Humanoid Robot Soccer

Proposal Tugas Akhir

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2025

Pernyataan Keaslian Tugas Akhir

Saya yang bertandatangan di bawah ini menyatakan bahwa isi sebagian maupun keseluruhan Tugas Akhir saya yang berjudul: "Humanoid Robot Soccer" adalah **hasil karya sendiri, diselesaikan tanpa menggunakan bahan-bahan yang tidak diizinkan**, dan **bukan merupakan karya pihak lain yang saya akui sebagai karya sendiri**. Semua referensi yang dikutip atau dirujuk telah ditulis secara lengkap pada daftar pustaka. Apabila ternyata pernyataan saya ini tidak benar, saya bersedia menerima sanksi sesuai peraturan yang berlaku.

Batam, 30 Juni 2025

Choirul Prayoga
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Batam, 30 Juni 2025

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Lembar Pengesahan

Tugas Akhir disusun untuk memenuhi salah satu syarat memperoleh gelar
Sarjana Terapan Teknik (S.Tr.T)
Di
Politeknik Negeri Batam

Disusun oleh:
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Dani Muti Aziz (4212201010)
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Tanggal Seminar:

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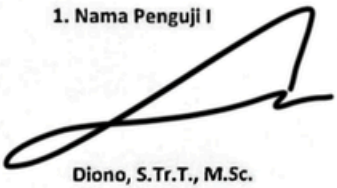

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Barelang FC - Extended Abstract

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 · bipedal robot · robot soccer · 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

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 prompt-based 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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RoboCup EINDHOVEN 2024

17 - 21 July

CERTIFICATE OF PARTICIPATION

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Co-chair, Local Organizing Committee

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CERTIFICATE OF AWARD

RoboCup Humanoid League
KidSize Soccer Competition
Third Place

Barelang FC

Politeknik Negeri Batam

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CERTIFICATE OF AWARD

RoboCup Humanoid League
KidSize Technical Challenge
Third Place

Barelang FC

Politeknik Negeri Batam

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RoboCup
L'UNIVERSITÉ DE BORDEAUX PRÉSENTE
ROBOCUP23
BORDEAUX, NOUVELLE-AQUITAINE, FRANCE
CERTIFICATE OF PARTICIPATION
Bordeaux, France
July 4 - 10, 2023
Yohanes Hasintongan Manullang
Politeknik Negeri Batam
RoboCupSoccer - Humanoid - KidSize League
Claude Sammut
President of RoboCup Federation
Dominique Duhaut
General Co-Chair of RoboCup 2023
Olivier Ly
General Co-Chair of RoboCup 2023

RoboCup

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ROBOCUP23
BORDEAUX, NOUVELLE-AQUITAINE, FRANCE

CERTIFICATE OF PARTICIPATION

Bordeaux, France
July 4 – 10, 2023

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Politeknik Negeri Batam

RoboCupSoccer - Humanoid - KidSize League

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SOCCER
RoboCup Humanoid League

KidSize Soccer Competition

Third Place

Barelang FC
Politeknik Negeri Batam

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RoboCup23
BORDEAUX, NOUVELLE-AQUITAINE, FRANCE

AWARD CERTIFICATE

SOCCER
RoboCup Humanoid League

KidSize Drop-In Challenge

Third Place

Barelang FC
Politeknik Negeri Batam

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Olivier Ly
General Co-Chair of RoboCup 2023

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