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[XX 機電整合系統] 之功能與系統架構剖析

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摘要

本研究計畫旨在開發一套智慧交通巡檢系統，利用四軸飛行載具（Unmanned Aerial Vehicle, UAV）進行違規停車車輛的偵測。不同於以往先判斷紅線位置再確認車輛是否違規的方法，本研究透過四軸飛行器的 GPS 定位資訊來判斷車輛是否違規，避免車輛停在紅線上或完全遮掩紅線的情況。由於系統僅檢視違規區域，此方法還能加快巡邏速度，提升巡邏效率。

本系計畫統採用 YOLOv7 物件偵測模型進行即時車輛辨識，結合飛行器的姿態與相機拍攝角度，利用逆透視變換 (Inverse Perspective Mapping，IPM) 定位，將偵測結果轉換為地面上的絕對位置，這樣能夠快速確定違規停車車輛的位置。透過事先建立的資料庫，無人機將比對飛越指定區域所拍攝的影像，並即時偵測違規車輛，記錄其位置。該系統的優勢在於高效的監控能力，能夠大幅減少設備投資成本，並提升違規車輛檢測的靈活性和即時性。

關鍵字：即時物件偵測、四旋翼無人機、空間對位

Abstract

This research aims to develop an intelligent traffic inspection system utilizing unmanned aerial vehicles (UAVs) to detect illegally parked vehicles. Unlike conventional methods that first identify the location of red lines and then verify whether vehicles are violating parking regulations, this system determines whether a vehicle is in violation by using the UAV's GPS positioning information, preventing vehicles from parking on or completely covering red lines. Since the system only inspects the violation areas, this approach helps speed up patrol operations and enhance overall patrol efficiency.

This research adopts the YOLOv7 object detection model for real-time vehicle identification, combined with the UAV's attitude and camera angle. By using Inverse Perspective Mapping, the system locates and converts the detection results into absolute ground positions, allowing for quick identification of illegally parked vehicles. Through a pre-established database, the UAV compares the images captured while flying over designated areas and immediately detects violation vehicles, recording their locations. The advantage of this system lies in its efficient monitoring capability, significantly reducing equipment investment costs and improving the flexibility and immediacy of illegal parking detection.

Keyword: Real-time Object Detection, Quadcopter, Georeferencing

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1 緒論

1.1 研究背景

無人機（Unmanned Aerial Vehicle, UAV）技術近年來快速發展，整合各種附加設備並隨著飛行控制與自動化技術的成熟，在軍事、執法及科技應用領域取得顯著成效。四軸旋翼無人機因其安全性高、成本低的優勢，已廣泛應用於各種場景，其中攝影與錄影功能尤為重要。無人機擁有比傳統攝影設備更廣的視角，且受環境限制較小，使其在大範圍場景捕捉方面表現優異，優於傳統監控方式。

2 參考文獻