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A Survey on Energy Efficiency Transmission in Cognitive Radio Network

Gulshan kumar[1], Prof. Jitendra Mishra[2]

[1]M. Tech Scholar, Department of EC, PIES, Bhopal (India)

[2]Head & Professor, Department of EC, PIES, Bhopal (India)

[1]gulshankumarbhu@gmail.com, [2]jitendra.mishra260@gmail.com

ABSTRACT

As the explosion of wireless devices and services make the unlicensed spectrum increasingly crowded, traditional sensor networks operating on the unlicensed spectrum may suffer from severe interference caused by the nearby applications working on the same spectrum band. Cognitive radio sensor network (CRSN) has emerged as a promising solution to address the spectrum scarcity problem in traditional sensor networks, by enabling sensor nodes to opportunistically access licensed spectrum. In this paper we study various research papers on wireless sensor network to solve the problem of traditional sensor networks.

Keywords: Cognitive radio, Wireless Sensor Network, Cognitive Radio Network, Wireless local Area Network, Spectrum.

INTRODUCTION

Wireless sensor network (WSN), as a promising event monitoring and data gathering technique, has been widely applied to various fields including environment monitoring, military surveillance and other industrial applications [1]. Energy supply is always a critical issue in wireless communications. Traditionally, portable/mobile wireless nodes operate with energy supply from a battery, which has a limited capacity and needs to be physically charged or replaced regularly. Recently, RF energy harvesting technology has been developed and is able to supply energy to wireless nodes [9]. The constantly growing request for advanced multimedia services, combined with the resource constraints of wireless networks, places increased stress on the fixed radio spectrum used by the current access technologies.

The need for improved resource allocation techniques becomes even more essential as some spectrum usage measurements indicate that a significant amount of spectrum is used sporadically, leading to its underutilization [5].

Wireless sensor networks (WSNs) are characterized by the communication and resource-constrained devices, and traditionally, they employ a low-power communication standard such as IEEE 802.15.4 that operates on unlicensed fixed spectrum. The unlicensed spectrum has become saturated due to the coexistence of various emerging networking standards, particularly IEEE 802.11, Bluetooth (IEEE 802.15.1), and WSN itself. It is therefore imperative to exploit the dynamic spectrum access techniques in WSNs by employing CRs, hence giving birth to the CR sensor networks (CRSNs) [3].

Channel binding has been used in many types of wireless networks such as wireless local area networks (WLANs), cellular networks, wireless sensor networks (WSNs) and cognitive radio networks (CRNs). Although these wireless networks have been widely researched, it is important to use effective spectrum assignment techniques to support channel bonding, and thereby, improving spectrum utilization [4]. The demand for radio spectrum has increased tremendously with recent advances in wireless communication technologies.

The major reason for the spectrum shortage is the current policy of fixed spectrum assignment. Cognitive radio represents a solution to this spectrum scarcity, as well as to the issue of underutilization of licensed bands [12]. Cognitive radios can operate in both licensed and unlicensed bands.

A cognitive radio network (CRN) is formed by advanced radio devices, which observe the radio environment for a suitable band, employ an intelligent agent for decision-making and a frequency-agile radio that can be tuned to a wide range of frequency bands and, eventually, operate on an intelligently selected band [8]. Cognitive Radio (CR) has emerged as a promising technology to improve the spectrum utilization by enabling opportunistic access to the licensed spectrum bands [3]. This technology can also be applied to WSNs, which leads to Cognitive Radio Sensor Networks (CRSNs). Sensor nodes in CRSNs can sense the availability of licensed channels and adjust the operation parameters to access the idle ones, when the condition of the licensed-free channel degrades. In CR terminology, primary users (PUs), also known as incumbent users, are licensed users with legacy rights or higher priority to utilize a particular part of the spectrum. Secondary users (SUs), also referred to as cognitive users, are unlicensed users with a lower priority, and exploit the spectrum opportunistically such that PUs do not suffer harmful interference from them. SUs as a result must possess CR capacity, such as dynamic spectrum access techniques, that will allow them to function in the most favorable channel [7].

