Web address: **http://www.sciencedaily.com/releases/2007/07/070713233431.htm**

ScienceDaily

Your source for the latest research news

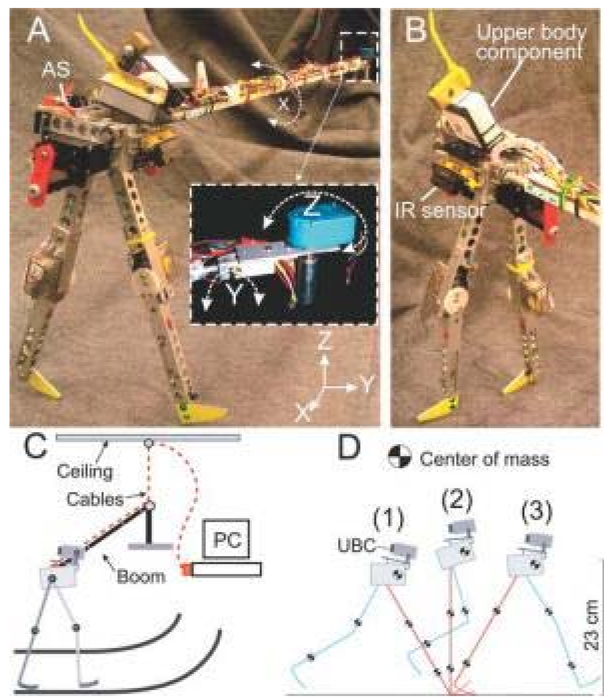
Source: Public Library of Science
Date: July 16, 2007

More on: Artificial Intelligence, Robotics, Perception, Robotics Research, Vehicles, Language Acquisition

A Walking Robot Goes Mountaineering

Science Daily — The human gait is a marvel of coordination. All aspects of movement control -- from the angle of the knee joints to the momentum of the hip up to the balance point of the torso -- need to be meticulously adjusted. In addition, the gait is adaptable to different environments. Walking on ice is different from walking on solid ground, walking uphill is different from downhill.

In their study, publishing in PLoS Computational Biology July 13, 2007, scientists around Florentin Wörgötter, Bernstein Center for Computational Neuroscience at the University of Göttingen, have simulated the neuronal principles that form the basis of this adaptivity in a walking robot. "RunBot", as it is called, lives up to its name -- it holds the world record in speed walking for dynamic machines. Now its inventors have expanded its repertoire. With an infrared eye it can detect a slope on its path and adjust its gait on the spot. Just as a human, it leans forwards slightly and uses shorter steps. It can learn this behavior using only a few trials.



(A,B) The planar dynamic robot RunBot with its active UBC. It is constrained sagitally by a boom freely rotating in three orthogonal axes. (C) The experimental setup of the RunBot system. (D) Illustration of a walking step of RunBot. (Credit: Adaptive, Fast Walking in a Biped Robot under Neuronal Control and Learning Manoonpong P, Geng T, Kulvicius T, Porr B, Wörgötter F PLoS Computational Biology Vol. 3, No. 7, e134)

The robots ability to abruptly switch from one gait to the other is due to the hierarchical organization of the movement control. In this respect, it resembles that of a human and can hold as a human model. On the lower hierarchical levels, movement is based on reflexes driven by peripheral sensors. Control circuits ensure that the joints are not overstretched or that the next step is initiated as soon as the foot touches the ground. Only when the gait needs to be adapted, higher centers of organization step in -- a process triggered by the human brain or, in case of the robot, by its infrared eye leading on to a simpler neural network. Because of the hierarchical organization adjustment of the gait can be achieved by changing only a few parameters. Other factors will be automatically tuned through the regular circuits.

At its first attempt to climb a slope, RunBot will fall over backwards, as it has not yet learned to react to its visual input with a change in gait. But just like children, RunBot learns from its failures, leading to a strengthening of the contact between the eye and the sites of movement control. Only once these connections are established, step length and body posture are controllable by the visually induced signal. The steeper the slope, the stronger RunBot will adapt its gait.

CITATION: Manoonpong P, Geng T, Kulvicius T, Porr B, Wo¨ rgo¨ tter F (2007) Adaptive, fast walking in a biped robot under neuronal control and learning. PLoS Comput Biol 3(7): e134. doi:10.1371/journal.pcbi.0030134

Note: This story has been adapted from a news release issued by Public Library of Science.