Flying Hawk: An Innovative Algorithm To Enhance Drone Performance by PID Controller Tuning

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The increasing usage of autonomous machines and robotics necessitates effective control systems, such as PID (proportional-integral-derivative) controllers, to ensure stability and functionality. These PID controllers have various gains that must be tuned to maximize efficacy. While existing simulations aid in controller design, real-world complexities limit their usability. This project created an algorithm, Flying Hawk, that can specifically tune PID controller gains. A prototype drone was tested using the Flying Hawk algorithm with an iterative tuning approach. Modeling was first conducted with the drone in order to better understand the results of various PID gains. The Flying Hawk algorithm emulates line search with the PID gains to quantify the relationship between PID gains and performance. A scoring system is used with each gain in order to better represent their performance. A regression is applied to the scores to find optimal gains. An introduced constant T is used in I training to allow for the customizability of the algorithm to produce PID gains that are suitable for different applications. This algorithm has the notable advantage of tuning PID gains that are custom suited for their environment. Experimentation with the drone testbed revealed significant improvements in all three error metrics compared to the Ziegler-Nichols method.

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