An AI-Based Multi-UAV Coordination and Navigation System with Real- Time Visual Recognition and Precision Control

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Abstract

This study presents an AI-driven multi-UAV system for real-time coordination and navigation. Powered by Jetson Xavier NX and ROS2, the UAVs integrate YOLOv11 for real-time object detection, scene understanding, and mission inference, enabling autonomous target search and vision-based guided landing. RTK-based precision positioning and IMU data support accurate navigation, while a gimbal-mounted camera enables dynamic tracking and visual guidance. The front-end interface, developed using Flutter, supports multi-UAV task control and real-time monitoring. The backend, implemented in Go and integrated with a MySQL database, manages APIs and mission records. Real-time image and command streaming is achieved via WebSocket. By embedding AI-based perception, planning, and decision-making capabilities across multiple UAVs, the system enhances scalability, responsiveness, and control accuracy, providing a robust foundation for autonomous aerial system development.