The continuous evolution of commercial Unmanned Aerial Systems (UAS) is fueling a rapid advancement in the fields of network edge-communication applications for smart agriculture, smart traffic management, and border security. A common problem in UAS research and development is the cost related to deploying and running realistic UAS testbeds. Due to the constraints in safe operation, handling limited energy resources, and government regulation restrictions, UAS testbed building is time-consuming and not suitable for high-scale experiments. In addition, experimenters have a hard time creating repeatable and reproducible experiments to test major hypotheses.

In this paper, we present a set of design principles for performing trace-based NS-3 simulations that can be helpful for realistic UAS experiments. We feed the NS-3 simulator with real-world UAS traces including various mobility models, geospatial link information and video analytics QoS measurements obtained from real-world data-gathering efforts. Our design fits within a hierarchical UAS platform with a suite of visual and geolocation applications that provides a 'common operating picture' view of UAS video analytics. The simulator scripts support the ability to integrate different Unmanned Aerial Vehicle (UAV) configurations, wireless communication links (air-to-air; air-to-ground), as well as mobility routing protocols, to evaluate algorithms pertaining to the management of energy consumption, video analytics performance, and networking protocols. We demonstrate our simulator scripts using a map interface with dynamic contextual markers functionality that helps with the management of several UAVs in application scenarios relating to: (a) smart city traffic management, and (b) disaster incident management.