Barelang FC - Extended Abstract

Humanoid Kid-Size League RoboCup 2024 Eindhoven

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Abstract. This paper describes the Barelang FC team for participating in the RoboCup 2024 Eindhoven. The paper discusses some of the problems experienced in the previous year's competition and the recent development of the Barelang FC team.

Keywords: humanoid robot · bipedal robot · robot soccer · RoboCup humanoid.

1 Introduction

The Barelang FC team has been actively participating in the RoboCup competition in the kid-size humanoid league since 2017. The team achieved third place in the last participation at RoboCup 2023 Bordeaux. However, several obstacles and challenges arose during the match, prompting the need to make further improvements and development to enhance the robot's performance.

This extended abstract aims to discuss the problems faced during the match at RoboCup 2023, as well as outline the development efforts that have been made and will be made by the Barelang FC team.

2 Major Problems in Previous Competition

In the RoboCup 2023 competition, several problems affected the overall performance of the Barelang FC team. First, there was the problem of the robot's walking speed. The Barelang FC team had a low walking speed compared to the other two finalists. The team could only reach a maximum speed of 0.31 m/s, while the CIT Brains team, as the second winner, reached 0.33 m/s, and the Rhoban team, as the first winner, had a walking speed of 0.35 m/s. This relatively slow speed is the main obstacle for the robot in competing for the ball on the field.

In addition to speed-related issues, the vision aspect of the robot is also a concern in the RoboCup 2023 competition. The field of view coverage of the camera on the Barelang FC robot still requires improvement to see and recognize

objects in the entire field area effectively. The measurement results show that the object detection coverage of the robot goalkeeper only reaches 61.13% of the entire field area. Although the object detection distance by the Barelang FC robot is quite long, almost reaching 9 m, the obstacle mainly arises from the limited object detection on the robot's side. This constraint often causes the robot to search for the ball excessively, ultimately affecting efficiency and the number of goals that can be scored during a match.

In addition to the previous constraints, the Barelang FC team was also faced with the problem of the unavailability of obstacle avoidance algorithms. The impact can be seen when the robot often collides with teammates and opponents on the field while trying to chase the ball.

3 Future Improvement

Based on some of the problems faced in the RoboCup 2023 competition, the Barelang FC team made some improvements and upgrades for the future. To increase the robot's walking speed, the Barelang FC team has manually tuned the walking gait parameters. The results obtained at this time show that the robot can walk with a maximum speed of 0.34 m/s. There is an increase in performance of 9.67% compared to the previous year's baseline.

In addition to tuning the parameters of the walking gait, we are also currently developing a pressure sensor on the sole of the robot's foot that adopts the hardware proposed by [1]. This sensor will be integrated with the walking gait to make the robot more stable and efficient in moving.

As for the object detection coverage area, we upgraded the camera sensor from the C930e webcam to the See3CAM_24CUG. In addition, we upgraded the lens to a wider lens so that the coverage area of object detection can be expanded. Moreover, we also added classes to the object detector. Previously, we only detected balls, goal landmarks, and field landmarks. Now, we are adding robot detection to the object detector. The purpose is to recognize opponent robots or teammates on the field.

On the other hand, we added a monocular depth estimation algorithm using Midas [2]. Midas will be integrated with the object detector, especially the detection of the opponent robot. So the robot can estimate the distance to the opponent robot and can make smarter decisions to avoid collisions with opponent robots or robots in their team.

References

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