International Journal of Engineering Research-Online
A Peer Reviewed International Journal
Articles available online http://www.ijoer.in

Vol.3., Issue.5., 2015
(Sept.-Oct.)

RESEARCH ARTICLE

ISSN: 2321-7758

COMPRESSIVE SPARSITY ORDER BASED SENSING & MULTI HOP NETWORK ACCESS TECHNIQUE FOR REDUCING DELAY CONSTRAINTS IN COGNITIVE RADIOS

PRINCE SHARMA, Dr. RAMESH CHAND KASHYAP

[1]M.tech Student, RIEIT/Punjab Technical University, Punjab

[2]H.O.D ,RIEIT Punjab Technical University, Punjab

PRINCE SHARMA

ABSTRACT

A cognitive radio is basically an intelligent system which is well aware of its vicinity and learns form it in order to make adaptations in its internal states based on the RF stimuli which it receives by carrying out changes in its corresponding operational parameters on real time basis. A cognitive radio can be regarded as a transmitter or receiver operating in the radio frequency which is designed so as to detect whether a segment of this spectrum is being used currently or not. If the segment is being used at that instant, it has the ability to jump to other unused segments of the spectrum in a rapid manner so as to reduce the interference caused to the authorized users [4]. The cognitive radio possesses the ability to coordinate the usage of the spectrum in an autonomous manner. The primary function is to detect the unused part of the spectrum and then to make use of this portion of the spectrum in an intelligent way. These unused portions of the spectrum are called as spectrum holes or opportunities. Since cognitive radio is well aware of its surroundings, they make use of the method of learning from their environment. Then they make adaptations depending on the stimuli received. The most desirable objectives of the cognitive radios are [5]:

To provide a reliable way of communicating when required.

To make use of the spectrum in the most efficient manner.

INTRODUCTION

In a cognitive cycle, the interaction with an environment means measurement of the physical environment in terms of the RF stimuli. Then it analyses these measurements by the processes of estimation and prediction. Then the cognitive radio tries to learn from its environment and initiates the implementation of the desired changes i.e adapts to the environment.

When the regulatory aspects of the CR are to be taken into account, it becomes more convenient to simplify the above representation in three basic elements: a software radio, a module for monitoring of spectrum and a policy box. The software based module is employed for the transmission and reception of wireless payload. The hardware that exists within this module must possess the ability to move rapidly and with ease in order to make proper use of the spectrum available. The information that is provided as input to this module includes the user data along with the QoS. The second module is that for the monitoring of spectrum. It looks for the vacant spectrum portions or the spectrum holes on the basis of the information received. The output provided by this module includes list of options. These options are basically the set of parameters such as frequency, power being transmitted etc. The last module is that of policy module. It causes the evaluation of these options. It compares the options with the

information provided by the regulations of spectrum. One such regulation is the availability of spectrum for secondary users. It also decides about the appropriate set of parameters that can be utilized.

Spectrum Sensing: It is a process of creating awareness about the spectrum. In this process, the cognitive radio is made to monitor the environment and surroundings. It also takes into account the usage statistics of both primary as well as secondary users. Apart from this another task to be accomplished during spectrum sensing is the detection of presence of spectrum holes. This process can be carried out by a cognitive radio in an independent way or it may involve the use of multiple terminals.

Spectrum Decision: After carrying out the process of spectrum sensing, on the basis of the gathered information regarding the surroundings the cognitive radio makes decisions regarding the initiation of operation, the frequency of operation and the corresponding technical requirements. The foremost objective of the cognitive radio is transmission of maximum amount of data or information providing adequate quality of service and without causing interference to others.

Spectrum Sharing: As cognitive radio enables a number of users to make use of the available spectrum, it needs to allot the spectrum among these users in a way so as to achieve the most efficient utilization of spectrum. The sharing is to be done in a way so that the secondary users do no pose any sort of interference to primary users.

Spectrum Mobility: in a situation where the primary user returns to its spectrum, the cognitive radio must be able to provide another portion of the spectrum to the secondary user. This is done to reduce the chances of causing interference. Thus, the cognitive radio needs to monitor the environment in real time basis in order to search for spectrum holes that can be used in that situation.

It is an intelligent system which knows its environment, learns from it and adapts its internal operating state in accordance with the RF Stimuli and makes corresponding changes in the real time operating parameters. The main objectives of the Cognitive Radio include high reliability and utilization of the spectrum in most efficient way.

