

CALL FOR PAPERS

IEEE Internet of Things Journal Special Issue on Carbon Intelligent Industrial Internet of Things

Industry 5.0 is empowered by a wide range of modern-day technologies like artificial intelligence (AI), the Internet of Things (IoT), communication systems (like 5G/6G), network architectures (e.g. software-defined networking), and robotics. IoT acts as one of the most important enablers for Industry 5.0 or smart city applications or autonomous (self-driven) transportation. It connects a wide array of data generators (devices, sensors, people) and empowers them to communicate and seamlessly interact with each other. IoT collects data (or rather big data) and processes it (in bulk or real-time) at massive data centers (cloud) or local compute servers (edge) to improve the underlying processes, making them a measurable and more quantifiable, paving the way for Industrial IoT (IIoT). IIoT engulfs AI-based technologies to provide enhanced automation and embedded intelligence to realize decision-making in real time and achieve optimized decisions at a lower cost. The key driving force behind industrial applications (like smart factories, intelligent aerodynamic systems, and smart defence ecosystems) is to improve the quality of everything (QoE) within the stipulated industrial environment.

Although the potential benefits of the IIoT paradigm outweigh its challenges, one key challenge that has been a concern globally is related to the increasing energy consumption. In the conventional ecosystem, the reliance on data centers to process the massive amount of data generated by IoT devices has ended up in the expansion of cloud data centers (involving millions of servers at one or more locations). This expansion directly impacts energy consumption and carbon emissions globally. Thus, in the past several years, the research spectrum has been concerned about this issue, and many solutions have emerged to tackle this issue in partial. The concerns around climate change have led to energy efficiency being a key vertical in the United Nations Sustainable Development Agenda as well. A recent report¹ suggested that although IoT technologies will burden the global energy consumption by 34 TWh by 2030, the use of intelligent IoT solutions will help to reduce energy consumption by 1.6 PWh (i.e., enough energy to support 136.5 million homes every year). Addressing the key challenge of climate change and ever-increasing carbon footprints, carbon-intelligent computing can be utilized to manage the ever-increasing energy demands of computing paradigms. For instance, a carbon intelligent solution may leverage AI technology to understand the energy forecasts, predict hourly carbon intensity, predict internal hourly power requirements, and finally align the tasks with low-carbon energy supply in an intelligent manner. This way, the future can witness minimized carbon emissions by shifting IIoT loads based on time and location. Here, it is important to understand the difference between carbon-aware computing (based on time when one can use more energy from sources like solar and wind) from carbon-intelligent computing which considers both time and location where carbon-free energy is available.

This special issue will act as a platform to put forward novel solutions and techniques to support the carbon intelligent IIoT ecosystem. This special issue will cover various aspects related to carbon intelligence for IIoT or vice-versa. We call upon the researchers (working in academia or industry) to share their latest unpublished high-quality research work on carbon-intelligent computing for IIoT. The relevant topics include, but are not limited to, the following:

- Protocol design for embedding carbon intelligence in IIoT
- Carbon intelligent resource allocation and management
- Modelling and performance analysis for Carbon intelligent IIoT

¹<https://iottechnews.com/news/2021/apr/21/iot-technology-will-save-eight-times-the-energy-it-consumes-by-2030-new-report-shows/>

- Machine learning, deep learning for intelligent IIoT
- QoS and QoE provisioning for carbon intelligent IIoT
- Carbon vs Reliability for low-latency IIoT communications
- Energy and scalability issues in IoT, edge and cloud
- Security and privacy issues for carbon intelligent IIoT
- Implementation and testbeds for carbon intelligent IIoT
- Deep computing and learning methodologies carbon intelligent IIoT
- Edge-enabled carbon intelligent systems
- Sustainable computing for for IIoT, edge and cloud
- Green computing for IIoT, edge and cloud
- Carbon intelligent osmotic computing
- Energy-efficient solutions for IIoT, edge and cloud
- Electric vehicles as a service for IIoT, edge and cloud
- Smart Grid and distributed energy resources for IIoT, edge and cloud
- IIoT and AI for improvising smart grid operations

Guest Editors

- **Gagangeet Singh Aujla**, Durham University, UK
Email: gagangeet.s.aujla@durham.ac.uk
- **Amir H. Gandomi**, University of Technology Sydney, Australia; Obuda University, Hungary
Email: gandomi@uts.edu.au, amirhossein.gandomi@uts.edu.au
- **Danda B. Rawat**, Howard University, USA
Email: danda.rawat@howard.edu
- **Chunxiao Jiang**, Tsinghua University, China
Email: jchx@tsinghua.edu.cn

Important Dates

- Manuscript Submission Deadline: February 15th, 2025
- Initial Decision Date: April 15, 2024
- Revised Manuscript Due: May 15, 2025
- Second Reviews Due/Final Decision Date: June 15th, 2025
- Final Manuscript Due: June 30th, 2025
- Publication Date: September 2025

Submission:

All original manuscripts and revisions must be submitted electronically through IEEE Manuscript Central <http://mc.manuscriptcentral.com/iot>, where, at the “Article Type” step, authors are must select the correct special issue name. Solicited original submissions must not be currently under consideration for publication in other venues. Author guidelines and submission information can be found at <https://iee-iotj.org/>.