2019.04(Shaoxing, China): We attended 2019 RoboCup China Open where we met ZJUDancer team who is both a strong opponent and a good friend for us. Although we won the final game after intensive fighting, we were convinced by their talent of making the robots better and better during the competition.
2019.07(Sydney, Australia): We took part in 2019 RoboCup Competition [1,2] and listed the fourth which indicated our improvement compared to the year before. But we were also aware of the prominent progress of our peer teams. We must try our best to promote the robot technology in order to play with them in the future.

2 Improvements and plans on mechanical design

Last year the front metal cover of the robot was fixed on the trunk of the robot by many screws, which brings a great trouble of dismantle it to handle the circuit boards in the chest cavity. This year we adopt Rhoban team's method that making a flexible cover with velcro for easy remove.

2.5mm-thickness piano wire is too forceless to protect the fallen robot since it would be seriously distorted after the robot fallen. This year we will use 4.0mm wire.

Last year the throw-in behavior of Rhoban robot has earned enough eye-balls so we hope our robots can do so in 2020. Obviously the hands of Rhoban robots were made from rigid circle parts which require accurate shoulder joint pitch angle for the robot

holding ball. We plan to design flexible hands for the robot so that it can clip the ball with different forces without damaging the shoulder motor.

3 Improvements and plans on electrical configuration

During 2019 game, we suffered many times of low battery capacity alarm that the robot was forced to be serviced when it is attacking. So this year we decide to replace 4000mAh battery with 6000mAh.

Camera is the most important sensor on the robot thus we carry out an investigation on it by taking 53 Point Grey camera, 90 Logitech C930e and 170 S-YUE to contrast. The robot with too narrow vision field may lose chance to challenge the ball. So we hope to change Point Grey camera to cheaper and human-eyes-like S-YUE camera with respect of 2050 goal, which will bring a lot of work on software.

4 Improvements and plans on software work

Based on practiced operation and debugging, we are making the following improvements:

The walking speed of the robot is faster. We can increase the stride length of our robot after 2019 game but the robot is often falling down. We are adjusting them to a stable state.

The self-localization precision of our robot should be improved. Our robots often give up the match during 2019 competition. It will not happen in 2020 RoboCup since we are modifying the software in order to identify more targets.

The two-level algorithm of ROI+DNN for target identification is ingenious. However, after many competitions, we realize that the robot's vision system is difficult to adapt to various field environments. Therefore we should do some work in image preprocessing to make the robot adapting new environment more easily.

In order to make the visual recognition model of the robot adapting to various lighting environment, we plan to sample the field under various light conditions so as to provide more complete sample sets for training neural networks which may resort to GPU.

References

- 1 https://submission.robocuphumanoid.org/uploads//SYCU_Legendary-tdp-5c4de7c03b326.pdf
- 2 Wu Fenghua, Li liande, Wang Chengye, Jin Xin, Wang Hao, Yang Zhehai, Yin Jingyao, and Zhang Yuping. Design and Development of Autonomous Soccer Humanoid Robot CU-legendary. Journal of Physics: Conference Series, 2019:1176(3): 266-271. 2018 International Seminar on Science and Engineering Technology, SCSET 2018-Robotics and Artificial Intelligence, March 26, 2019. (EI:20191406738791).