生物策略表

類別	生物策略 (Strategy)
生物策略 STRATEGY	受雨燕啟發的高度機動無人機 (Highly Maneuverable Drone Inspired by Swifts)
生物系統 LIVING SYSTEM	普通雨燕 (Common swift (*Apus apus*))
功能類別 FUNCTIONS	#進入/穿過氣體 #Move in/Through Gases
作用機制標題	南澳大利亞大學的監視無人機利用尾部仰角和推力來控制滑翔和懸停。 (Surveillance drones from University of South Australia use tail elevation and thrust to control gliding and hovering.)
生物系統/作用機制示意圖 (確認版權、註明出處；畫質)	 https://asknature.org/innovation/highly-maneuverable-drone-inspired-by-swifts/

作用機制摘要說明 (SUMMARY OF FUNCTIONING MECHANISMS)

挑戰

在戰爭或災區等可能危險或難以到達的地區，運送含有必需品的包裹可能至關重要，而無人機是有用的選擇。 然而，典型的無人機又大又重，這降低了它們的速度並降低了它們的機動性。 此外，重型無人機成本更高，消耗更多能源，對環境的影響更大。

創新細節

撲翼無人機也稱為撲翼機，重量相當於兩湯匙麵粉。 它可以像雨燕一樣懸停、衝刺、滑翔、制動和俯衝，使其能夠在擁擠的區域飛行，但也能夠突然停止並避免碰撞。 這使得它比現有的四軸飛行器無人機更通用，並具有更安全、更安靜的額外優勢。 它使用尾部控制來充當滑翔傘、飛機和直升機。 透過改變尾部的方向和高度，無人機可以控制其速度和運動。 此外，無人機重量輕，機翼緩慢跳動，可以在承載不同重量時控制推力和運動。

生物模型

雨燕透過改變翅膀的位置來控制它們的飛行模式。 加長的機翼用於緩慢轉彎和滑行，而後掠翼（稍微向後傾斜）用於更好地控制高速轉彎。

The Challenge

In areas that may be dangerous or difficult to reach, like war or disaster zones, delivering packages with essential supplies can be critical, and drones are a useful option. However, typical drones are bulky and heavy, which slows them down and reduces their maneuverability. Additionally, heavy drones cost more and use more energy, making more of an impact on the environment.

Innovation Details

The flapping wing drone, also called the ornithopter, weighs the same as two tablespoons of flour. It can hover, dart, glide, brake and dive like a swift, allowing it to fly in crowded areas but also be able to stop suddenly and avoid collisions. This makes it more versatile than existing quadcopter drones, with the added benefits of being safer and quieter. It uses tail control to act as a paraglider, airplane, and helicopter. By changing the orientation and height of the tail, the drone can control its speed and movement. Additionally, the drone is lightweight and has slow beating wings which allow for control over the thrust and movement when carrying different amounts of weight.

Biological Model

Swifts control their flight patterns by varying the position of their wings. Extended wings are used for slow turns and glides, while a swept wing (angled slightly backwards) is used for more control over turns at higher speeds.

文獻引用 (REFERENCES)

「雨燕的特技飛行對於微型飛行器任務非常有用。」

「快速攔截和轉彎將允許在雜亂和無組織的空間中飛行。」

「在這裡，我們報告了一種重 26 克、機身長度為 200 毫米的 X 翼撲翼機，能夠進行多式聯運。」

「特技轉彎是透過以每秒 31.4 公尺每秒的最大減速度停止飛鏢而在 32 毫米半徑內實現的。」

「The aerobatic maneuvers of swifts could be very useful for micro aerial vehicle missions.」

「Rapid arrests and turns would allow flight in cluttered and unstructured spaces.」

「Here, we report a 26-gram X-wing ornithopter of 200-millimeter fuselage length capable of multimodal flight.」

「The aerobatic turn was achieved within a 32-millimeter radius by stopping a dart with a maximum deceleration of 31.4 meters per second squared.」

參考文獻清單與連結 (REFERENCE LIST) **Harvard 或 APA 格式**
Efficient flapping wing drone arrests high-speed flight using post-stall soaring *Science Robotics* | 2020 | Chin, Y.W., Kok, J.M., Zhu, Y.Q., Chan, W.L., Chahl, J.S., Khoo, B.C. and Lau, G.K. (https://www.science.org/doi/10.1126/scirobotics.aba2386)
延伸閱讀: Harvard 或 APA 格式（取自 AskNature 原文；若為翻譯者補充，請註明）
生物系統延伸資訊連結 (LEARN MORE ABOUT THE LIVING SYSTEM/S)
撰寫/翻譯/編修者與日期
藍莉媛翻譯 (2024/3/26)；陳柏宇編修 (2024/11/30)
AskNature 原文連結
https://asknature.org/innovation/highly-maneuverable-drone-inspired-by-swifts/

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