ABSTRACT

Swarm robotics is a new and quickly growing field of research that has many applications to the real-world. The idea is to use a coordinated group of devices to perform tasks that are either unsafe or infeasible for a single device to accomplish.

While a lot of research is being done on swarms surprisingly there are not many physical platforms available to apply these ideas to. Being able to take this research out of simulation will greatly improve the quality and feasibility of these ideas outside of near-perfect conditions.

In this paper we develop a new swarm control platform (that can function as either a Centralized or Distributed system), as well as potential research applications and educational exercises that can be created using this platform. The platform utilizes an open source Nano-Quadcopter called the Crazyflie and uses the OptiTrack motion capture camera system for localization. It is designed for scalability using VRPN, a type of Multi-Cast UDP protocol, to transmit localization data. We use this location data and set of 9 nested PID controllers to command the Crazyflie to any location in space. It also supports flying multiple Crazyflies on one USB Radio, and multiple radios per computer, further reducing the scale up cost.

As a proof of concept we crafted a few applications for the Platform to demonstrate its abilities. These examples range from simple single Crazyflie autonomous flight, to more complex gesture controlled multi-Crazyflie master-slave 'follow-the-leader' type systems. We intend to extend these systems to test even more complex problems in optimization and stochastic lossy networks. As well as creating lab experiments and educational resources for students to learn more about controls.

Based around C and C++, the objective of this platform is to provide an accessible and quick tool to researchers and professors to craft unique and interesting hands-on experiences in distributed control systems.