Project for Promoting RoboCup
Humanoid TeenSize Open Platform

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1. Motivation

- The Humanoid League pursues the original vision of RoboCup, which is to be able to win with humanoid robots against the FIFA world champion by 2050

- Competitions are held in three size classes:
  – KidSize (<60 cm)
  – TeenSize (90–120 cm)
  – AdultSize (>130 cm)
- In KidSize class, 3 vs. 3 soccer games are played and many teams participate
- In AdultSize class, fewer teams participate in 1 vs. 1 Dribble&Kick competitions, because the AdultSize robots are more expensive and cannot survive falls
- The TeenSize class started 2 vs. 2 soccer games in 2010, but the number or participating teams is not sufficient yet: only five teams are qualified for RoboCup 2012
- Despite the small number of participating teams, the capabilities of some TeenSize robots are good
- One reason for the small number of TeenSize teams might be the lack of an affordable robot platform

3. Hardware Concept

- Height of about 95 cm and total weight of about 7 kg
- 20 joints, driven by Robotis Dynamixel actuators:
  – six per leg (MX-106)
  – thee per arm (MX-64)
  – two in the neck (MX-64)
- Main computer ZBOX Nano (1.6 GHz dual-core AMD Fusion processor with 4 GB RAM, SSD, WLAN, USB 3.0, and HDMI)
- Robotis CM-730 subcontroller with acceleration and turning rate sensors
- Logitech C905 camera(s) with wide-angle lens
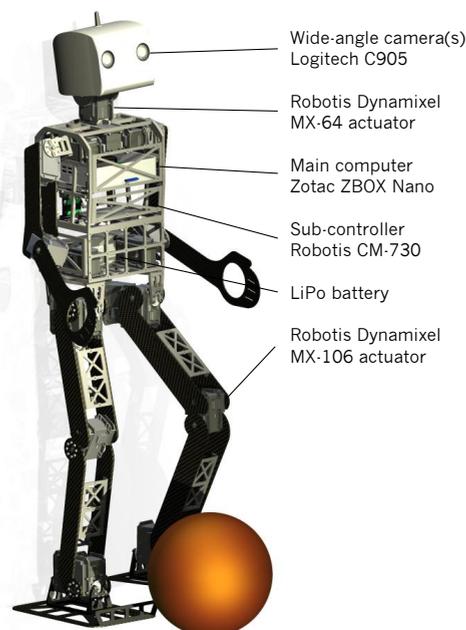- Lithium-polymer battery (14.8 V, 3.6 Ah)

5. Software Concept

- Robot software will be based on the ROS middleware
- With help of community, develop modules for
  – visual perception of the game situation
  – robot state estimation
  – inverse kinematics
  – omnidirectional walking
  – motion generation
  – basic soccer skills
  – robot communication
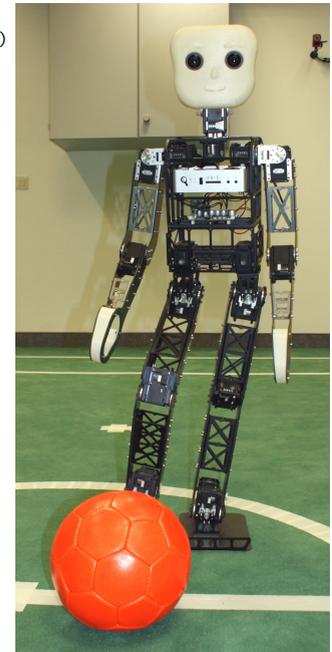 – game control by the referee box

2. Objective

- To promote the Humanoid League TeenSize class, team NimbRo wants to share its expertise with the community by developing and releasing an affordable TeenSize open platform
- This includes robot hardware and software suitable for playing RoboCup soccer games
- Robot hard- and software will be modular, such that other research groups can easily assemble the robot, operate it, repair it, and modify it to their needs
- Developed hard- and software will be documented and published as open source

4. Constructed Robot

Wide-angle camera(s) Logitech C905

Robotis Dynamixel MX-64 actuator

Main computer Zotac ZBOX Nano

Sub-controller Robotis CM-730

LiPo battery

Robotis Dynamixel MX-106 actuator

CAD drawing 04/2012   Robot image

6. Results

- Construction of robot skeleton and head finished
- First robot prototype assembled
- Robot demonstration during RoboCup 2012 on TeenSize field and at Robotis booth
- List of eight interested teams collected already in 2011
- Drawings will be released shortly after RoboCup 2012
- Robot construction kit will be available from University of Bonn and Robotis
- Project will be continued with support of German Research Foundation (DFG) in cooperation with igus® GmbH

Acknowledgements