From Picosatellites to Quantum Genetic Algorithms – the latest proceedings of Infocommunications

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THE 2023 autumn issue of Infocommunications Journal gives a nice mixture of the latest "news" in our domain.

The article by Hussein Taha, Péter Vári and Szilvia Nagy discusses the future of the 470-694 MHz band in Europe, as the World Radiocommunication Conference 2023 (WRC-23) is set to decide on its use, balancing broadcasting services and mobile broadband needs. It analyzes various options, recommending secondary allocation to mobile service in a downlink-only mode to accommodate both broadcasting and mobile services without causing interference.

Tibor Herman and Levente Dudás introduces a new technique for identifying picosatellites and estimating their Doppler shift using passive radar methods and crosscorrelation with known transmissions in their paper. Their method enables the use of omnidirectional antennas instead of high-gain directional ones. The algorithm compensates for antenna gain differences and has been practically tested on the MRC-100 PocketQube mission. The method particularly addresses the challenge of Doppler estimation for small satellites without precise orbital data post-launch, enhancing tracking accuracy when multiple satellites are closely grouped in orbit.

The paper by Mohamed Al Amrani et al. presents a novel approach to optimizing caching and availability in UAVassisted cellular networks for 5G, employing game theory to analyze the competition among UAVs for caching and sharing revenue, leading to cost-effective strategies for energy and QoS. The study underscores the importance of UAVs as flying relays in smart city development and 5G networks, focusing on optimizing network performance through competitive game theory to achieve a Nash equilibrium that maximizes coverage and ensures fair pricing.

In their paper, Ameen Al-Azzawi and Gábor Lencse delve into the Lightweight 4over6 (lw4o6) transition technology, which facilitates the move from IPv4 to IPv6, comparing it to DS-Lite in terms of topology, functionality, and security concerns. Through a practical test-bed built with open-source software like Snabb, their study explores lw4o6's efficiency and security by simulating attack scenarios and suggesting countermeasures.

The paper by János Csatár, Péter György and Tamás Holczer investigates security weaknesses of the IEC 60870-5-104 protocol, widely used in European power systems, which lacks essential security features such as encryption and authentication. The authors developed and tested novel attack vectors in both simulated and actual environments, and in the paper highlighted potential entry points for threat actors and demonstrating how attacks can be precisely targeted to compromise telecontrol systems.

György Wersényi evaluated bone conduction and active noise-cancellation headsets through listening tests in a virtual environment. One of the key findings was that up to five virtual source locations could be reliably identified using stereo panning, regardless of the noise cancellation feature and the spectral content of the sounds. Bone conduction headsets matched the detection accuracy of ANC headsets, despite lower subjective sound quality. Future research will involve visually impaired participants and various distractor sounds to further assess headset performance.

The study by A. M. A. Sabaawi, M. R. Almasaoodi, S. El Gaily, and S. Imre presents the highly constrained quantum genetic algorithm (HCQGA), a novel quantum computing method aimed at solving optimization problems with extremely large and complex search spaces that are impractical for current classical or quantum processors. The HCQGA was tested on maximizing energy efficiency in an uplink multicell massive MIMO system, achieving faster convergence to the optimal solution than classical algorithms.

In their paper, Balázs Ádám Toldi and Imre Kocsis propose a novel blockchain-based method for preserving the confidentiality of collaborative business processes orchestrated by smart contracts, which safeguards sensitive information by only storing encrypted and hashed process states and using zero-knowledge proofs to validate participant actions. This approach, which focuses on a practical subset of BPMN models, ensures secure message-passing between participants and includes an open-source prototype that automatically generates essential software components. The presented solution is unique and has been functionally validated and assessed for its efficiency in terms of computational resources and associated blockchain transaction costs.

Adrian Pekar et al. investigate the adaptive gradual flow aggregation in network flow metering systems as a means to balance the preservation of detailed flow information with the need for data volume reduction, due to the challenges of scalability in managing growing flow entries. Their paper concludes that this method can optimize the trade-off between resource constraints (CPU and memory usage) and the integrity of flow information, with one specific buffer (B2) offering the best balance with a minimal loss of information deemed acceptable for enhanced resource efficiency.

With this overview, let us see all the Infocommunications Journal papers in the 3nd issue of 2023.

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