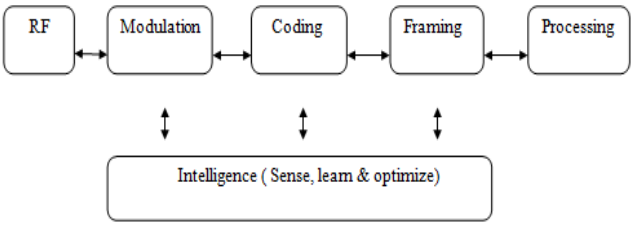

Figure 1 shows Block diagram representing CR

Spectrum Sensing

With the increasing popularity of cognitive radios, the function of spectrum sensing is gaining more and more attention day by day. The main aim of employing this technology is to determine a way that can result in more efficient utilization of the spectrum available. The spectrum sensing holds an important role to perform for acquiring this objective. The spectrum sensing thus forms an important function of the systems based on cognitive radios [8].

The Cognitive systems have the capability of effective detection of the unused sections of the radio spectrum. This capability owes its existence to the function of spectrum sensing. It provides a mechanism of continuously monitoring the system. this is done to make sure that no interference is being caused to the primary users. It also makes the system able to sense the presence of unused spectrum holes [9].

In many areas of application of cognitive radios, it is observed that in addition to the cognitive radio system there is co- existence of some other radio systems that needs to share the same spectrum without interfering with each other. For the spectrum sensing system to operate the following considerations need to be taken care of:

The first and the most important consideration is regarding the continuous monitoring of the system to sense the occupancy of available spectrum. A cognitive system is desired to make use of spectrum without causing interference to primary users. Another important task that needs to be performed is to continuously check the spectrum to know whether the primary user returns or not.

If the cognitive system senses that the primary user returns to the spectrum which was ebing utilized by secondary user; the cognitive

system is required to vacate the spectrum and make alternative arrangements for the secondary users.

Spectrum Management:

Spectrum management is concerned with the function of capturing such an available spectrum that suits best to the requirement of the users. It is the task of cognitive radio to choose the best band of spectrum in order to fulfill the QoS requirements of the user among all the bands available. Thus, this function is vital for the functioning of cognitive radios. The task of spectrum management is further divided into two:

Spectrum Analysis: This is the technique in which each of the spectrum holes needs to be characterized by taking into consideration both the radio environment that varies with time and activity of primary user.

Spectrum Decision: after analyzing all the spectrum bands, there is a need to select a spectrum band for carrying out the current transmission by taking into consideration the requirements related to QoS in addition to the characteristics possessed by spectrum. Then based on the data rate requirements of the user, the bandwidth needs to be determined. After this, a decision is taken so as to chose an appropriate band based on decision rule.

Spectrum Mobility: This is the process in which the CR user is supposed to exchange the frequency in which it is operating. The CR networks always aim towards the use of the available spectrum in a dynamic way. It allows the radio to function in the frequency band in the spectrum which best suits its requirements. It also maintains the communication to be seamless *during the time in which the transition occurs.*

Spectrum Sharing: This is the most challenging function of the cognitive radio. The cognitive radios are capable of sensing their environment and allow the secondary users to utilize the unused spectrum bands or holes opportunistically so as to increase the QoS requirements of the secondary users. When a secondary user detects the presence of spectrum which is available, the secondary user can make a use of this spectrum after it has been vacated by the primary user.

The techniques for sharing the spectrum can be categorized on the basis of following: architecture, behavior of allocation of spectrum and techniques employed for accessing the spectrum [14].

Survey of Previous Work

D.D. Ariananda, M.K.Lakshmanan, H. Nikookar [7], gives the distinctive strategies to discovering the empty recurrence from the authorized range. They have ordered these techniques into parametric and non parametric range estimation systems. The most ordinarily known range detecting strategy is vitality discovery system which is delegated a non parametric estimation range detecting routines.

Lu, Xiangwei Zhou, Uzoma Onunkwo and Geoffrey Ye Li [8], clarifies the guideline of range detecting ideas, neighborhood range detecting strategies, challenges for every range detecting procedures. In short diverse range sharing and allotment plans have been considered to expand the range proficiency.

Bodepudi monika,Kolli Ravi Chandra, Rayala Ravi Kumar [9], clarify the distinctive difficulties for range detecting in psychological radio innovation. Such difficulties are recognizable proof of range opening, dependable correspondence, proficient use of radio range, no impedance with essential clients and so forth.

Tevfik Y¨ucek and H¨useyin Arslan [10], states that psychological radio is a critical answer for using a radio range in powerful way. Likewise, states diverse phrasing utilized as a part of psychological radio innovation and distinctive elements of intellectual cycle. Out of this four capacity range detecting is the most vital capacity of subjective radio. This is exceptionally critical assignment to distinguish the empty frequencies from authorized range.

