Guest Editorial of the Special Issue on the 2nd IEEE International Conference on Digital Twins and Parallel Intelligence (IEEE DTPI 2022)

THE IEEE JOURNAL OF RADIO FREQUENCY IDENTIFICATION (JRFID) hosts a Special Issue collecting journal papers that were presented at the *IEEE International Conference on Digital Twins and Parallel Intelligence (DTPI) 2022 Conference*, held in two simultaneous venues on opposite sides of the world on October 28-30, 2022. The first venue was in Ningbo, China and the second venue was Boston, MA, USA. Both venues featured talks that were recorded and/or streamed to hybrid attendees. With 174 total submissions, 119 acceptances, and 69 articles accepted to the IEEE Journal for RFID, one might say that this conference was digitally twinned to a successful result.

Authors from academia and industry participated at both venues, following on the heels of the inaugural IEEE DTPI 2021 conference hosted in Beijing. The IEEE Council on RFID (CRFID) worked closely with counterparts at the Chinese Automation Association (CAA) to sponsor and organize these events. And although the 2021 meeting was largely online due to the pandemic, it was also extremely successful, both in terms of attendance and in terms of paper submissions.

The emerging interest in engineering for digital twins over the last several years has been clear to the CRFID community. Consider Figure 1, which presents the frequency of "Digital Twin" in publications hosted on the IEEE Xplore over the last six years.

As the field takes shape, it has also become clear that many distinct areas are coming together to form the DTPI community, each with unique motivations and notions of digital twin technology. We include a high-level summary of these unique "areas" below:

Life-Cycle Tracking: Maintaining a twin of objects on the cloud will allow industry to track products across their life-cycle, re-integrating components back into the manufacturing space as part of a green, circular economy.

Digital Reality: The act of twinning an object from the physical world is a key component of augmented reality, virtual reality, and metaverses.

Complex System Tracking: Digital twins help understand and analyze complicated systems that change over time.

Cloud-centric Telemetry: Sensors that record and relay information to the cloud help maintain digital twins of physical objects, enabling new real-time data applications.

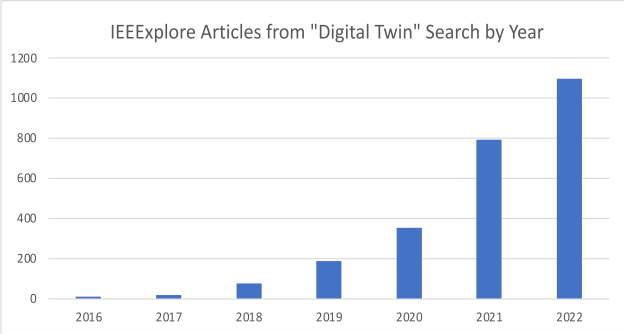

Fig. 1. Number of occurrences in IEEE Xplore of articles with the term "Digital Twin" from 2016-2022.

Chain of Custody: Tracking ownership of systems or units that helps establish ownership and history. Both RFID and blockchain are major parts of this effort.

Visualizations: The creation of a digital twin of an environment allows much more efficient visualization of large amounts of data. For example, a 3D heatmap of real-time retail traffic in a commerce area is much more effective at conveying information than a table of raw, changing numbers.

RFID technology has a part to play in all of these specific areas. These areas and the related "motivation to exist" cut across the many applications and cross-cutting disciplines that were represented by the technical papers at IEEE DTPI 2022. Specifically, some of the digital twin applications discussed in our conference includes healthcare, smart cities, spectrum management, agriculture, and aerospace, to name just a few.

Summary of Special Issue Works: Broken into several key categories, here in the following table are the papers by topic in the special issue on Digital Twins and Parallel Intelligence.

DTPI Topic	References
Aerospace	[A1]-[A3]
Artificial Intelligence	[A4]-[A8]
Energy Systems	[A9]-[A19]
Manufacture	[A20]-[A28]
Medical	[A29]-[A31]
Robotics	[A32]-[A37]
Sensing	[A38]-[A43]
Smart City	[A44]-[A49][A44]
Transportation	[A50]-[A69]

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In Closing: This special issue collects the extended versions of papers presented at *IEEE DTPI 2022 Conference,* and demonstrates the burgeoning interest in Digital Twins as a distinct research field. We look forward to the 2023 editions of the DTPI series, which will once again involve IEEE DTPI 2023 in Orlando, FL in 7-9 November 2023 and the distributed hybrid sister event in Macau SARC from October 16th through November 9th in 2023. We would like to express our appreciation to all the authors contributing to this IEEE JOURNAL OF RADIO FREQUENCY IDENTIFICATION Special Issue.

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APPENDIX: RELATED ARTICLES

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