In the context of cognitive radio (CR) based networks, dynamic spectrum access (DSA) has turned out to be a promising approach for communication in those bands where radio spectrum is already overcrowded [6]. This approach has already shown a positive impact on the power consumption levels, network life time and the interference faced by its member nodes [4]. However, since the energy consumption for supporting the CR functionalities, e.g., channel sensing and switching, is considerable for battery-powered sensor nodes, the opportunistic channel access should be carefully studied to improve the energy efficiency in CRSNs [1].

The regulation of radio spectrum today is based on a fixed spectrum assignment policy, where government agencies regulate spectrum usage and assign portions of the spectrum over extended periods of time and large geographic areas to license holders or services such as mobile cellular communication or terrestrial television. Large portions of the allocated spectrum are utilized intermittently and spectrum use is congested at particular regions of the spectrum space, while a considerable part of it is left underutilized [7].

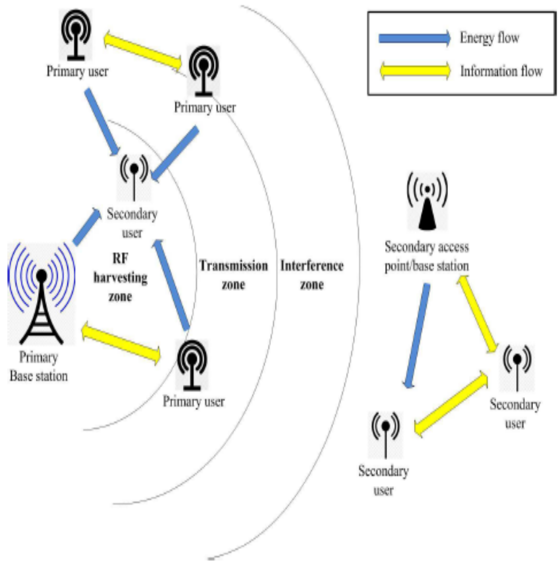

Fig. 1: Network architecture of RF-powered cognitive radio networks [9].

The rest of this paper is organized as follows in the first section we describe an introduction of about the wireless sensor and cognitive radio network. In section II we discuss about the wireless sensor network. In section III we discuss about the rich literature for the cognitive radio and wireless sensor networks. In section IV we discuss about the problem formulation and statement as we getting from the rich literature survey, finally in section V we conclude the about our paper which is based on the literature survey and specify the future scope.

II WIRELESS SENSOR NETWORKS

Wireless sensor networks (WSNs) have become a prevalent solution to a wide range of applications including environmental monitoring, patient monitoring and smart homes [11]. Typically, WSN uses the unlicensed Industrial, Scientific, and Medical (ISM) band for data transmission. However, with the exponential growth in the number of wireless devices operating in this band, WSNs suffer from severe interference [11].

A wireless sensor network (WSN) is a combination of many autonomous small computing nodes (called motes) deployed over an area or a region. These small motes can be deployed for large number of applications, for example, indoor sensing, industrial automation, forest fire detection, remote surveillance, and collecting weather information. Although the requirements for each of these applications vary to great extent, majority of these applications require high bandwidth, low latency, network robustness, energy conservation, and simultaneous access from several nodes with in a small geographical area [4]. Though WSNs have a wide range of applications, their successful operation is extremely challenging due to several reasons. In many applications, sensor nodes have to be randomly deployed in harsh, remote and inaccessible geographic locations (e.g., in underground mines for monitoring, in forests for early fire detection , in disaster affected areas for situation management, etc.), thereby requiring self organization capabilities in the resulting WSN [6].

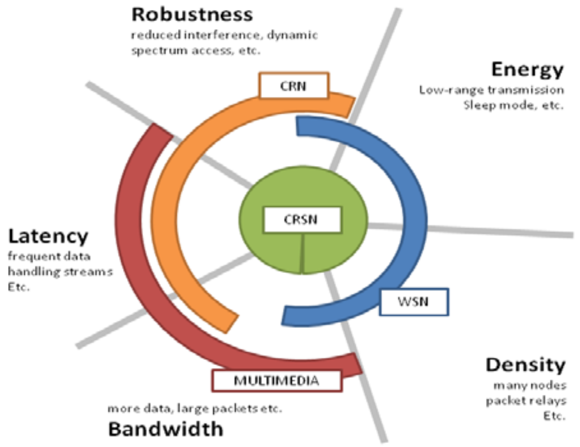

Fig. 2: Types of wireless networks and major requirements in their applications [4].

