Zurich team develops walking, jumping, balancing, Cubli (w/ Video)

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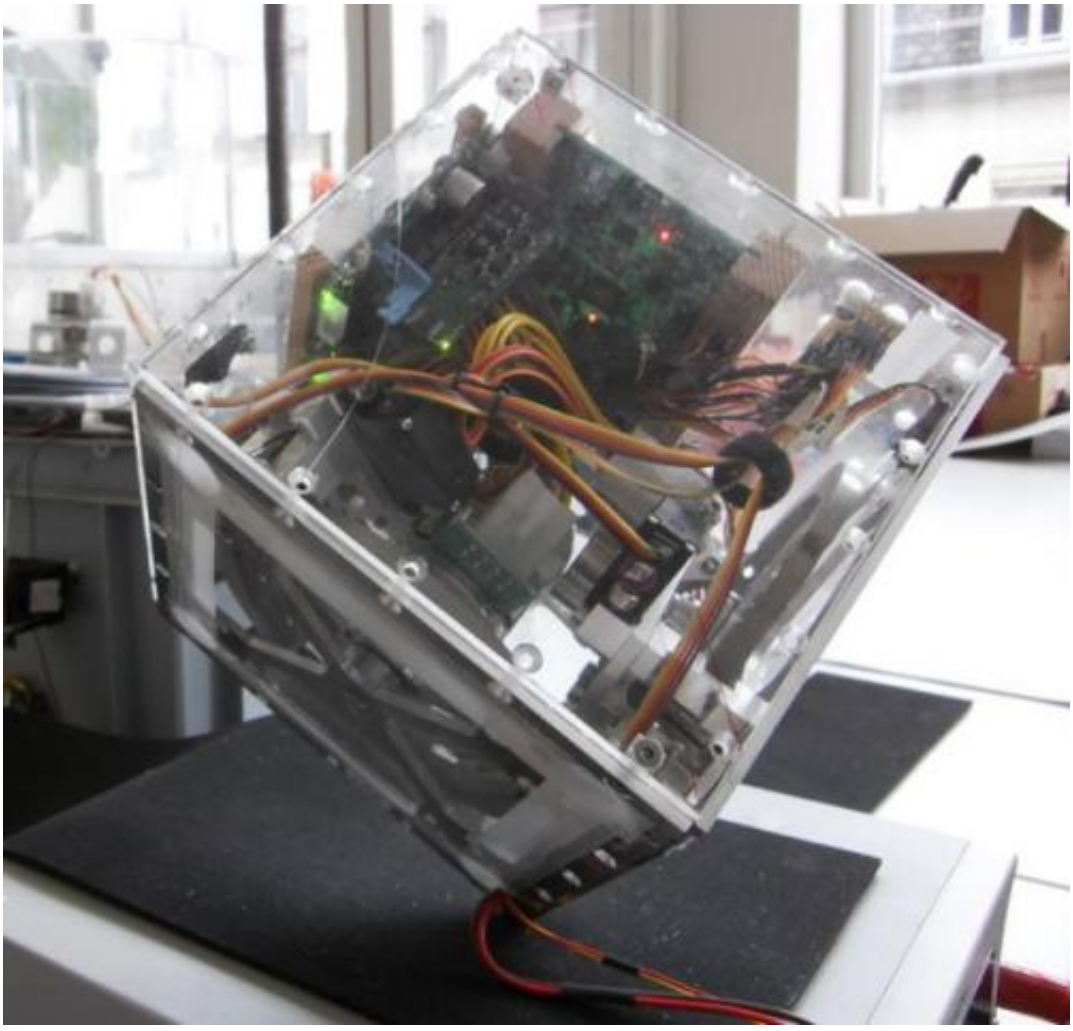

Cubli balancing on the corner.

(Phys.org) —Researchers from the ETH Zurich's Institute for Dynamic

Systems and Control have developed the Cubli, a device that can walk, jump, and balance itself on a corner. The name "Cubli" is derived from the English word and the Swiss German diminutive.

The creators explain what Cubli is and what it can do: "The Cubli is a 15 × 15 × 15 cm cube that can jump up and balance on its corner. Reaction wheels mounted on three faces of the cube rotate at high angular velocities and then brake suddenly, causing the Cubli to jump up. Once the Cubli has almost reached the corner stand up position, controlled motor torques are applied to make it balance on its corner. In addition to balancing, the motor torques can also be used to achieve a controlled fall such that the Cubli can be commanded to fall in any arbitrary direction. Combining these three abilities—jumping up, balancing, and controlled falling—the Cubli is able to 'walk'."

The designers have presented a video showing the device in action, which is fun to watch, but the Cubli is also a serious exercise as the Institute continues its work in exploring various design challenges. Building on principles in mathematics and physics, their research may involve aerial vehicles, combustion engines, or robot systems, studying dynamics and control "crucial to the efficient monitoring, control and design of complex systems." Earlier this year, Mohanarajah Gajamohan, Michael Muehlebach, Tobias Widmer, and Raffaello D'Andrea presented their paper, "The Cubli: A Reaction Wheel-based 3D Inverted Pendulum," for the 2013 European Control Conference (ECC) that was held in July in Zürich. The paper tracked the development of their cube, described as a 3D inverted pendulum "with a relatively small footprint."

The authors called attention to the fact that inverted pendulum systems are nothing new; they have been a part of the controls community for slightly more than a century and utilized to test, demonstrate and benchmark control concepts and theories. They also said, "Algorithms for controlling pendulum systems are an active area of research today."

What makes their cube stand out, they said, are two unique features. First, their device has a small footprint and, second, Cubli can jump up from a resting position without any external support, by suddenly braking its reaction wheels rotating at high speeds.

More information: www.idsc.ethz.ch/Research_DAndrea/Cubli
www.nt.ntnu.no/users/skoge/pro … data/papers/0829.pdf