BreDoBrothers

Robot Questionnaire for RoboCup 2006

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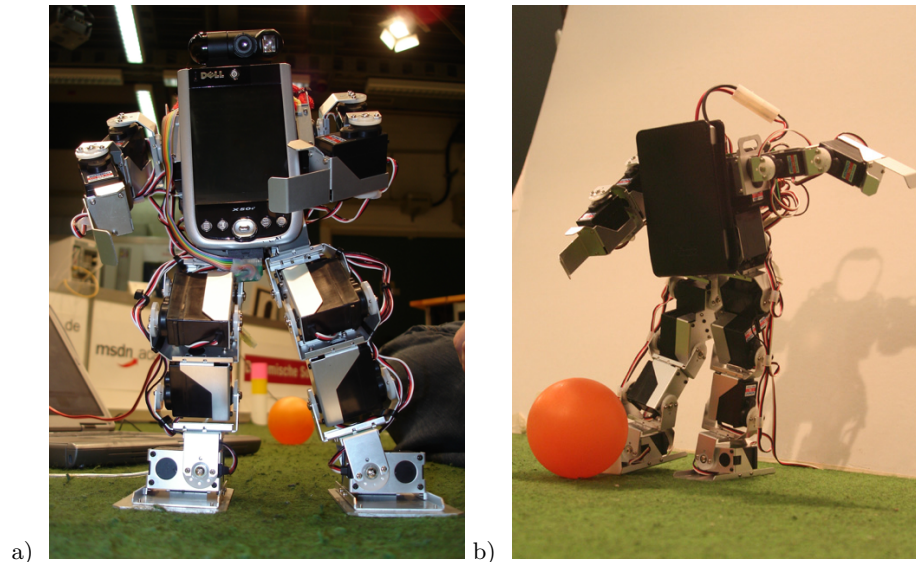
1 The Robots

Fig. 1. The two Kondo KHR-1 based robots from a) Dortmund and b) Bremen (not having a camera and a mirror yet).

The team BreDoBrothers uses the commercially available KHR-1 robot kit from Kondo as a basis. Due to some shortcomings of the original controller board,

we designed a new controller using an Atmel ATMega128 controller. For all on-board computations, we equipped the robot with standard PDAs from Dell and Fujitsu Siemens respectively. Figure 1 shows two of our robots equipped with PDAs.

Our robots have a weight of 1450g and a height of 31,5cm (will be a increased after mounting the omnidirectional vision system). The robots currently walk with a maximum speed of 5cm/s and have 17 degrees of freedom: five for each leg, three for each arm and a panning head[4].

2   Actuators

Each of our robots is equipped with 16 or 17 Kondo KRS-784ICS digital servos. The power for the servos and the controller board is supplied by a Li-Poly battery pack with 11.1V. Figure 2 shows images of a servo and the battery.
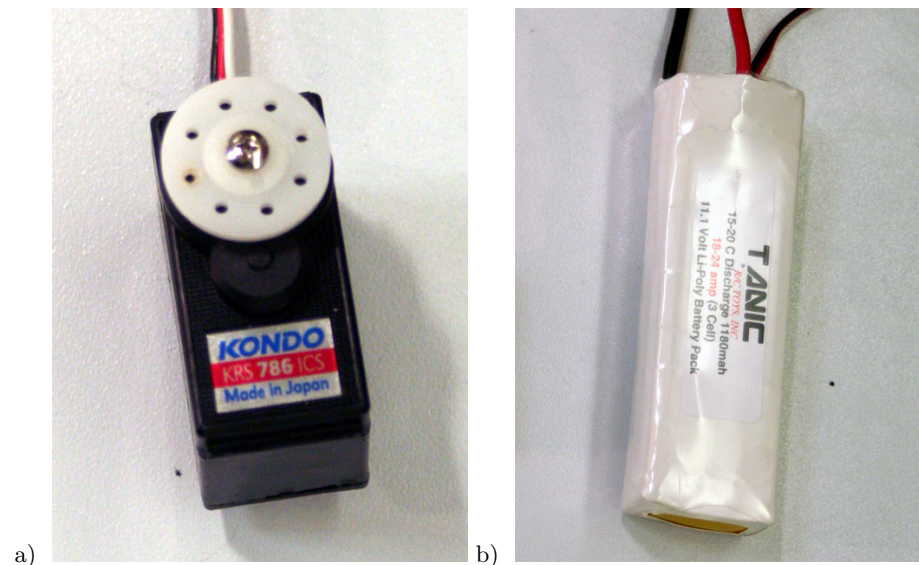

Fig. 2. a) The servo motor which is used for all joints. b) One of the Li-Poly batteries.

