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Title: Inferring UAV Position Relative to Smartphone Sensors Based on Acoustic Characteristics

#### Abstract

As commercial and non-commercial unmanned aerial vehicles (UAVs) improve technologically and increase in accessibility, their potential for use in actions antithetical to nuclear non-proliferation efforts increases as well. The ability to identify and locate UAVs using ubiquitous, inexpensive hardware and software would be advantageous as both a deterrent and an initial warning system. Our team looks to utilize smartphones as acoustic sensors to record and characterize UAV movement based on the sound produced while in flight. Multi-rotor UAVs produce identifiable acoustic spectral characteristics with frequencies and harmonics corresponding to motor revolutions per minute and the propeller characteristics. As the source moves closer to the receiver these spectral patterns remain relatively stable (at slow speeds), while the energy observed from the waves increases. The goal of this work is to utilize a small network of smartphone sensors with known, fixed positions to infer the relative position of an in-flight UAV with respect to the position of the smartphones through the variation in acoustic energy.