HERoEHS, Team Extended Abstract

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Abstract. Team HERoEHS has been upgrading ALICE, the 1.3m tall humanoid robot that has played in the last two years, to participate in the Robocup2020 humanoid adult size league. Many technical problems have been discovered in the previous games, and based on these experiences, the performances of walking algorithms, mechanical designs, vision recognition and localization have improved. We, Team HERoEHS, hope to show RoboCup participants more dynamic performances with better robots in RoboCup2020.

Keywords: ALICE, RoboCup, Adult size league, Humanoid Robot

1 Introduction

Team HERoEHS has been participating in the RoboCup humanoid adult size league since 2018. In 2018, we have built ALICE version 1, and in 2019 we upgraded to ALICE version 2. [1], [2] We are currently designing and fabricating ALICE version 3 to participate in RoboCup2020. We are studying and accumulating practical techniques for humanoid robots through RoboCup participation, that is the values we will continue to pursue. Therefore, we are currently working hard to show the Robocup paricipants ALICE version 3, a faster, more stable and smarter robot in RoboCup2020.

2 Technical Issues

2.1 Walking Algorithm

All humanoid robots of Team HERoEHS have used ZMP-based walking method. In particular, ZMP-based preview controls have been used to improve walking stability. [3] However, in a real-time situation such as soccer game, the preview control was

not effective. In order to use the preview control, it is necessary to spend some time to calculate before walking, but in many cases, the position of the soccer ball is changed so that it is not possible to respond immediately to changing the walking pattern. Therefore, we are working to make a new preview control walking method that does not cause time delay in RoboCup2020.

2.2 Mechanical Design

Until Robocup2019, adult size humanoid robots did not stand up when they fell down. However, in this RoboCup2020, adult-sized robots must play with some of teen-sized robots which are able to stand up by themselves, so we are going to make ALICE stand up too. Thus, we are trying to add some degree of freedom to her waist and attach some special devices that can absorb the falling impact.

2.3 Vision Recognition

Object recognition using deep learning has shown satisfactory results. For vision recognition, NVIDIA's Xavier as H/W and yolo v3 tiny as S/W model are used. it shows more than 15 fps performance in recognizing such as ball, goal and some specific points. Also, ZED stereo camera is used to obtain distance information. In the future, more field data will be acquired to increase the recognition probability.

2.4 Localization

The biggest weakness of Team HERoEHS so far has been that localization is poor. Until now, we have used IMU sensor data to determine the current position, but it has been difficult to deal with the data noise, so it has not been successful. Therefore, we are currently trying vision-based localization, that is receiving the current position data using various specific points on the soccer field.

3 Conclusion

The robot ALICE is being upgraded to a superior robot by solving many technical problems uncovered by participating in RoboCup. As such, the continued improvement in performance with the continued participation in the RoboCup will be a simple and clear way to realize that the robots play against WorldCup winners in 2050.

References

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