Mobile Networks and Applications (2023) 28:82–84
https://doi.org/10.1007/s11036-022-02081-8

Editorial: Wireless Networks and IoT Applications

Sérgio F. Lopes[1] · António D. Costa[2] · Henrique M. Dinis Santos[3]

Published online: 3 January 2023

1 Editorial

Wireless networks play a key role in IoT applications, often with wireless sensor networks as ad hoc local area networks with self-healing routing, recent low-power wide-area network technologies enabling new application fields and/or more efficient architectures, and mobile networks offering the possibility of extending applications to remote areas. Wireless networks also enable innovative and interesting applications ranging from smart-homes and smart-cities to precision agriculture and advanced healthcare. The widespread acceptance of these new services can be improved by designing techniques, promoting ubiquity and security, the definition of new protocols, new and more efficient sensors, and developing frameworks and architectures. All these contributions can not only simplify the development of IoT applications, but also system design, deployment, resilience, monitoring, and maintenance, taking into account power requirements and physical assembly, frequently in adverse environments. Although there are wireless networks and IoT technologies that enable high impact and diverse applications, there are many opportunities to innovate and foster future applications.

This special issue features six selected papers of high quality. The first paper, "EIPSO: an Energy efficient Indoor Positioning System based On game theory", proposes a new indoor 3D localization algorithm with improved energy efficiency. To achieve that, authors apply a non-cooperative game theory approach which considers link quality and battery levels to optimize the transmit power of anchor nodes. Experimental results point to an improvement of more than 40% of the network lifetime while maintaining a positioning accuracy level above 90%.

Extending the life of machinery is decisive for both businesses cost effectiveness and for a world with finite resources and limited materials recycling. Predictive maintenance is key to that, and the second paper, "Low-Cost Industrial IoT System for Wireless Monitoring of Electric Motors Condition", proposes a system for real-time monitoring of electric motors. It is an IoT system for Industry 4.0 that features vibration and temperature wireless sensors and a cloud information system that helps to prevent failures in electric motors.

The third paper ("A Comprehensive Study of Security and Cyber-Security Risk Management within e-Health Systems: Synthesis, Analysis and a Novel Quantified Approach") addresses the Risk Management issues within a susceptible area, e-Health, exposed to the emerging risks from the ongoing digital transformation. The evolution of the IoT paradigm is analysed along with its impact on e-Health applications, giving place to the so-called IoMT (Internet of Medical Things). The impact of security risk is noticeable, and the lack of trust may easily jeopardise highly relevant applications. The authors describe a study of Risk Management platforms used to address those issues in typical IT environments and show their limitations in IoMT. They identify several issues, not only technical but also legal, organisational, and even personal (lack of skills), derive some requirements, and propose a framework for Risk Management within e-Health systems. They propose a quantifiable approach based on well-defined Risk Management standard methods, using a reference architecture to deploy within an e-Health system. They also provide some possible use cases with detailed implementation details, particularly patient monitoring (covering an example from the Covid-19 pandemic situation).

The proliferation of mobile devices and their need to keep connected to the Internet has brought some attention to Mobile Adhoc Networks (MANET). One of the most critical functions of this type of network is routing, which is also the

✉ Sérgio F. Lopes
sergio.lopes@dei.uminho.pt

[1] Industrial Electronics Department, University of Minho, Guimarães, Portugal

[2] Department of Informatics, University of Minho, Braga, Portugal

[3] Information Systems Department, University of Minho, Guimarães, Portugal

main target of malicious activities. Disrupting the routing function with MANET may cause severe damage to applications relying on it. In the fourth paper ("Efficient Mobile Ad Hoc Route Maintenance Against Social Distances Using Attacker Detection Automation"), the authors analyse the main threats against the MANET routing protocols and the security controls available. After, they propose a new method to detect attackers, the Attacker Detection Automation of Bee Colony Optimization (ADABCP) method. They also describe some experiences aiming to compare the performance of the proposed solution, which shows some improvements over the other referred solutions in terms of communication overhead and energy consumption (despite the rising number of packets).

In the fifth paper, titled “Efficient Tree Aggregation and Processing Time for Wireless Sensor Networks “, the authors propose an algorithm for data aggregation in a Wireless Sensor Network structured as a tree, that takes into account the position of the parents, the number of leaves and the depth of the tree, in order to compute the optimal data aggregation time for each node in a tree towards the sink node in a WSN. The goal is to maximize data aggregation gain (traffic reduction due to aggregation) and to improve network performance, not failing to provide data within a given maximum acceptable delay. After enumerating the base assumptions, the algorithm called “Efficient Tree-based Aggregation and Processing Time” (ETAPT) is detailed, illustrated with one example, and then evaluated by simulation using QualNet 5.0. Results show that ETAPT provides a higher data aggregation gain, with lower energy consumption and end-to-end delay, when compared to two other related algorithms called “Aggregation Time Control” (ATC) and “Data Aggregation Supported by Dynamic Routing” (DASDR).

The sixth and last article, titled “Performance Improvement of Kötter and Kschischang Codes and Lifted Rank Metric Codes in Random Linear Network Coding”, presents a novel network coding scheme (referred to as NEC-CRC) that aims to improve the correction capabilities of KK and LRMC in mesh networks, when intermediate nodes apply random linear network coding. The goal is to prevent error propagation using error detection codes (CRC) to detect and remove wrong packets from the linear combinations. The authors first describe the problem, followed by an overview of KK and LRMC codes. The proposal is then detailed and evaluated using a simulator called NCS-EC (Network Coding Simulator with Error Correction). NEC-CRC was tested for transmission over coded networks where each link was modelled as a CBS or a GE channel, and a significant performance improvement was achieved compared to network error correction (NEC) without error detection.

Acknowledgements The guest editors are thankful to the reviewers for their effort in reviewing the manuscripts. We also thank the EAI and Springer staff for their support during the process. This special issue was supported by FCT – Fundação para a Ciência e Tecnologia within the R&D Units Project Scope: UIDB/00319/2020, of the Ministry of Science, Technology and Higher Education of the Portuguese Government.

Sérgio F. Lopes is currently an Assistant Professor at the Industrial Electronics Department, Engineering School of University of Minho, and researcher at ALGORITMI Research Centre / LASI, at the same university. He received the MSc degree in Electrotechnical and Computers Engineering from University of Porto, and the PhD degree in Industrial Informatics from University of Minho, Portugal. He participated in several research projects applied to fields such as, agriculture, climate, sea, production line inspection and tourism. He has served as treasurer of Portuguese chapter of IEEE Computer Society, organized 3 international scientific events, and served as editor and guest editor for 4 technical journals and proceedings. He has authored more than 30 papers in indexed publications and his research interests include software modelling and reuse, embedded and real-time systems, multiprocessing, and software performance.

António D. Costa is currently an Assistant Professor at the Department of Informatics, University of Minho, Portugal, where he has developed teaching and research activities in Computer Networks and Computer Communications since 1992. As a researcher, he currently integrates the Computer Communications and Networks (CCN) research group at ALGORITMI Research Centre / LASI, School of Engineering, University of Minho. He graduated in Systems and Informatics Engineering in 1992, obtained an MSc Degree in Informatics in 1998 and a PhD Degree in Computer Science in 2006 at the same university. He participated in several research projects, supervised MSc and PhD students, and co-authored more than seventy peer-reviewed papers in Vehicular Networks, Indoor positioning, Ad-Hoc Networks, Routing Protocols, Network Services, Quality of Service, P2P, IoT and Network Management. His current research interests are Vehicular Networks,

Named Data Networks, Indoor positioning, Internet of Things and Future Internet.

Henrique M. Dinis is an Associate Professor at the Information Systems Department, University of Minho, developing his research work in ALGORITMI Research Centre, at the same university. His main research and lecturing activities are in the Information Security area – emphasis on curricula development, Intrusion Detection, and IoT Security – and Computer Architecture area – emphasis on Computer Vision and Cloud Computing. He is also the President of a national Technical Committee (CT 136) for information system security standardization, President of the Portuguese Association for Data Protection (APPD), was Vice President for Conferences and Workshops of IEEE Education Society, from 2017 to 2021, and integrates frequently advice and scientific committees supporting civil, governmental and military organizations, concerning Information Security subjects. During the second semester of 1990, under an ERASMUS program, he was teaching at the University of Bristol, United Kingdom, where he was recognized as University Academic staff.