Joseph Mitola [11], gives the answer for the issue of range underutilization and range shortage through radio information representation dialect. This dialect means the radio respectability, equipment and programming modules, correspondence, base and prerequisites of client.

Current Issue in Cognitive Radios

According to the surveyed literature the spectrum access control is an issue in the spectrum assignment between SUs and becomes more severe when PUs are active, the previous systems have dealt with the multiple channel control with cognitive spectrum system, the system worked in two phase environment and reduced the channel delay, but the

following were concerns which were not addressed: The use of hop space for multiple channel at one time is not present Delay caused loss of communication info. Complexity is high due to multiple detection system.

Proposed System Working

Firstly a system is designed for detecting maximum possible space in the spectrum for all he secondary users, this is accomplished by using sparse order detection.

The second step is the assignment of the user channel to all secondary user with adjustment to the bandwidth of sensed spectrum according to the first detection.

After allotting the freq. space the secondary user form a cyclic detection order of detecting space in the sensed space while hooping into virtual channel periodically

This system assigns multiple SUs at one time and therefore reduces the delay between channel outages, unlike in the previous systems which increased outage making the delay between channel switching's more wider.

The proposed system of multiple channel in single spectrum detection has been verified using the outage capacity and stability in case of high data rate multiple users.

Results

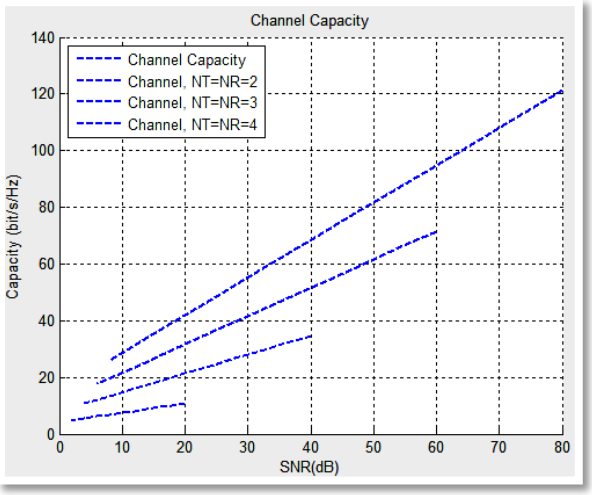

Figure 2 shows the output capacity of the system

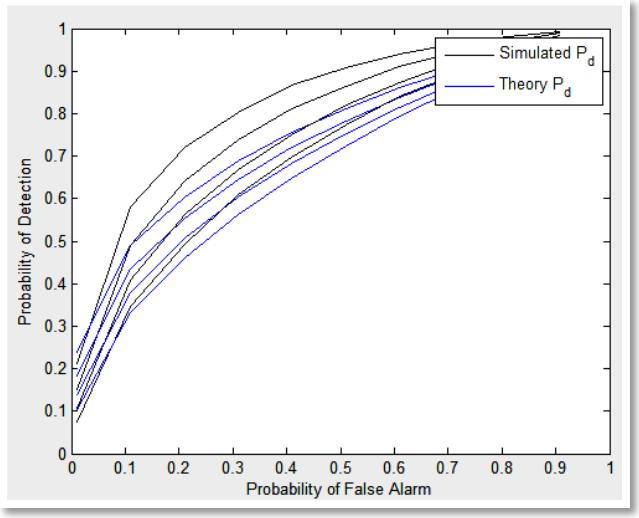

Figure 3 shows the detected spectrum for the spare order sensing

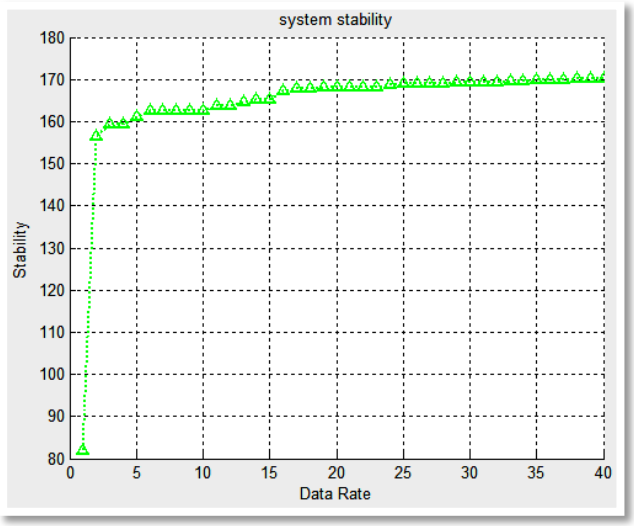

Figure 4 shows the stability for 4 users under high data traffic conditions

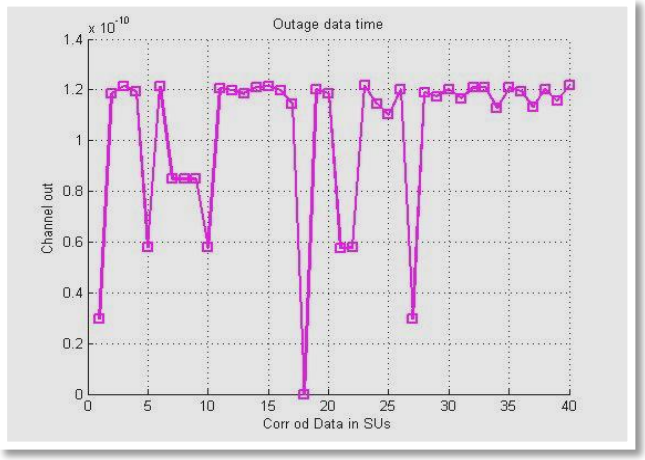

Figure 5 shows the outage data time taken by users under high traffic conditions

Conclusion

