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IEEE Internet of Things Journal Special Issue on Augmented Edge Sensing Intelligence for Low-Altitude IoT Systems

With the development of the Internet of Things (IoT), low-altitude systems such as drones, unmanned aerial vehicles (UAVs), and other aerial devices have garnered significant attention due to their unique capabilities and applications in environmental monitoring, disaster management and smart city implementations. The deployment and efficacy of low-altitude IoT systems hinge critically on the seamless integration of sensing and intelligence. However, the existing solutions encounter several challenges. First, the isolated-point wireless sensing by low-altitude nodes without network connectivity lacks data awareness, reducing overall sensing effectiveness. Meanwhile, the vast amounts of complex sensory data necessitate advanced processing capabilities to interpret the data accurately and efficiently. Then, traditional cloud-based data processing requires cross-domain communication, which risks data leakage and long response delays and thus is particularly impertinent for low-altitude IoT systems operating in dynamic and often unpredictable environments.

These observations motivate the emerging research theme of edge sensing intelligence, which refers to the integration of edge artificial intelligence (AI) and wireless sensing at the network edge. This fusion aims to achieve fast data processing and decision-making, offering advantages of reducing data transmission latency, enhancing data privacy and security, and lowering computing costs. Typically, base stations (BSs) and IoT devices leverage existing communication signal formats to perform uplink and downlink sensing in a task-oriented manner aligned with specific objectives. This approach facilitates subsequent data processing and decision-making, enabling the edge network to directly access massive real-time and diverse data. Such access contributes to real-time responsiveness, optimization of resource allocation, and implementation of privacy/security measures, while also driving the development of novel applications. As the intersection of edge AI and wireless sensing, edge sensing intelligence represents a groundbreaking paradigm where data is not only collected directly at the edge network but also wirelessly transmitted and intelligently processed.

The revolution of existing architecture necessitates a rethinking of current low-altitude IoT network in terms of fundamental limits and tradeoffs, hardware integration, information extraction, processing technologies, learning principles, and emerging challenges related to public security and privacy. This special issue aims to provide a comprehensive overview of state-of-the-art technologies and theories for integrating wireless sensing and AI in low-altitude IoT systems. It will provide a forum for the latest research, innovations, and applications of edge sensing intelligence technologies in these systems, helping to bridge the gap between theory and practice. We solicit high-quality original research papers on topics including, but not limited to:

- Fundamental limits for edge sensing intelligence in low-altitude IoT networks
- Low-altitude IoT Network architectures/transmission protocols/frame designs for edge sensing intelligence
- Artificial Intelligence (AI) and big data-driven designs for edge sensing intelligence
- Cloud/edge computing and task/data/computation offloading for edge sensing intelligence
- Waveform/receiver design for edge sensing intelligence in low-altitude IoT networks
- Security and privacy issues of edge sensing intelligence for low-altitude IoT applications
- Machine learning methods in edge sensing intelligence for low-altitude IoT connectivity
- Massive MIMO/Intelligent Reflecting Surface (IRS)/holographic MIMO surface for edge sensing intelligence in low-altitude IoT systems
- Standardization progress of edge sensing intelligence for low-altitude IoT
- Experimental demonstrations and prototypes of edge sensing intelligence for low-altitude IoT

Important Dates

- Manuscript Submission Deadline: June 15th, 2025
- First Review Due: August 20th, 2025
- Revised Manuscript Due: October 10th, 2025
- Acceptance Notification: November 20th, 2025
- Final Manuscript Due: December 15th, 2025
- Publication Date: February 2026

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