D.I.C.E - Dynamic Interlocking Cube-Drones Engineered With IR Tracking

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My project explores a novel design of cube-like drones that can build three-dimensional structures by connecting mid-flight. Rather than focusing on just the interlocking mechanism like the prior project, this project explores branching out to create 3-dimensional structures (rather than 2D), design custom flight software, create a way to track drones in 3D space using IR cameras, and improve battery life flexibility. The project's methodology involves first creating a system to track drones to extreme precision in 3D space to facilitate the interlocking aspect. This involved using uncalibrated stereo to map a 3D space using cameras in the room, locking in on drones with IR LEDs, and running that through a Kalman filter to receive their position in the room. Next, that data is sent to my custom-coded flight controller software running on the drone. At the same time, the drones maintain a link to a device connected to my computer over the esp-now protocol to learn about other drones in the environment. Using this data, drones can connect to create 3D structures while also physically connecting contacts to share battery life. Rather than exploring a fixed configuration like last year, I used a thrust stand to analyze 3D structures and determine if propeller wash affects the drone's performance when connected. The throttle was incrementally increased, and thrust data was collected. Then, I tested various aspects of the IR tracking system, such as accuracy and precision. Interlocking cube drones could adapt to environments and form structures on demand that allow quick shelter creation, self-assembling habitats for extraterrestrial environments, or self-building scaffolding.

Awards Won: