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## Editorial

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**Biographical notes:** Arun Kumar Sangaiah received his Master of Engineering in Computer Science and Engineering from Anna University, India. He received his Doctor of Philosophy in Computer Science and Engineering from VIT University, India. He is presently working as an Associate Professor in School of Computing Science and Engineering, VIT University, India. His areas of interest include software engineering, computational intelligence, wireless networks, etc. He has authored more than 100 publications in different journals and conferences. Besides, he is an editorial board member/Associate Editor of various international journals. In addition, he has edited a number of guest editorial special issues for Elsevier journals.

Quan Z. Sheng is a Full Professor and the Deputy Head of the School of Computer Science at the University of Adelaide. He holds a PhD in Computer Science from the University of New South Wales (UNSW) and has six years of experience as a Senior Software Engineer in industries. He has more than 250 publications as edited books and proceedings, refereed book chapters, and refereed technical papers in leading journals and conferences. He is one of the top-ranked authors in the World Wide Web research area by Microsoft Academic Search. He is the recipient of the Australian Research Council (ARC) Future Fellowship (2014), Chris Wallace Award for Outstanding Research Contribution (2012), and Microsoft Research Fellowship (2003).

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The internet of things (IoT) is a model of computing that deals with the usage of standard communication protocols to connect heterogeneous things in the world. Moreover, it enables devices of different functionality, technology and application to identify and effectively communicate with each other to achieve a goal. IoT expands the current Internet with the objectives of connecting smart objects, detecting real time changes in the surrounding environment and taking appropriate actions. Consequently, the technological evolution of IoT-related devices and communication protocols has a significant impact in the modern business world. Furthermore, the emergence of new sets of devices in industry results in the generation of new types of data and imposes a strong need for gaining efficiency, harnessing intelligence from a wide range of equipment and increasing customer satisfaction. Also, IoT applications are gaining substantial influence in addressing the socio-economical and business needs of the environment. The aim of this special issue is primarily to bring together the contributions of IoT researchers and disseminate the issues and proposed solutions in improving the communication, control and cost challenges that have a profound impact in business; resolving heterogeneity issues; addressing security threats; and formulating methods for

service/device discovery. The challenging issues in IoT span the disciplines of embedded systems, wireless sensor networks, data analysis and management, intelligence, radio access networks, telecommunication and cloud computing. To address these challenges, we need novel analytical tools, processes and methods with appropriate fundamental mathematical connotations to shed light on the performance limits of IoT systems and to lead to the design, implementation development and optimisation of evolving IoT technologies.

In the paper entitled 'A power management solution for Bluetooth low energy in smart homes of internet of things', Mario Collotta and Giovanni Pau propose a novel fuzzy-based solution that determines the sleeping time of field devices, in a home automation wireless network based on Bluetooth low energy (BLE), in order to improve its energy efficiency. Moreover, the proposed solution determines the sleeping time of field devices according to the battery level and to the ratio of throughput to workload (Th/Wl). The results obtained for Th/Wl are acceptable in contexts with and without real-time constraints.

The paper by Senthil Murugan Balakrishnan and Arun Kumar Sangaiah entitled 'Aspect-oriented middleware framework for resolving service discovery issues in internet

of things', explores the possibility of developing a smart solution in terms of middleware to overcome the hurdles in the design and the implementation of IoT. Consequently, the proposed work aims at contributing to the objective of solving certain issues like unknown topology, missing data point information and inaccurate data entry occurs during the service discovery in IoT and more specifically focusing on implementing the aspect oriented middleware and investigating its performance.

The paper by Ahmed Ismail and Wolfgang Kastner entitled 'Vertical integration in industrial enterprises and distributed middleware', presents the main requirements involved in the design of middleware solutions for vertical integration in enterprise infrastructure. Solutions from both the information and operations technology sectors are examined in light of said requirements with the aim of enhancing the current state of middleware solutions and industrial enterprises alike. In addition, this paper overviews the concepts of enterprise reference architectures (ERA) and ERA-derived network designs, respectively, along with discussions on methods of middleware integration with such ERAs and networks.

