WF Wolves – Humanoid KidSize Team Description Paper for RoboCup 2025

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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 learned lessons is given. Further major changes and the current state of implementation is portrayed. Hereby WF Wolves apply for participation at the RoboCup 2025 for **Team Competition** in Salvador, Brazil.

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. Due to close connections with Hamburg Bit-Bots (HBB) we participated as a joint Team in 2018 & 2019 to evaluate different software approaches on a similar hardware.
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 2025 for Humanoid League, KidSize.

2 Lessons Learned and Problems

While suffering from a very unstable and wobbly playing field during group stage in Eindhoven, some of our existing problems became more apparent. Further, our walking algorithm, while utilizing some controllers, as well as animations (e.g. get-up and kicks) are static and therefore inconsistent. Playing against the Hamburg Bit-Bots (HBB) on a different field resulted in a different experience, with robots walking across the field and standing up confidently. However, the potential to optimize robustness was demonstrated once again. Still, we were quite pleased with the results. Aside from stability issues our migration to the new NVIDIA Jetson Orin [1] was a great choice and our overall robustness increased greatly. Complexity was reduced due to the change to a single processing

[1] https://www.nvidia.com/de-de/autonomous-machines/embedded-systems/jetson-orin/

unit, and our vision pipeline now sufficiently relies on YOLOv7 [3] for ball, goal and robot detection, taking full advantages of the Orin's capabilities. In addition, our mechanical robustness increased as well, allowing us to maintain three robots a game without mechanical issues or having a device restarting after a collision or fall, which increased the robot's presence on the playing field a lot. Having a designated person as reliable support for food also increased our productivity and team mentality as well.

3 Major Changes and Status of Implementation

Although we had the chance to test our new CPG walking engine on a field at the RoboCup, it still lacks of robustness, even more than the old approach. Therefore, we decided to stick to the old approach during the competition. We plan to improve it further.
Further, in our old lab, which we had to move in 2019, we lacked of a playing field for integration testing, which had a big impact on our quality assurance. However, we were able to move to new premises having much more open space for people to work and a separate room for a slightly scaled down version of the field again, which is a huge benefit for us. There are plans to further increase robustness and utilize the capability of having multiple players on the field allowing for a more complex game plan, than multiple robots running in front of the ball and interfering with each other. Additionally, new animation recording and control systems are being developed to simplifyi the process of animation recording, but especially for animation playback, to ensure greater flexibility when enhancing or replacing playback algorithms to increase flexibility and stability.

Hereby, we embrace our long transition from our old monolithic walking and animation engine to be split further into the ROS architecture [2]. We also managed to prototype additional field features into our now stable YOLOv7 vision pipeline, however our localization approach is still a work in progress and fragile. However, through testing on the new field, cease of the Sim2Real gap becomes apparent, and we hope to accelerate our development process.
Furthermore, we strive to embrace mechanical improvements to a single robot again. During competition, we noticed certain stressed servos became unreliable due to lower voltages or heat, especially the knee joint. Therefore, we want to test several new servos for better durability, in particular the XH540-W150[2] and XH540-W270[3], which we will try to evaluate and use during the competition.
Currently, we have four similar robots and use an additional, slightly modified robot for mechanical prototyping.

References

1. University of Bonn, Computer Science VI, Autonomous Intelligent Systems. https://www.nimbro.net/OP/

[2] https://emanual.robotis.com/docs/en/dxl/x/xh540-w150/
[3] https://emanual.robotis.com/docs/en/dxl/x/xh540-w270/

2. Bestmann, M.: Towards Using ROS in the RoboCup Humanoid Soccer League. . Introduction p. 38 (2017)
3. Wang, C.Y., Bochkovskiy, A., Liao, H.Y.M.: YOLOv7: Trainable bag-of-freebies sets new state-of-the-art for real-time object detectors (Jul 2022)