Data-collecting quadrotor perch progress at Stanford

May 14 2016, by Nancy Owano

Researchers at Stanford's Biomimetics and Dexterous Manipulation Lab investigate robots at the boundary of airborn and surface locomotion. They have made a drone that, like insects, can land on vertical walls and even ceilings. This addresses a problem with hovering drones—namely, endurance.

Quadrotors flying over disaster scenes to collect information have endurance problems, but what if they could just perch?

Rough surface perching with opposed micro-spines" is the title of their video posted earlier this month.

"At Stanford, we are interested in the capabilities of small flying vehicles." They presented in the video their robot which can perch and land on vertical surfaces and, as importantly, the quadcopter can stay perched and take videos for hours before the battery dies.

Jacob Kastrenakes in *The Verge* on Thursday similarly noted what that means in terms of potential applications, as "it could allow a drone to rest for hours while recording video or capturing data with onboard sensors and then fly back down to safety."

(An earlier version of the technology was shown last year, Kastrenakes said, but the new video shows the research team's progress.)

Morgan Pope, a researcher involved with the project and PhD student, wrote about their research in *IEEE Spectrum*:

"Quadrotors are becoming affordable, ubiquitous platforms that can fly quickly over rugged terrain to collect critical data. There's a catch, though: most small (less than 1 meter in diameter) quadrotors can only stay in the air for tens of minutes at a time, and this limited endurance makes some missions unachievable. However, if the goal is to collect data from a fixed vantage point, there is an alternative to hovering in place that might extend mission life from minutes to days or even longer: perching."

Enter Hao Jiang. He is a PhD student at BDML working on "gecko inspired adhesives" and "insect inspired micro-spines." The *IEEE*

Spectrum report said Hao built a gripping system capable of attaching to an inverted surface such as a ceiling, useful when the robot needs to get out of the rain. A simple tail structure helps the robot engage with a wall.

Edwin Kee in *Ubergizmo* said "The tail will enable the drone to position itself in the correct place when it lands, while the pair of microspines will be dragged along the wall, with hopes that they will be able to get a grasp on microscopic grooves in the surface so that it can remain stuck."

Pope commented on research progress: "While it's still not as foolproof as landing on a level surface, we are closer than ever to making perching accessible outside of a research environment."

What's next: Hao said they achieved robust perching failure detection and recovery for indoor environments, and will investigate failure recoveries for outdoor applications, "possibly with wind disturbances and surface uncertainties."

More information: bdml.stanford.edu/