Humanoid Soccer Robot Design by TKU Team for Humanoid League of RoboCup 2012

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A humanoid soccer robot named HIWIN MAN and designed by the TKU team with HIWIN Company to attend the humanoid league of RoboCup 2012 is described. A platform for the study of biped walking plan and balancing control is designed and implemented. First, This humanoid robot is described with 23 DOF(degrees of freedom). Second, it can obtain the information from the environment by architecture and electronic components webcam, gyro and accelerometer. Third, robot can communicate with other robots by wireless network. In order to design the robot locomotion control, a human-machine interface is implemented to study the locomotion control design of biped robot. From the practical experiments, HIWIN MAN can be a soccer robot to decide some actions to get up from a fall, find a ball, walk to an appropriate position, and kick a ball autonomously.

Table 1. Specifications of the TWNHR-VI

<table>
<tr><td colspan="4">Specifications</td><td rowspan="4">  </td></tr>
<tr><td colspan="2">Name</td><td colspan="2">HIWIN MAN</td></tr>
<tr><td colspan="2">Height</td><td colspan="2">59 cm</td></tr>
<tr><td colspan="2">Weight</td><td colspan="2">4.5 kg</td></tr>
<tr><td colspan="2">Walking Speed</td><td colspan="2">Top Speed: 30cm/sec,
Average Speed: 15cm/sec</td></tr>
<tr><td colspan="5">Mechanism System</td></tr>
<tr><td></td><td></td><td>Number of DOF</td><td>Actuator Torque (kg/cm)</td><td>Actuator Speed (sec/60°)</td></tr>
<tr><td>Head</td><td>Neck</td><td>2</td><td>16.5 (AX-12)</td><td>0.196</td></tr>
<tr><td>Trunk</td><td>Waist</td><td>3</td><td>37.7(RX-28)</td><td>0.126</td></tr>
<tr><td rowspan="3">Legs</td><td>Hip</td><td>2</td><td rowspan="3">64.4(RX-64)/ 37.7(RX-28)</td><td rowspan="3">0.188/0.126</td></tr>
<tr><td>Ankle</td><td>2</td></tr>
<tr><td>Knee</td><td>1</td></tr>
<tr><td rowspan="3">Arms</td><td>Shoulder</td><td>2</td><td rowspan="3">18(AX-18)/ 37.7(RX-28)</td><td rowspan="3">0.196/0.126</td></tr>
<tr><td>Elbow</td><td>1</td></tr>
<tr><td>Wrist</td><td>1</td></tr>
<tr><td colspan="2">Total</td><td colspan="3">23</td></tr>
<tr><td colspan="5">Electronic System</td></tr>
<tr><td>Part</td><td colspan="2">Device</td><td colspan="2">Specification</td></tr>
<tr><td rowspan="3">Sensors</td><td colspan="2">Webcam</td><td>Microsoft LifeCam Cinema</td><td>320x240 resolution</td></tr>
<tr><td colspan="2">Accelerometer</td><td>RM-G144</td><td>3-axis</td></tr>
<tr><td colspan="2">Gyro</td><td>ITG-3200</td><td>300 degree/sec</td></tr>
<tr><td rowspan="2">Processor</td><td colspan="2">TKICBoard</td><td>Intel Pineview-D510 Processors</td><td>45nm process</td></tr>
<tr><td colspan="2">FPGA</td><td>T3C40-V6</td><td>EP3C40F484C8</td></tr>
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