# Barelang FC - Extended Abstract Humanoid Kid-Size League RoboCup 2024 - Salvador, Brazil

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Abstract. This paper describes the Barelang FC team's preparation for RoboCup 2025 in Salvador, Brazil. It discusses the key problems faced in the 2024 competition—such as vision perception, durability issues, and labeling efforts—and outlines recent developments undertaken to address these concerns.

Keywords: humanoid robot  $\cdot$  bipedal robot  $\cdot$  robot soccer  $\cdot$  RoboCup humanoid.

## 1 Introduction

The Barelang FC team is a research group specializing in humanoid robotics at Politeknik Negeri Batam, Indonesia and regularly participates in international competitions to evaluate and benchmark its research developments.

This paper discusses the lessons learned and the significant challenges encountered during the competition. In addition, it outlines the team's development plans for future participation in RoboCup 2025, which will be held in Salvador, Brazil.

# 2 Lessons Learned and Major Problems

During the RoboCup 2024, the Barelang FC team faced several significant challenges. The first issue involved vision perception. Specifically, the robots struggled to distinguish between the white ball on the field and the white shoes worn by the referees. In addition, the robots were unable to consistently detect whether the ball was on the field or outside its boundaries, sometimes causing them to navigate in unintended directions.

The second issue concerned the durability of the robots. In multiple matches, Barelang FC's robots experienced hard collisions with opposing robots. These 2 E.R. Jamzuri et al.

impacts occasionally resulted in over-current in some actuators, necessitating the removal of the robot from the field to prevent further damage.

A third problem emerged outside the field. The variety of balls used in the 2024 RoboCup proved challenging for the robots to recognize. As a result, team members had to collect additional data and manually label it during the competition. This extra workload distracted the limited team members from other crucial tasks and reduced overall focus.

### 3 Future Improvements

Based on the challenges encountered in the 2024 RoboCup competition, the team has devised several development plans for the upcoming 2025 event. The first area of focus is the robot's visual perception. In RoboCup 2024, the robot could detect objects and landmarks on the field but lacked advanced post-processing to determine whether these objects were inside or outside the field boundaries. Previously, YOLOv7 running on a Jetson Xavier NX was used for object detection. Going forward, we plan to upgrade to YOLOv8, which offers both detection and segmentation capabilities. Specifically, detection will target balls, landmarks, and other relevant objects, while segmentation will be used to identify field boundaries. This segmentation information will help filter object positions, ensuring accurate identification of whether objects are located within or beyond the field limits. Additionally, we are considering replacing the Jetson Xavier NX with the Raxda ROCK 5B+ as the main controller, due to cost and feature considerations. We are currently porting the software and conducting benchmarks to evaluate the Raxda ROCK 5B+ for compatibility and performance.

To address the impact forces the robots sustain during matches, we plan to adopt a soft bumper design inspired by the KURA Team. These soft bumpers are designed to reduce the stress on actuators in the pelvis, neck, and arms when the robot falls. Furthermore, we adjust the positioning of the robot arm during locomotion to minimize the probability of severe joint impacts.

Lastly, we seek to improve the efficiency of time in robot calibration and environmental adjustments during matches. One key objective is to employ promptbased automatic labeling leveraging the Segment Anything Model (SAM) and Grounding DINO [1], [2]. The development of this tool is expected to reduce or eliminate the need for manual labeling, thus allowing team members to maintain focus on other critical match-related tasks.

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