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SMALL SCALE UAV TESTBED FOR SPACE FORMATION FLYING EXPERIMENT

Abstract

since the ability of the space vehicles are getting more and more stronger, the scale of the space vehicles goes smaller, formation flying becomes reality. However, the cost of the system is not getting cheaper the same time as its ability. By using the small UAV system is a good way to test whether the formation flying algorithm is applicable or not, we have made a system consists of several quadrotors and helicopters, the system uses GPS, IMU and some other sensors as its perception source, the system needs to run on a large field without high buildings surrounded. We have tested some basic formation flying algorithm, and the results are acceptable. First, we use two quadrotors to fly by routines that are predefined using dubins 2D path algorithm, then replace it with flyable clothoid path. During the flight, the system state estimation is based on kalman filter, and the quadrotors are mounted with collision avoidance sensors, so when flying, each quadrotor would not collide with each other. by using this system, we could simulate the outer space motion such as rendezvous, we have made a time scaled test which simulate the rendezvous motion based on CW equation, though the system is not the same as the real sattilite, it is a good choice to demonstrate how the space vehicles move in outer space. we also have made systems which is composed of a central vehicle and several small scaled quadrotors, the central vehicle is a 15kg scaled unmanned helicopter, it carries a transmitter which broadcast its information to the quadrotors, by doing so, the quadrotors could fly a bit more higher and cover more area than by absorbing information from ground. we have made an expriment that the quadrotors fly around the central helicopter, which on the other hand demonstrate the cooperative target rendezvous.