In the paper entitled 'Linear discriminant analysis-based service discovery algorithm in MANET', M. Buvana, M. Suganthi and K. Muthumayil present SD-LDA (linear discriminate analysis-based service discovery) algorithm to find web services. This paper exploits a solution for service discovery in ad hoc environment based on clustering using LDA algorithm. Moreover, SD-LDA aims to minimise the communication cost during service discovery and it is very flexible, efficient and can be adopted to work in an ad hoc environment. The result of this paper reveals that less energy consumption during service discovery (LDA), minimise the discovery overhead, and rank identification.

The paper by S. Bharath Bhushan and Pradeep Reddy entitled 'BB-LBA: biogeography-based load balancing algorithm in multi cloud domain', proposes a biogeography-based load balancing algorithm (BB-LBA), which balances the load across geographically distributed data centres' and virtual machines for maximising the throughput. The authors derived Markov models for biogeography-based load balancing in multi cloud domain with migration and mutation operators. A comparative experiment with genetic algorithm, particle swarm optimisation is conducted, and the results show that the proposed BB-LBA algorithm outperforms the other methods in term of response time, number of task migrations and waiting time of tasks in queue.

In the paper entitled 'Remote user authentication scheme using smart card: a review', Marimuthu Karupppiah investigates most of the currently available user authentication schemes over insecure wireless networks. Moreover, the authors have defined all the security requirements and goals of an ideal remote user authentication scheme. Consequently, the paper presents a survey of remote user authentication schemes for the client-server model. The performance analysis and security

requirement comparisons of the related schemes are also discussed in this paper.

The paper by Wenjing Yue, Cong Wu and Zhi Chen entitled 'Cooperative spectrum sensing based on side information for cognitive radio sensor networks in internet of things applications', proposes a cooperative spectrum sensing scheme based on side information, and the scheme uses a cooperative spectrum sensing framework and an efficient clustering algorithm that can meet the specific requirements of IoT applications. Moreover, simulation results show that the proposed cooperative spectrum sensing scheme has better performance than the conventional cognitive radio models such as equal gain combining, maximal ratio combining algorithm. In addition, the influence of sensor nodes' density and distance range on the sensing performance is analysed.

The paper by H. Abdul Gaffar and P. Venkata Krishna entitled 'A virtual backoff algorithm-based MAC protocol for underwater acoustic sensor networks', presents a new medium access control (MAC) protocol for underwater communication which is called as underwater virtual backoff algorithm-based medium access control (UVMAC). In addition, UVMAC approach is mainly based on virtual backoff algorithm (VBA). The simulation results show that the proposed UVMAC perform well compared to reservation medium access control (RMAC) and broadcast MAC for underwater acoustic sensor networks (UASN).

The paper of Swathi Jamjala Narayanan, Rajen B. Bhatt and Ilango Paramasivam entitled 'User localisation using wireless signal strength – an application for pattern classification using fuzzy decision tree', introduces a new pattern classification application called user localisation using wireless signal strength. In addition, the authors have proposed the fuzzy decision tree (FDT) for this classification problem. Similarly, this work made an attempt for different extension of FDT development using fuzzy ID3 by introducing changes in various modules of FDT construction.

Finally, in the paper entitled 'Fuzzy trust-based aggregator sensor node election in internet of things', G. Rajesh, X. Mercilin Raajini and B. Vinayagasundaram present fuzzy-based aggregation algorithm (FTBA). Moreover, this FTBA has been validated, verified and the performance is found to be better than the existing direct transmission, LEACH and PEGASIS protocols. Consequently, FTBA outperforms compared with existing approaches like LEACH, PEGASIS, and direct transmission in performance parameters like aggregation ratio, network life time, average node's residual energy and false positive rate of the aggregator election.

We thank all the authors for considering this special issue as an outlet to publish their research results. We also would like to thank the referees who provided very useful and thoughtful feedback to the authors. This special issue would not have been possible without their help and selfless dedication. We also would like to thank the Editor-in-Chief of *IJIPT*, Professor Sherali Zeadally, for his continuous support during the review and publication process.