# UAV Swarm-based Antenna System

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Unmanned aerial vehicles (UAVs), in conjunction with antennas operating within the radio frequency band, have a wide range of applications in remote sensing and imaging, such as forest monitoring, search and rescue missions, mineral exploration, landmine detection, synthetic aperture radar (SAR) imaging, and many others. However, most of these UAV platforms use expensive high-gain antenna equipment in order to achieve the desired resolution. One way to minimize the cost of high-resolution imaging and remote sensing is to use a number of inexpensive, commercially-available drones collaborating to direct their combined electromagnetic energy as necessary for a particular application.

In this paper, the concept of a UAV swarm-based reconfigurable antenna system is introduced. Each member of the swarm is to be equipped with a low-cost microstrip patch antenna. Although the concept will be demonstrated at a fixed frequency, multiple frequency operations should also be feasible. Coverage on the ground will be dynamically updated based on the relative orientation of the drones in space making it possible to synthesize the collective radiation pattern, as well as the beam coverage on the ground. This key aspect adds to the versatility of the UAV swarm system with regard to its applications.

We will apply this concept of the UAV swarm-based reconfigurable antenna system to track the motion of a moving object in real time. We will develop a motion-planning approach, which enables the team of UAVs to reach a desired configuration while avoiding collisions with obstacles and other UAVs. As the object moves, the motion planner will update the path of each UAV to ensure that the team continuously tracks the moving object. To achieve real-time performance, the motion planner leverages recent advances in sampling-based motion planning. In particular, the motion planner conducts a search over the space of feasible motions using probabilistic sampling and evaluation metrics to effectively guide the search.