Humanoid TeenSize Open Platform NimbRo-OP

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Abstract. In recent years, the introduction of affordable platforms in the KidSize class of the Humanoid League has had a positive impact on the performance of soccer robots. The lack of readily available larger robots, however, severely affects the number of participants in Teen- and AdultSize and consequently the progress of research that focuses on the challenges arising with robots of larger weight and size. This paper presents the first hardware release of a low cost Humanoid TeenSize open platform for research, the first software release, and the current state of ROS-based software development. The NimbRo-OP robot was designed to be easily manufactured, assembled, repaired, and modified. It is equipped with a wide-angle camera, ample computing power, and enough torque to enable full-body motions, such as dynamic bipedal locomotion, kicking, and getting up.

1 Introduction

Low-cost and easy to maintain standardized hardware platforms, such as the DARwIn-OP [1], have had a positive impact on the performance of teams in the KidSize class of the RoboCup Humanoid League. They lower the barrier for new teams to enter the league and make maintaining a soccer team with the required number of players easier. Out-of-the-box capabilities like walking and kicking allow the research groups to focus on higher-level perceptual or behavioral skills, which increases the quality of the games and, hence, the attractiveness of RoboCup for visitors and media. In the competition classes with larger robots, teams so far are forced to participate with self-constructed robots. Naturally, this severely affects the number of participants willing to compete, and, in consequence, the progress of the research that attempts to solve the challenges arising with robots of larger weight and size.

Inspired by the success of DARwIn-OP, we developed a first prototype of a TeenSize humanoid robot and released it as an open platform. Our NimbRo-OP bipedal prototype is easy to manufacture, assemble, maintain, and modify. The prototype can be reproduced at low cost from commonly available materials and standard electronic components. Moreover, the robot is equipped with configurable actuators, sufficient sensors, and enough computational power to ensure a considerable range of operation: from image processing, over action planning, to the generation and control of dynamic full-body motions. These features and the