III RELATED WORK

In this section we discuss about the rich literature survey for the cognitive radio and wireless sensor networks**.**

[1] In this paper, they have studied the dynamic channel accessing problem to improve the energy efficiency in clustered CRSNs. By considering the energy consumption in channel sensing and switching, they have determined the conditions of sensing and accessing licensed channels for potential energy consumption reduction. It can provide some insights for making channel switching decisions in CRSNs, from the perspective of energy efficiency.

[2] This paper focuses on the investigation of the receiver-based routing protocol for enhancing QoS in cognitive radio-enabled AMI networks, due to their potentials of enhancing reliability and routing efficiency. In accordance with practical requirements of smart grid applications, a new routing protocol with two purposes is proposed: one is to address the real time requirement while another protocol focuses on how to meet energy efficiency requirements.

[3] In this paper, a cognitive adaptive MAC (CAMAC) protocol, which supports opportunistic transmission while addressing the issue of power limitation in CRSNs, is proposed. Energy conservation in CAMAC is achieved in three fronts: on-demand spectrum sensing, limiting the number of spectrum sensing nodes, and applying a duty cycle. Spectrum sensing is initiated on-demand when the nodes have data to transmit, and it also exploits a subset of spectrum sensing nodes to gather spectrum availability information for all the nodes.

[4] This paper first focuses on providing a survey of CB schemes for traditional wireless networks such as cellular networks, wireless local area networks and wireless sensor networks, and then provides a detailed discussion on the CB schemes proposed for cognitive radio networks.

[5] This paper provides an overview of cognitive radio (CR) networks, with focus on the recent

advances in resource allocation techniques and the CR networks architectural design. The contribution of this work is threefold. First, a systematic way to study the resource allocation problem is presented; various design approaches are introduced, such as signal-to interference and-noise ratio (SINR) or transmission power-based, and centralized or distributed methods.

[7] In this paper, they discuss the potential benefits and current limitations of using cognitive radio techniques in industrial wireless sensor networks. Cognitive radio approaches can be added to the lower layers of existing industrial network stacks to improve resistance to interference, simplify coexistence with other industrial and consumer networks, and offer additional communication spectrum to allow wideband communication or additional narrow-band channels.

[9] In this article, they provide an overview of the RF-powered CRNs and discuss the challenges that arise for dynamic spectrum access in these networks. Focusing on the tradeoff among spectrum sensing, data transmission, and RF energy harvesting, then we discuss the dynamic channel selection problem in a multi-channel RF-powered CRN.

IV PROBLEM STATEMENT

There is several medium access control protocols are designed for WSN as well as for CRN. Comparison and surveys of them are also published. But that protocols are not directly applicable to CR-WSN due to the limitation of wireless sensor node which is resource limited device [10]. The presented bandwidth is limited so we have to increase the bandwidth of wireless network. For which we increase the Channel bonding along with cognitive radio technology for not even only the increase bandwidth but also help to reduce delay in wireless sensor network. In addition to inefficient spectrum and energy utilization, inaccurate spectrum sensing is another limitation of traditional sensor networks.

V CONCLUSIONS AND FUTURE WORK

Cognitive radio-based wireless sensor network is the next-generation sensor network paradigm. Important to this emerging sensor network is the need to reduce energy consumption, paving way for 'green' communication among sensor nodes. To overcome the limitation of individual spectrum sensing, collaborative spectrum sensing is generally employed in CRSNs to improve the spectrum sensing accuracy. In this paper we presents the rich literature survey for the cognitive radio based wireless sensor network, in future we plan to implement the best solution for the problem discussed in problem statement.

REFERENCES:-

[1] Ju Ren, Yaoxue Zhang, Ning Zhang, Deyu Zhang, and Xuemin Shen, "Dynamic Channel Access to Improve Energy Efficiency in Cognitive Radio Sensor Networks", IEEE TRANSACTIONS ON WIRELESS COMMUNICATIONS, VOL. 15, 2016. pp 3143-3156.

[2] Zhutian Yang, Shuyu Ping, Hongjian Sun, A. Hamid Aghvami, "CRB-RPL: A Receiver-based Routing Protocol for Communications in Cognitive Radio Enabled Smart Grid", Durham Research Online, 2016. pp 5985-5994.

