ABSTRACT

In the development of drone technology, the ability to detect and track objects in real-time using the OpenCV library is increasingly being utilized, including in the field of sports for fast-moving objects such as balls. This research aims to implement a real-time ball tracking system on a DJI Tello drone by addressing challenges related to lighting, object size, and color. The methods employed include converting images to the HSV color space, range-based color segmentation, as well as erosion and dilation operations to reduce noise. Object size is controlled through minimum and maximum radius limits, while lighting is addressed by adjusting HSV values. The control system employs a PID method with manually tuned gain parameters (trial and error) on each motion axis (yaw, up/down, forward/backward) to achieve stable response and minimal oscillation. Test results show that the system can track the ball with a centering count percentage of 80% in static scenarios and 70% in dynamic scenarios under normal lighting conditions. Real-time performance is demonstrated by an average frame rate of ±30 FPS, enabling the drone to respond quickly to changes in the object's position. Thus, the developed system is capable of performing real-time ball tracking in a controlled environment through the integration of OpenCV and PID control on the DJI Tello platform.

Keywords: detection system, DJI Tello, OpenCV, real-time, tracking system