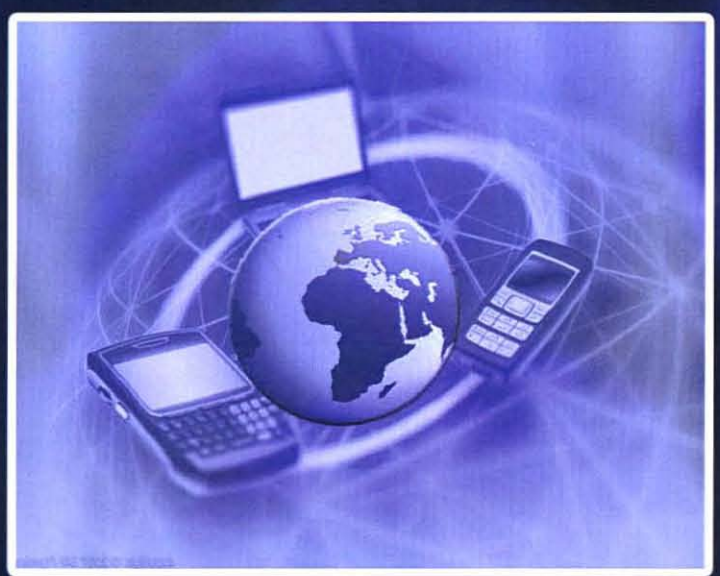
Research Issues in Wireless

Communications and Networking

Farhat Anwar
Wajdi Al-Khateeb



IIUM Press
INTERNATIONAL ISLAMIC UNIVERSITY MALAYSIA

Research Issues in Wireless Communications Networking

Farhat Anwar & Wajdi Al-Khateeb

IIUM Press

Published by:
IIUM Press
International Islamic University Malaysia

First Edition, 2011

Perpustakaan Negara Malaysia Cataloguing-in-Publication Data

Farhat Anwar & Wajdi Al-Khateeb: Research Issues in Wireless Communications Networking

ISBN: 978-967-418-149-9

Member of Majlis Penerbitan Ilmiah Malaysia – MAPIM
(Malaysian Scholarly Publishing Council)

Printed by :
IIUM PRINTING SDN.BHD.
No. 1, Jalan Industri Batu Caves 1/3
Taman Perindustrian Batu Caves
Batu Caves Centre Point
68100 Batu Caves
Selangor Darul Ehsan
Tel: +6**03-6188 1542 / 44 / 45** Fax: +6**03-6188 1543**
EMAIL: iiumprinting@yahoo.com

CHAPTER 29

PROSPECTS AND PROBLEMS OF COGNITIVE RADIO NETWORK ARCHITECTURES IN WIRELESS SENSOR NETWORKS

Abdulazeez F. Salami[1,a], Muktar Hussaini[2,b], Farhat Anwar[3,c], Habeeb Bello-Salau[4,d]
[1,2,3,4]ECE Dept, Fac. of Eng., International Islamic Univ. Malaysia (IIUM)
Jalan Gombak, 53100 Kuala Lumpur, Malaysia
[a]kermkerm1@gmail.com, [b]intaiium@gmail.com, [c]farhat@iium.edu.my, [d]bellosalau@gmail.com

29.1 INTRODUCTION TO COGNITIVE RADIO NETWORKS

Cognitive radio is a technique proposed by Mitola which provides a way to efficiently use precious radio spectrum resources [1, 2]. A cognitive radio recognizes, analyzes, and learns the situations of the radio spectrum and then employs various strategies to maximize spectrum usage. The concept of cognitive radio is to detect and ascertain which aspect of the spectrum is presently unused, and then perform data transmission at the newly discovered frequency band. An alternative cognitive radio scheme is to transmit signals on top of existing transmissions as long as the interference temperature measure is lower than threshold. Spectrum sharing, spectrum sensing, and spectrum management are the stages of a cognitive radio. Spectrum sensing gathers up-to-date spectrum usage data, spectrum management determines the optimal spectrum access timing and scheme, and spectrum sharing ensures that users are served in a fair and timely manner [2, 3].

29.2 TREND OF HIGH-SPEED NETWORKS

Researches on sensor networks have long focused on low power, low data rate systems due to the limitations on hardware complexity and battery lifetime. However, more and more applications require sensor network to support high data rate, and computational expense is getting cheaper and cheaper these days [2]. Therefore, this is one of the motivations for this chapter which delineates the key design issues and concepts in high speed sensor networks. Examples of high speed sensor networks are real-time video surveillance systems and battlefield monitoring systems. Imagine that on a battlefield, cameras mounted on soldiers' helmets are reporting real-time scenes back to squad leaders and commanders. Since there might be many squads on the battlefield, different transmissions might be happening at the same time to achieve high speed and low delay. In addition, sensors might have different characteristics and capabilities, or use different methods to communicate [3, 4].

Moreover, different units might not have time or capability to talk to each other before data transmission. This kind of network, in this chapter, can be viewed as a cognitive radio network [3]. In this chapter, it is proffered that high speed cognitive radio network architectures based on blind signal separation (BSS) methods should be developed. The idea of blind signal separation is to recover original messages by observing signals received from different antennas [4]. This chapter will consider three network scenarios. The first is a simple data collection problem. Two or more sensors want to report to the data collector simultaneously. These sensors can be either homogeneous or heterogeneous. This chapter suggests the consideration of cognitive radio networks without and with routing in the second and the third scenario, respectively. One of the key