The Sweaty 2020 RoboCup Humanoid Extended Abstract*

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1 Introduction

Advances in the development of the adult size humanoid robot Sweaty are described in previous team description papers [3], [2], [4], [1], [5]. 2019 was the first year in which the Sweaty team participated with two robots in the RoboCup humanoid adult size competition. The possibility to pass the ball to a team mate drastically increases momentum of the game and to some degree allows for compensating inferior low level skills. An elaborate team strategy will be essential to stay competitive in future competitions. Soccer is a rather fast moving sport, but most teams struggle with a continuously changing game situation. While Sweaty is one of the fastest walking robots in the humanoid league, it still requires considerable time to position itself appropriately for kicking behind the ball. In order to exploit the full potential of Sweaty's low level skills, a tight coupling between the decision and motion modules is required. Furthermore, more flexible transitions between different low level skills are needed for quick reaction times.

With the third generation of the Sweaty robot, Sweaty III, significant improvements in the mechanical design have lead to better maintainability of the robot in general, better exchangability of broken parts, simplifications in the manifacturing process as well as an overall more rigid and durable construction. Still, Sweaty II was suffering from a broken hip element and one of Sweaty III's feet disconnected from the ankle after heavy contact with an opponent.

2 Vision

As mentioned in [5], we still intend to improve the detection and modelling of other robots on the field. The detection of team markers and player numbers remains to be implemented. The newly installed calibration setup for the binocular vision system did not result in the desired performance and accuracy. Furthermore, calibration effort, the management of the calibration files as well as the

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sensibility of the binocular camera system in general pose serious drawbacks with respect to its maintainablility. To overcome this issues, we decided to use the ready-to-buy binocular ZED Mini[1] camera system. A further benefit of the ZED Mini camera system is the automatic synchronization of the camera images and the IMU measurements. The vision system is already working with the new ZED Mini camera.

3 Software

The introduction of the ROS middleware has dramatically improved maintainablility of the code base as well as the development and debugging process. However, ROS was mainly used to interconnect the major components: vision, decision and motion. There is still a lot of information within the individual components that is interesting to know, but not available in the log files. As a consequence, the major components still need to be debugged as an unit. Similarly, the development of new modules is challenging, as they have to be integrated into their respective component for testing with live log data. While the code-generated Matlab/Simulink programm for controlling Sweatys' actuators provided excellent real-time performance, even slight changes to the system require significant compilation time, slowing down the development process.

For this reasons, it was decided to further separate the major components into multiple nodes dedicated to specific tasks and to increase the use of the ROS ecosystem. To assure real-time performance, we are currently porting the Matlab/Simulink programm to C++ using ROS2.

4 Hardware

We are still working on incorporating the additional position and speed sensors of the joints to improve their compliance, as described in [5]. The required hardware is installed on Sweaty III and the corresponding motor controller software is currently under testing. It is not planned to repeat this upgrade for Sweaty II.

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[1] `https://www.stereolabs.com/zed-mini/`

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