

# A12-106

作品名稱	無線生態觀測系統 Wireless Ecological Monitoring System
隊伍名稱	鳥頭牌愛“輻”好 / Bird-Watcher
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## 作品摘要 Abstract

大自然物種的行為與群聚分佈特性，會反映出環境與氣候的變遷，進而影響到一國的農業發展甚至經濟。其中鳥類扮演著生物鏈中基層的傳播關鍵，觀測其習性更是生態學（Ecology）研究中重要的一環。目前鳥類之生態研究大部份以影像方式觀測，影像必須取決於光線強弱，若缺乏光線，如晚上或陰天時，往往會失去此時珍貴的資訊。

不同種類鳥類的體形與翅膀振動頻率皆有所不同，因此飛行物種之翅膀拍頻，可視為另一種生物辨識特徵。在本作品中，我們提出一創新之技術應用：無線生態觀測系統。透過都普勒（Doppler）雷達技術及後端演算法，可檢測微小的振動位移，因此可用來量測鳥類的翅膀振動頻率，進而建立不同物種的生物特徵和行為模式的資料庫，有利於未來於戶外觀測時，能夠迅速了解該區域內生態鳥類的棲息分佈狀況。以微波方式進行檢測，除其穿透力強，可日夜監看，不受氣候影響，更可達遠距檢測，不致於驚動鳥群。實驗結果成功驗證本系統可在 1 秒的觀測時間內判讀多飛行物種，且不受周遭靜態回波干擾，目前最大檢測距離為五公尺。我們最終希望將此系統應用於實際自然環境中，未來更可建構無線感測網路，長遠觀測與紀錄鳥類或昆蟲之習性，將可節省大量的時間與人力，對生態觀測與維護將會有長足的貢獻。

The species behavior and distribution can reflect the environment and climate change, thereby affecting a country's agricultural development, and even economic. Since birds play the key tertiary consumers in the food chain, it is important to observe their behaviors in the ecology study. Currently, the identification of a bird is mainly based on video observation. However, the quality of filming image strongly depends on the intensity of light. It could become an issue in the night or cloudy days.

It has been found that the wing-flapping frequency can be treated as another biometric identification for flying objects. In this work, we propose an novel technology: Wireless ecological monitoring system. By utilizing Doppler radar technique and related algorithm, we are able to measure the bird's wing beat frequency based on the flying wing displacement. The experimental results demonstrate that the proposed system can successfully identify multiple flying objects within one second without being disturbed by the surrounding stationary clutters. The maximum detection distance is 5 meters. The great features of using microwave technique include less influence by weather, 24-hour observation, and long-distance detection without disturbing the birds. With pre-established database of wing beat frequencies, we should be able to quickly identify the existing species by radar scanning the area. Ultimately, we hope this system can be applied to the natural environment, making contributions to future ecological observation.

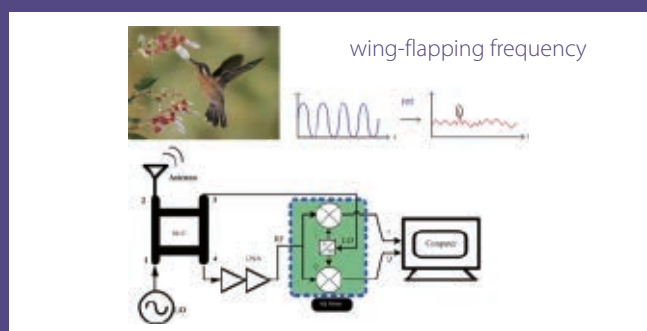


Fig.1 > 系統架構示意圖