The servos have the following specifications:

– Double-sided Hone, Resin Gear
– Limit: 180°
– Torque: 8.7kg/cm
– Speed: 60° in 0.17 sec

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[4] The head is useless, if no sensors are attached to it. In preparation for the omnidirectional vision system, one robot's head has already been removed.

- Voltage: 6V
- Weight 45g
- Size: 41x35x21mm

3   Sensors

By now our robots make use of a LiveView FlyCam CF 1.3M connected to the compact flash port of the PDA. The specifications of the omnivision mirror and an appropriate camera are not decided yet. Our current camera details are as follows:

- LiveView FlyCam CF 1.3M
- Approximately 10 frames/s
- Resolution of 160x120 pixels
- Conrad Electronics #117617, 105° Wide angle lens

For the measurement of accelerations of the robot, we have equipped our controller board with a three axis accelerometer with these specifications:

- FreeScale MMA7260Q 3 Axis solid state accelerometer
- Analog output, 1.5g - 6g selectable range

In addition to the accelerometer, the robots are also equipped with a Murata Gyrostar gyroscope.

4   Processing Boards

As mentioned above, we designed a controller board with an Atmel ATMega128 controller at 16 MHz to control the servos and to provide additional sensor data.

The board is shown in Fig. 3 and has the following properties:

- 4k EEProm used for saving robot calibration directly on the board.
- 24 Servo outputs with read-back capability
- 8 ADC inputs
  - Battery voltage sense
  - 2 optional PSD sensor inputs
- Switching power supply
  - Operates from a two-cell 1760mAh Lithium Polymer battery
  - $> 90\%$ efficiency, ≈ 40 minutes of walking
  - 6V/10A continuous, 15A peak current
- Two serial ports
  - Packet communication using RFC 1055 SLIP protocol
  - 1x RS232 with level shifter for direct PC connection
  - 1x TTL-RS232 for PDA connection
- I^2C Extension port
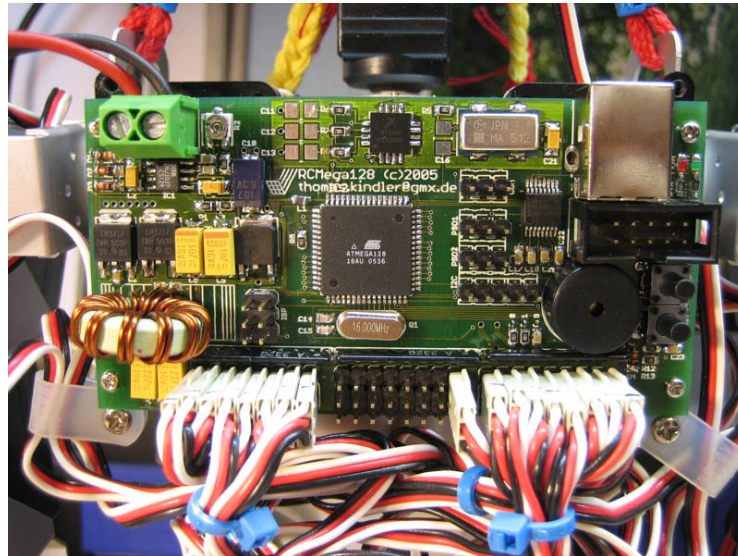- Loop-Through USB Connection for PDA
- 2 Button interface

Fig. 3. The custom controller board with sensors, switching power supply power and connectors for the servos and the PDA.

– Beeper with Nokia ringtone support

The on board calculations of the robot are done on a PDA which is connected with a serial cable to the controller board; the camera is directly connected to the PDA. Currently, our robots can run with both a Dell AximX50v and a Fujitsu Siemens PocketLoox 720 PDA. Both PDAs run the Microsoft Windows Mobile 2003SE operating system, use the wireless LAN connection for debugging and the serial connection to communicate with the controller board. The Dell AximX50v has an Intel X-Scale CPU with 620MHz and the PocketLoox 720 PDA an Intel PXA272 CPU with 520MHz. The PocketLoox is also equipped with an integrated camera.