Advancing Resilient and Trustworthy Seamless Positioning and Navigation: Highlights From the Second Volume of J-ISPIN

THIS year sees the publication of the second volume of the IEEE JOURNAL ON INDOOR AND SEAMLESS POSITIONING AND NAVIGATION (J-ISPIN), a gold open-access publication of the IEEE Sensors Council, the IEEE Signal Processing Society, and the Instrumentation and Measurement Society.

With 25 original articles, this volume covers a wide range of subjects proposing highly innovative solutions compared with more traditional subjects, such as using Wifi and Bluetooth radio signals and fingerprints. New sensor technologies and data utilization are gaining attention, driving the field forward with novel concepts and applications.

Among the emerging technologies featured in this volume is a power over ethernet-enabled visible light positioning scheme with low-bandwidth and high-precision pulse reconstruction, millimeter-wave radar technology, omnidirectional transmitting and receiving acoustic sensors that leverage reflected signals measured with Doppler effects and, finally, phase shifts detected on injection-locked tunable photonic oscillators. These solutions demonstrate exceptional accuracy in 2-D and 3-D indoor localization, achieving localization's accuracy from millimeter to decimeter levels.

A significant proportion of the articles employ artificial intelligence (AI) methods to enhance positioning performance in environments where measurements are heavily degraded by surrounding conditions. Techniques, such as machine learning, are utilized to estimate radio signal propagation delays or weights, while transfer learning methods generalize approaches to different urban environments. More and more AI-driven advancements improve integrity estimation for critical applications, including guidance systems for the visually impaired.

Several articles reflect the multidisciplinary dimension of the journal, placing humans at the center of the challenges addressed. For example, one study focuses on recognizing behavioral changes within groups to analyze social interactions using cameras. Another explores seamless personal services by managing transitions between different spaces, such as indoors and outdoors, equipped with localization systems.

As the vulnerability of global navigation satellite systems (GNSSs) in outdoor environments increases, the need for resilient navigation systems has become more urgent than ever. Research and innovative technologies published in this volume and those to come are pivotal in addressing urban vulnerabilities. By tackling seamless positioning and navigation challenges, J-ISPIN plays a crucial role in overcoming GNSS vulnerabilities and ensuring global navigation safety. Similarly, spoofing, now an emerging threat even to ultra wide band (UWB) indoor positioning systems, underscores the need for robust spoofing-detection or spoofing-free localization techniques. One article notably open sources its simulation code for detecting distance spoofing with UWB tags, paving the way for more secure and trustworthy indoor localization applications.

These advancements are vital for fostering a new generation of resilient and reliable navigation solutions, further reinforcing the importance of J-ISPINs contributions to safeguarding navigation systems against emerging threats.

We sincerely thank the authors featured in this issue for their outstanding contributions and support of J-ISPIN. We are very grateful to the members of the Editorial Board for their efforts in finding qualified reviewers, providing constructive feedback to authors and making thoughtful publication decisions. Our sincere thanks also go to the reviewers, whose dedication is essential to maintaining the high quality of the journal.

We hope you enjoy the wide range of articles in this second volume of J-ISPIN.

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