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Indoor Autonomous Positioning and Control System of Quadrotor UAV Using Monocular Vision Assistance

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Abstract

Under indoor conditions without global positioning system (GPS) signals, this paper proposes a feasible method to realize autonomous positioning and tracking of unmanned aerial vehicles (UAV). The system uses the quadrotor's own inertial measurement unit (IMU), peripheral optical flow and ranging module as the main source of height positioning and hovering information, and uses a monocular camera to assist in indoor positioning. This paper builds a test environment, in which we verify that the system is stable, reliable, and highly feasible.

The indoor autonomous positioning and control system of the quadrotor UAV is mainly divided into three modules - flight control module, main control module and vision module.
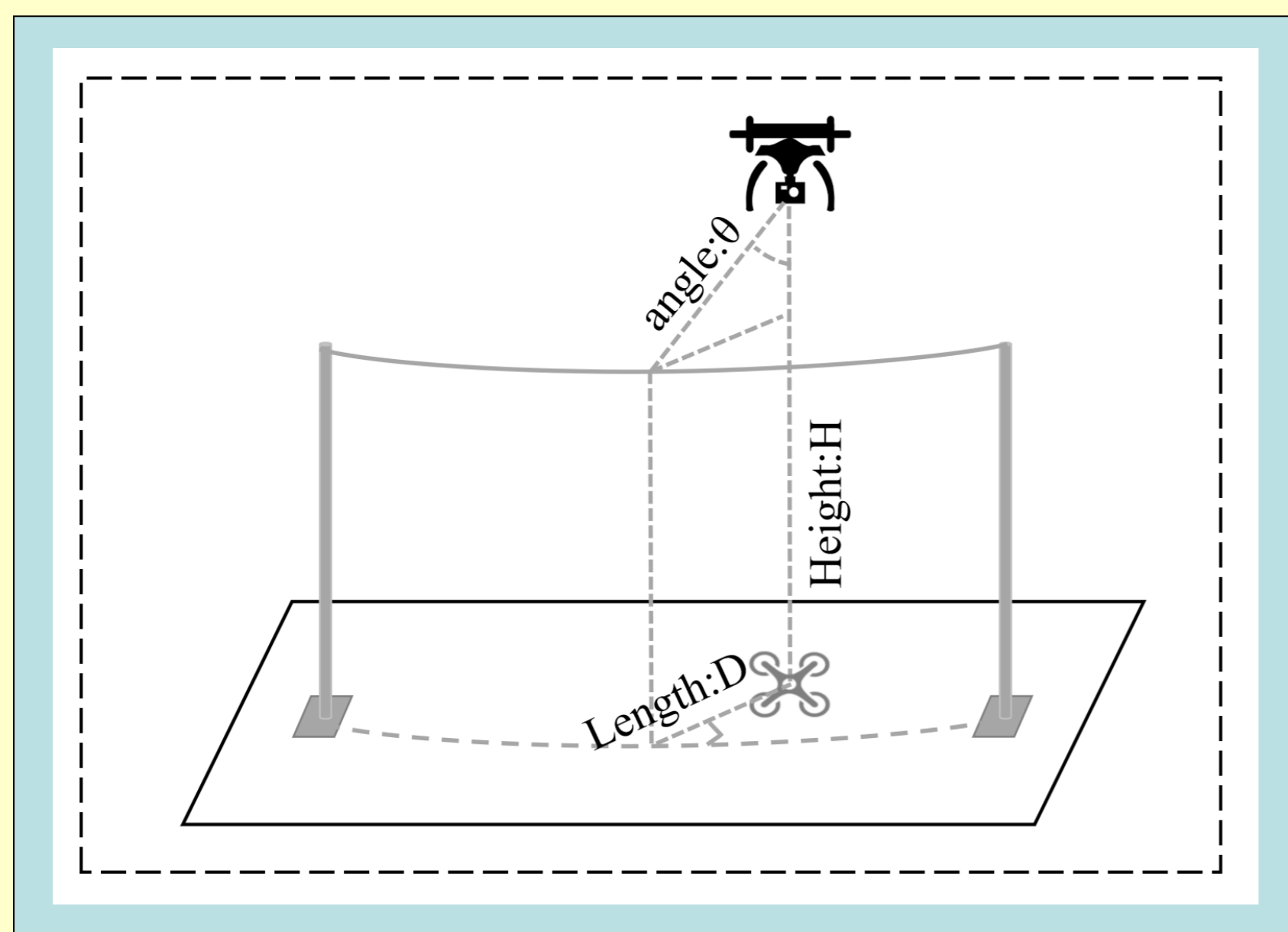
Overview of container design

Fig.1. Schematic diagram of the tracking principle

Briefly, the main flow of the UAV in the process of performing the task is as Fig2.

