

Drone team took cues from birds for fixed-wing perching on vertical surfaces

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(Tech Xplore)—Reliable perching? Roboticists working with fixed-wing drones know that is not so easy if the drone is to qualify as a useful UAV. Well, now there is a drone capable of landing on walls like a bird, and drone watchers are impressed.

Their result is S-MAD, which stands for Sherbrooke's Multimodal

Autonomous Drone. The University of Sherbrooke team claims it as a first—that is, the first fixed wing UAV capable of repeated perching and takeoff cycles.

Nature often offers the best solutions for robotics challenges and this is no exception. They said their inspiration came from birds' ability to adjust their flight path with a last-minute upward thrust as they close in on perching locations.

An upward thrust—the key phrase in their work, as many small birds generate it to approach perching places. They also use the thrust to take off. The researchers tried to reproduce this with their robotic platform. The team used "microspines" for the device clinging to walls. At wall contact, the microspine feet cling on to the surface.

Nick Lavars in *New Atlas* said these feet will engage any rough surfaces, including concrete, stucco and bricks.

"With the drone [settled](#) on the wall, it can apparently remain there until it is time to take off again," Lavars said.

Lavors provided a word picture that indeed makes us think of birds: "The drone flies horizontally towards the oncoming wall at a speed of 7 to 9 meters per second. A laser sensor then detects the wall and [feedback control](#) slows the aircraft down to 1 to 3 meters per second, as it tilts the drone upwards. Thrust increases meanwhile to hold its [vertical](#) position as it closes in on the wall."

The video showing their [drone](#) talks about wall detection with a range sensor; and "rapid pitchup through feedback control." (Evan Ackerman in *IEEE Spectrum* explained that a pitch-up maneuver "turns the fixed-wing airplane into a temporary helicopter of sorts, relying entirely on the propellor for lift generation.")

Applications could include aerial monitoring and building inspections.

Why care about their work was discussed in *IEEE Spectrum*: "The ideal fantasy UAV would be a [fixed-wing aircraft](#) with the magical ability to land on a dime, and a group of researchers from the University of Sherbrooke in Canada have come very close to making that happen, with a little airplane that uses [legs](#) and claws to reliably perch on walls."

But don't quadrotors perch nicely? Yes, but that is easy. "Perching with a quadrotor is significantly easier than perching with a fixed-wing aircraft, because you have many more degrees of control, and you're not obligated to keep the vehicle moving forward all the time," Ackerman said.

"Fixed-wing perching is a more difficult problem, since perching generally requires the vehicle to be very close to stationary to keep it from just bouncing off of whatever surface it's trying to land on."

Dino Mehanovic, John Bass, Thomas Courteau, David Rancourt, and Alexis Lussier Desbiens are the researchers who looked to birds for answers. They described their research in their conference paper, "Autonomous Thrust-Assisted Perching of a Fixed-Wing UAV on Vertical Surfaces." It was presented at the International Conference on Biomimetic and Biohybrid Systems, Living Machines 2017, in [Stanford](#), in July.

What's next? The video notes said they are working on enabling thrust assisted climbing and recovery from failed perching attempts.

More information: Autonomous Thrust-Assisted Perching of a Fixed-Wing UAV on Vertical Surfaces, link.springer.com/chapter/10.1...978-3-319-63537-8_26

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