SATellite-less solUtions for secuRe uav Navigation in smart city applications

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Abstract:

The main goal of this research is a timely response from a selected inter-disciplinary team to create a future generation of unmanned aerial vehicles (UAVs), a.k.a. drones. The research aims to develop a holistic view on UAV development, by integrating diverse expertise in the domain of navigation, autonomous control, secure localization, and drone vision and sensing. Equipped with both model-based (non-linear optimization) and data-based

(machine learning/artificial intelligence) toolsets the team will execute innovative and dynamic research entirely tailored for future UAV industry.

The use and application domains of UAVs are rapidly increasing. Due to their mobility, miniaturization, and flexible usage, UAVs are enabling a plethora of applications in domains such as monitoring, search and rescue, telecommunications, agriculture, etc. In Smart Cities, UAVs are holding promise of providing efficient delivery services, dynamically deployable mobile base stations for broadband hotspot connectivity, infrastructure inspection, first responder services, including earthquakes, gas leakage, explosions, etc. However, future prospects and ubiquity of drones in urban areas bring significant technical and societal challenges in the domain of privacy, cyber security, and public safety. Therefore, providing full autonomy in drone operation requires improving performance, reliability, autonomy, and connectivity of UAV platforms, while also addressing potential privacy, security and safety concerns. These are the main drivers put forth by this research.

Although present commercial drones usually possess advanced systems for video imaging, GPS-based outdoor localization, and communications to ground controllers, these systems are largely isolated. UAVs do not exploit all available information using advanced data analytics nor machine learning methods, and are prone to tampering or failure. Hence, improving sensing, awareness and perception capabilities, multi-modal information aggregation, and design of reliable and versatile UAV communications, will enable full cognitive autonomy in drone navigation and foster the next level of drone performance. This will cultivate advanced applications with increased safety and massive public exploitation of drones.