



PAWR Project Office

Mahfizur Khan - AERPAW

Unmanned aerial vehicles (UAVs) have emerged as promising components of 5G and beyond wireless networks, supporting aerial communication and data collection. However, efficient UAV operation requires careful trajectory and position optimization under limited mission time, varying wireless conditions and interference constraints.

This work investigates two UAV-assisted wireless communication applications using the Aerial Experimentation and Research Platform for Advanced Wireless (AERPAW). First, a UAV aided data collection framework is developed to efficiently collect data from multiple ground base stations (GBSs). K-means clustering algorithm is used to identify optimal waypoints near each GBS to reduce flight time, while adaptive hovering adjusts the hovering time based on instantaneous link quality and data volume.

The proposed framework is evaluated using the AERPAW Digital Twin and validated using the AERPAW testbed. Results from both environments demonstrate improved data collection efficiency and show similar performance between the Digital Twin and testbed. Second, a score aware UAV placement framework is developed to identify suitable UAV operating locations while maintaining reliable communication with ground users and limiting interference toward a Radio Astronomy Service (RAS).

The AERPAW geofence is discretized into candidate grid locations, which are evaluated using SNR measurements from the communication users and RAS node. A hill climbing search strategy identifies a favorable operating location within the mission time constraint. Emulation results demonstrate that the proposed approach limits interference toward the RAS while maintaining reliable communication with the user nodes.

Overall, these studies demonstrate the effectiveness of UAV trajectory and position optimization for efficient data collection and reliable communication while limiting interference toward the RAS using the AERPAW platform.