The proposed system works with variable secondary users under same detected spectrum space with most of the channels in active state due to multiple virtual channel extension and high correlation of the data sent to the Secondary receiver with reduced primary interference by estimated adjustment of the transmitter channel state. This technique proved to be efficient as the stability becomes more flexible in high data rates.

REFERENCES

[1]. S. Haykin, Cognitive Dynamic Systems, Proceedings of the IEEE, vol. 94, no. 11, Nov. 2006, pp.1910-1911

[2]. B. A. Fette (Editor), Cognitive Radio Technology, Elsevier 2006, Hardcover, 656 Pages, ISBN 978-0-7506-7952-7

[3]. E. Hossain, V. K. Bhargava (Editors), Cognitive Wireless Communication Networks, Springer 2007, approx. 450 pages, ISBN 978-0-387-68830-5 sensing and reporting channels: application to cognitive radio networks",IEEE Transactions on Wireless Communications pp: 5813-5821

[4]. E. Hossain, V. K. Bhargava (Editors), Cognitive Wireless Communication Networks, Springer 2007, approx. 450 pages, ISBN 978-0-387-68830-5

[5]. F. Zeng, Z. Tian, C. Li (2010), "Distributed compressive wideband spectrum sensing in cooperative multi- hop cognitive networks", in: Proc. Of IEEE ICC 2010, pp: 1-5.

[6]. I. F. Akyildiz, S. Mohanty, J. Xie, "A ubiquitous communication architecture for next-generation heterogeneous wireless systems", *IEEE Commun. Mag.*, Vol. 43, No. 6, June 2005, pp. s29-s36.

[7]. Partha Pratim Bhattacharya, Ronak Khandelwal, Rishita Gera, Anjali Agarwal, "Smart Radio Spectrum Management for Cognitive Radio", International Journal of Distributed and Parallel Systems (IJDPS) Vol.2, No.4, July 2011.

[8]. Nawaf Hadhal Kamil, Xiuhua Yuan, " Detection Proposal Schemes for Spectrum Sensing in Cognitive Radio", *Wireless Sensor Network,* 2010*,* 2*,* 365-37.

[9]. Anita Garhwal and Partha Pratim Bhattacharya, " A Survey on Spectrum Sensing Techniques in Cognitive Radio", International Journal of Computer Science & Communication Networks,Vol 1(2), 196-206 ISSN:2249-5789

[10]. Bodepudi Mounika, Kolli Ravi Chandra, Rayala Ravi Kumar, "Spectrum Sensing Techniques and Issues in Cognitive Radio", *International Journal of Engineering Trends and Technology (IJETT) - Volume4Issue4- April 2013.*

[11]. Mansi Subhedar and Gajanan Birajdar (2011), "Spectrum Sensing Techniques in Cognitive Radio Networks: A Survey", International Journal of Next –Generation Networks, Vol.3, No.2.

[12]. Shamik Sengupta, Mainak Chatterjee, Kevin Kwiat (2009) , "Dynamic Spectrum Access in Cognitive Radio Tactical Networks", In IEEE Conference on Wireless Communications and Networking.