[3] Ghalib A. Shah, Ozgur B. Akan, "Cognitive Adaptive Medium Access Control in Cognitive Radio Sensor Networks", IEEE TRANSACTIONS ON VEHICULAR TECHNOLOGY, VOL. 64,2015. pp 757-857.

[4] Syed Hashim Raza Bukhari, Mubashir Husain Rehmani, and Sajid Siraj, "A Survey of Channel Bonding for Wireless Networks and Guidelines of Channel Bonding for Futuristic Cognitive Radio Sensor Networks", IEEE Communications Surveys and Tutorials, 2016. pp 924-948.

[5] Georgios I. Tsiropoulos, Octavia A. Dobre, Mohamed Hossam Ahmed, and Kareem E. Baddour, "Radio Resource Allocation Techniques for Efficient Spectrum Access in Cognitive Radio Networks", IEEE COMMUNICATION SURVEYS & TUTORIALS, VOL. 18, 2016. pp 825-849.

[6] Ayaz Ahmad, Sadiq Ahmad, Mubashir Husain Rehmani, and Naveed Ul Hassan, "A Survey on Radio Resource Allocation in Cognitive Radio Sensor Networks", IEEE COMMUNICATION

SURVEYS & TUTORIALS, VOL. 17, 2015. pp 888-917.

[7] Tapiwa M. Chiwewe, Colman F. Mbuya, Gerhard P. Hancke, "Using Cognitive Radio for Interference Resistant Industrial Wireless Sensor Networks: An Overview", IEEE 2015. pp 1-16.

[8] Ghalib A. Shah, Member, IEEE, Fatih Alagoz, Member, IEEE, Etimad A. Fadel, and Ozgur B. Akan, "A Spectrum-Aware Clustering for Efficient Multimedia Routing in Cognitive Radio Sensor Networks", IEEE TRANSACTIONS ON VEHICULAR TECHNOLOGY, VOL. 63, 2014. pp 3369-3380.

[9] Lu Xiao, Ping Wang, Dusit Niyato, Ekram Hossain, "Dynamic Spectrum Access in Cognitive Radio Networks with RF Energy Harvesting", 2014. pp 1-16.

[10] Jemish Maisuria, Saurabh Mehta, "An Overview of Medium Access Control Protocols for Cognitive Radio Sensor Networks", 4th International Electronic Conference on Sensors and Applications, 2017. pp 1-7.

[11] Deyu Zhang, Zhigang Chen, Ju Ren, Ning Zhang, Mohamad Khattar Awad, Haibo Zhou, Xuemin (Sherman) Shen, "Energy Harvesting-Aided Spectrum Sensing and Data Transmission in Heterogeneous Cognitive Radio Sensor Network", IEEE 2016. pp 1-20.

[12] Waleed Ejaz, Ghalib A. Shah, Najam ul Hasan, Hyung Seok Kim, "Energy and throughput efficient cooperative spectrum sensing in cognitive radio sensor networks", TRANSACTIONS ON EMERGING TELECOMMUNICATIONS TECHNOLOGIES, 2014. pp 1-12.

[13] Dinh Thai Hoang, Dusit Niyato, Ping Wang, Dong In Kim, "Opportunistic Channel Access and RF Energy Harvesting in Cognitive Radio Networks", IEEE JOURNAL ON SELECTED AREAS IN COMMUNICATIONS, VOL. 32, 2014. pp 2040-2054.

Gulshan Kumar received his Bachelor`s degree in Electronics & comunication, PIT, Bhopal, M.P., in 2015. Currently he is pursuing Master of Technology Degree in Electronics & comunication (Digital communication) from PIES, (RGPV), Bhopal, Madhya Pradesh India. His research area include Wireless sesnor networks.

Mr. **Jitendra Kumar Mishra** he is Associate Professor and Head of the Department of Electronics and communication in PIES, Bhopal (RGPV). His received Master of Technology and Bachelor's of engineering respectively in Digital communication from BUIT, Bhopal and from RGPV, Bhopal. He has more than 10 years of teaching experience and publish 20+ papers in International journals, conferences etc. His area of Interests are Antenna & Wave Propagation, Digital Signal Processing, Wireless Communication, Image Processing etc.