Hindawi Publishing Corporation
International Journal of Distributed Sensor Networks
Volume 2016, Article ID 4964068, 2 pages
http://dx.doi.org/10.1155/2016/4964068

Editorial

Applications of Cognitive Radio Networks: Recent Advances and Future Directions

Sung W. Kim,[1] Miao Pan,[2] Gyanendra Prasad Joshi,[1] Orhan Gazi,[3] Jianhua He,[4] and Marceau Coupechoux[5]

[1] *Department of Information and Communication Engineering, Yeungnam University, Gyeongsan 38541, Republic of Korea*
[2] *Department of Computer Science, Texas Southern University, Houston, TX 77004, USA*
[3] *Department of Electric and Communication Engineering, Cankaya University, 06790 Ankara, Turkey*
[4] *Department of Electrical, Electronic and Power Engineering, Aston University, Birmingham B4 7ET, UK*
[5] *Department of Computer and Network Science, Telecom ParisTech, 75013 Paris, France*

Correspondence should be addressed to Gyanendra Prasad Joshi; joshi@ynu.ac.kr

Received 13 December 2015; Accepted 14 December 2015

Contemporary wireless networks must meet the ever increasing bandwidth requirements to assure the quality of service (QoS) to the end users. Cognitive radio (CR) technology with efficient electromagnetic spectrum management can achieve increased bandwidth beyond its traditional limits. The innovative spectrum management by CRNs allows for usage of incumbent spectrum band by unlicensed (cognitive) users possibly without interfering with the incumbent users. CR network is an intelligent and adaptive wireless communications system in which CR devices learn from its surroundings and decide the operation based on the learning. CR devices are inevitably so intelligent that they can dynamically choose carrier frequency, bandwidth, transmission rate, transmission power, and so forth.

There are many emerging CR networks applications based on CR technologies. This special issue is focused on presenting state-of-the-art research results on the application of CR networks. This is targeted for the innovative and productive discussion on the recent advancement in the application of CR networks and future directions.

The article "Convergence Research Directions in Cognitive Sensor Networks for Elderly Housing Design" by S. Suh et al. is about the application of CR sensor network. It defines smart home and surveys CR sensor network- (CRSN-) based systems for elderly housing. This article proposes research directions for the elderly smart home services based on CRSN. Particularly, the article is focused on adopting CRSN technologies to cope with dense sensors environment and heterogeneous network environment. It also discusses customizing sensors/networks classification correlated with the elderly types, and converging sensor network technologies with architectural technologies.

A lightweight and robust mechanism that appropriately secures the channel selection process is presented in the article "A Cognitive-Radio-Based Method for Improving Availability in Body Sensor Networks" by O. León et al. In this article, authors describe a new network paradigm known as cognitive body sensor networks (CBSNs). In the body area networks, seamless connectivity is crucial and must be guaranteed. Connectivity losses during emergency situations may prevent a patient from immediately receiving medical assistance and may end up in catastrophic results. This article discusses how to prevent CBSNs from the specific attacks by securing the sensing process. The proposed method relies on cryptographic primitives that require a minimum amount of memory and low energy consumption, thus being more suited for devices with limited resources. It offers authentication and encryption of control data shared by the sensors in the CBSN to agree on a given channel.

An energy-efficient layered video multicast (LVM) transmission over OFDM-based CR systems for "bandwidth-hungry" video services is presented in the article entitled

"Energy-Efficient Layered Video Multicast over OFDM-Based Cognitive Radio Systems" by W. Xu et al. This article proposes an energy utility- (EU-) based power allocation algorithm by jointly employing fractional programming and subgradient method. The novel performance metric EU is proposed to measure the sum of achieved quality of reconstructed video at all subscribers when unit transmit power is consumed. The objective is to maximize the system EU by jointly optimizing the intersession/interlayer subcarrier assignment and subsequent power allocation. To achieve the objective, it performs subcarrier assignment for base layer and enhancement layers using greedy algorithm and then presents an optimal power allocation algorithm to maximize the achievable EU using fractional programming.

In the article "A Cross-Layer-Based Routing Protocol for Ad Hoc Cognitive Radio Networks" by G. P. Joshi et al., the authors propose a cross-layer-based routing protocol for mobile ad hoc CR networks. The motivation for this paper is that rerouting is expensive in terms of energy, delay, and throughput. Thus, it is better to select a route in such a way that requires less channel switching. This paper examines the expectation of channel switching in the range of scenarios and proposes a novel route selection method to mitigate the frequent channel switching. Because excessive workload on a particular node causes network partitioning and induces repeated rerouting, the proposed protocol distributes the routing overheads among cognitive users in the network and prolongs the network lifetime. This protocol incorporates power awareness and spectrum information with a cross-layer approach.

The Sensor Virtualization Module (SVM) is proposed in the article "Sensor Virtualization Module: Virtualizing IoT Devices on Mobile Smartphones for Effective Sensor Data Management" by J. Ko et al. There are limited IoT resource-utilizing applications due to the traditional stovepipe software architecture, where the vendors provide supporting software on an end-to-end basis. The proposed SVM in this article provides a software abstraction for external IoT objects and allows applications to easily utilize various IoT resources through open APIs. It also presents the applications with a common virtualized environment where external IoT devices can be easily accessed from and via mobile computing platforms.

In the article "An Analytical Approach to Opportunistic Transmission under Rayleigh Fading Channels" by Y. B. Zikria et al., the authors present the effectiveness of the opportunistic transmission in terms of reliability and delay of transmission analytically. A fixed-distance-based statistical model is proposed for multihop and opportunistic transmission for CRSNs. Also, a unique generic Markov chain model is proposed to show the stability of opportunistic transmission.

Acknowledgments

This work was supported by the 2015 Yeungnam University Research Grant. Finally, we thank all the authors who submitted their work to this special issue and many experts who participated in the review process. We expect that this issue will certainly help researchers, academicians, practitioners, and industrialists to realize the recent advances and also may help them to work in the future directions.

Sung W. Kim
Miao Pan
Gyanendra Prasad Joshi
Orhan Gazi
Jianhua He
Marceau Coupechoux