5G-GNSS System for Improved Navigation and Positioning of Drones

Breif Background

Maintaining highly accurate drone localization in urban and indoor environments is still an open challenge, as GNSS signals suffer from blocking, fading, multipath effects, and are vulnerable to jamming and spoofing. Although 5G base stations can provide faster angle and range measurements than GNSS, current GNSS-5G integration methods do not fully exploit this advantage and are impacted by near-far noise uncertainty. Therefore, combining the complementary strengths of GNSS and 5G is essential for achieving reliable, high-accuracy Position, Navigation, and Timing for drones in complex environments,

Application Sectors

- UAV Communication and Navigation,
- Disaster Management and Emergency Response,
- Agriculture and Environmental Monitoring

TRL 4

Tech/Prod. Summary

The technology integrates GNSS with 5G networks and employs a switched beam antenna array to overcome fading, multipath, and visibility challenges, thereby enhancing drone localization accuracy and enabling reliable position, navigation, and timing in complex environments

Tech/ Product Description

GNSS-5G integrated drone communication system uses a switched beam antenna array with 360° coverage and dual polarization to ensure stable links between drones, base stations, and other drones. Pattern-reconfigurable antennas are used for ground communication and high-gain switched beam antennas are used for aerial links, improving angle and delay estimation while reducing interference. Real-time 5G angle/range measurements are fused with GNSS data, and adaptive noise estimation mitigates near-far effects, enabling robust, interference-resistant, and high-accuracy PNT services for multi-drone networks

Impact - SDG:

SDG 9 – Industry, Innovation, and Infrastructure
SDG 13 – Climate Action
SDG 11 – Sustainable Cities and Communities

Market Potential

5G-enabled UAV communication systems: ~USD 3–4 Billion in 2024 → ~USD 10–12 Billion in 2030

Value Proposition

1. GNSS – 5G provides High-precision, reliable, and secure drone communication.
2. Consistent connectivity and minimimun interference in complex environments.

IIT Tirupati Navavishkar I-Hub Foundation (IITTNIF)