

WF Wolves – Humanoid Soccer - Small Size Team Description Paper for RoboCup 2026

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Abstract. In this team description paper the team WF Wolves, their robots and the current research status are introduced. A short overview of problems and lessons learned is given. Further major changes and the current state of implementation is portrayed. Hereby WF Wolves apply for participation at the RoboCup 2026 for Team Competition in Humanoid Soccer League in Incheon, Republic of Korea.

1 Introduction

The team WF Wolves is from Wolfenbuettel, Germany and is supported by the Ostfalia University of Applied Sciences. We are a interdisciplinary student working group, where Bachelor, Master and Ph.D. students work together from different disciplines e.g. Computer Science, Electrical Engineering and Mechanical Engineering. Since 2014 we are working with our adapted version of the Nimbro-OP based platform [1] successfully.

In this paper we want to give an overview of our challenges in RoboCup and how we are trying to overcome them. Thereby, we intend to participate at the RoboCup 2026 for Humanoid Soccer League, Small Size.

2 Lessons Learned and Problems

In our last competition, 2025 in Salvador - Brazil, we came to the conclusion that our current open loop walking engine is not sufficient to compete with the newly upcoming commercially available robot platforms. While we improved its stability by adding additional control algorithms, the precision of our positioning is still a problem for our playing behaviour, resulting on a high percentage of missed plays.

For the last competition, we replaced the knee actuators of one of our robots with XH540-W150¹, for the purpose of improving backlash and speed. Comparing the robots performance to the other ones, using MX106² for the knee,

¹ <https://emanual.robotis.com/docs/en/dxl/x/xh540-w150/>

² <https://emanual.robotis.com/docs/en/dxl/mx/mx-106-2/>

the robot needed less maintenance and required only one set of X540 actuators for the whole competition. The backlash reduction was significant, but the benefits were smaller than expected for the robots walking, positioning and animations. However, this change resulted in new problems regarding our approach for standup and kick behaviour. We experienced overload issues and therefore could not execute animations with high dynamic loads reliable.

We are still pleased with our switch to the NVIDIA Jetson Orin³ in the last two years. While the reduction in processing units reduced the overall complexity of our system, we are now struggling with external peripherals. Currently most of peripheral connections are based on USB, which turned out to be quite unreliable if not fixed permanently together. In addition, we improved mechanical robustness and reduced parts complexity in arms and legs, allowing us to maintain four playing robots against Booster K1 fielded by THMOS, while only having 5 teammates on site.

3 Major Changes and Status of Implementation

Due to personnel changes, we had to discontinue our development of a new CPG-based walking engine. While our old open loop walking engine is robust, it lacks the precision to move the robot safely in proximity to obstacles or the ball. To compensate for this, we are in the process of developing and training a reinforcement learning model, based on Mujoco Playground[2].

In addition to changes regarding our mechanical hardware we are currently developing a radio based emergency stop. This system allows the robot's actuator power to be disconnected from the battery via the built-in e-stop or remotely, without depending on a Wi-Fi or game controller connection. With this we want to keep up with a possible increase of safety requirements due to higher capable robot platforms.

Due to the changes in robot platforms across the league and the ongoing problems with high-reduction gear actuators, we are replacing our current actuators with brushless DC (BLDC) motors.

Consequently our current focus is the development of a new humanoid robot platform based on actuators with planetary reduction gears.

References

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³ <https://www.nvidia.com/de-de/autonomous-machines/embedded-systems/jetson-orin/>