The orientation of OpenMV required in the two tasks of positioning and tracking is different, so we use a servo gimbal controlled by the microcontroller to control the orientation. The initial position defaults to the ground.
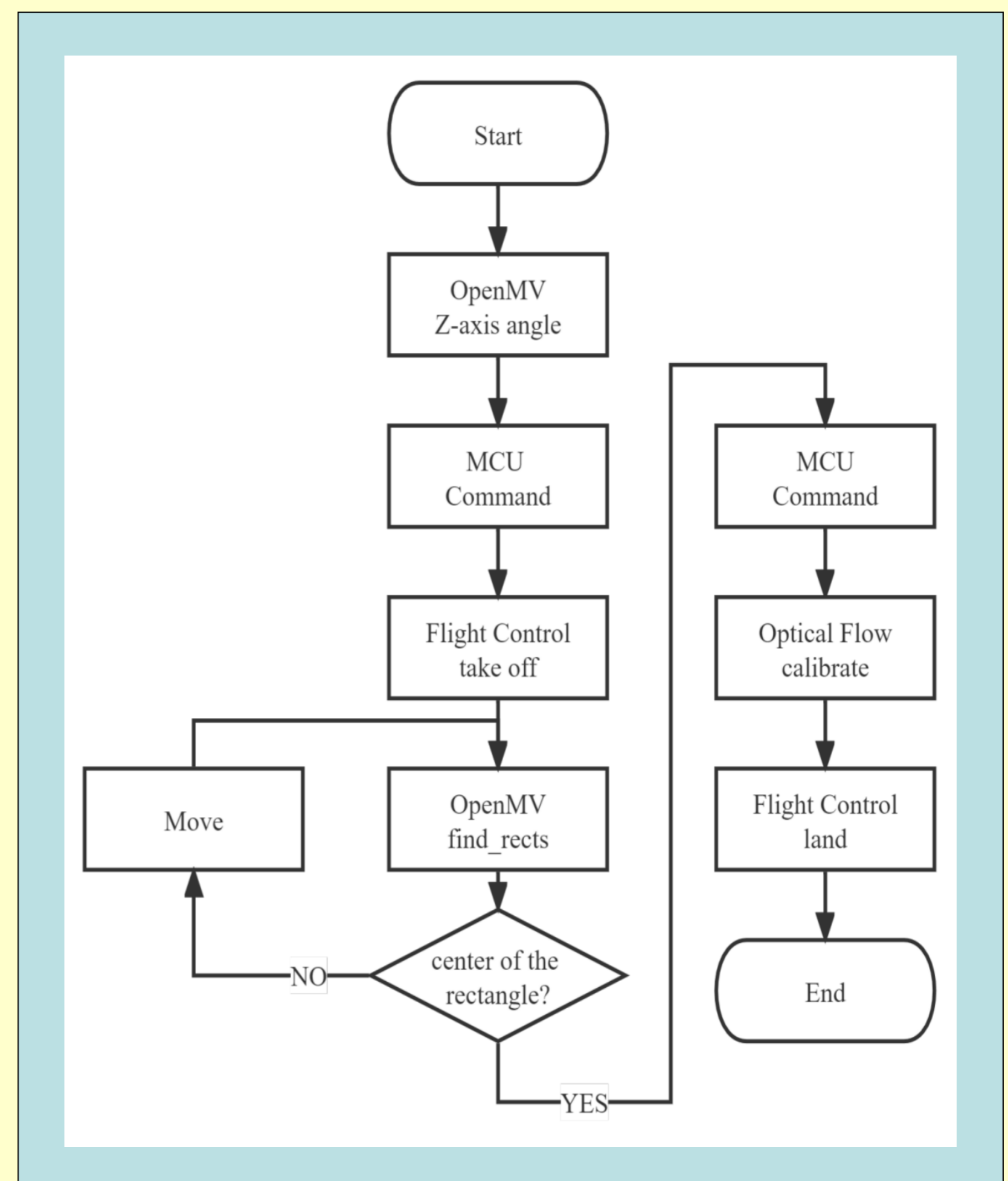

Fig.2. Flow chart of flight phase

Summary

This paper mainly proposes a method for UAV to use vision for positioning and tracking tasks in the absence of GPS signals, and it has been verified to have good robustness. The system can achieve a good positioning and tracking effect with the help of monocular vision and some peripheral sensors, and has a simple principle and strong practicability.

Since this solution does not rely on manual operation and the assistance of GPS signals, it has great application prospects in tasks such as power tunnel inspection, indoor item identification and sorting.