Flying Light Specks Flight Pattern Optimization

Abstract

Modern day drones typically occupy a significant amount of space, and considerable time must be spent to calibrate the position of drones in order to gain control over location and movement. These drones can then be used to create an immersive visual experience, with each drone equipped with light sources. A more efficient way of achieving this purpose is through miniature drones, which is the idea envisioned with Flying Light Specks (FLSs). An FLS is a micro-drone configured with RGB light sources, programmed for autonomy, and integrated with precision sensors. The purpose of this study is to determine various measures of localizing and timing the drones, as well as generating flight patterns. We propose the potential utilization of autonomous FLS algorithms as a means of creating coordinated shapes which users can watch and maintain haptic interaction with. In order to maintain smooth display and the ability to render haptic interaction, the drones are pre-equipped with various flight patterns and timed light displays. This is done by a centralized, offline algorithm which requires drones to be placed in a field in a certain arrangement. This centralized algorithm assumes complete information of the field including the flight duration and obstacles in display patterns. In order to simulate this process, we were able to interface the signal inputs of commercial mini-drones (cost as low as $20) with Arduino pulse-wave modulation outputs which we utilized in various autonomous programs for the Arduino, including the launch, pausing mid-air, spiral orbiting, different speed controls, various flight radii, etc. We were primarily able to control these patterns by utilizing the yaw, pitch, roll, and throttle commands which we defined to steer the signals on the drone controller. The information we collected during the calibration phase allowed us to identify vital data such

as the latency in launching the drone (which was in the range of a couple hundred milliseconds), efficient flight patterns (for example, combining pitch and roll for orbiting), and the range of drone speeds (which could determine the orbiting radius). The collected information is promising for allowing us to develop FLSs to perform in the most efficient way possible by accounting for drone features when developing algorithms.