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A REVIEW ON COGNITIVE RADIO COMMUNICATION TRENDS

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ABSTRACT

The Cognitive radio is one of the recent revolutionary advancement that promises to govern the future wireless world. The ultimate objective of cognitive radio is to use available spectrum efficiently in fair-minded and cost-effective manner and provide highly reliable communication for all users of the network, wherever and whenever needed. The concept of a cognitive radio extends the binding of hardware radio and software defined radio (SDR) from a straightforward, single operate device to a radio that senses and reacts to its operational atmosphere. In this paper a review on various cognitive network work strategies is done with a futuristic view of improvising the current state by enhancing the spectrum usage efficiency.

Keywords*: Spectrum, radio, sensing, LPF, energy detection, spectrum management.*

INTRODUCTION

With the increase in the applications of the various wireless devices, this resource is being crowded. It can be regarded as best alternative as it possess the capability of adapting its operating parameters in a rapid and autonomous manner with the changes in its conditions. Thus, this technology proves helpful in solving the issue related to the underutilization of the spectrum in the field of wireless communication. 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 [1].

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 [2]:

To provide a reliable way of communicating when required.

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

COGNITIVE RADIO FUNCTION

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 not 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 such a technology in which the parameters of either transmission or reception of the network are varied in order to communicate without any interference to the licensed users. Figure 1, shows the concept of spectrum holes which represents the opportunities for the use of spectrum in a safe way so as to not cause any interference. However, the main task is to sense whether a secondary system is within a spectrum hole or not.

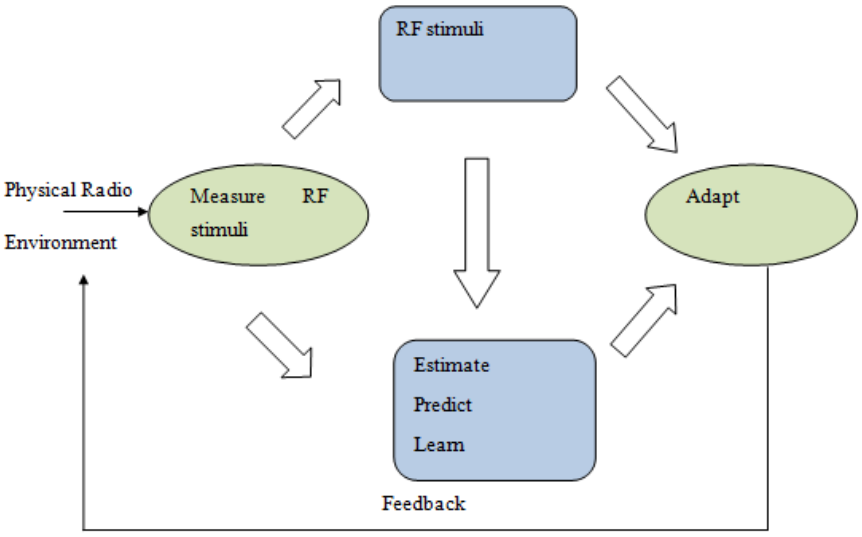

Figure 1, Basic Cognitive System

As shown in Figure 1 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. It also involves the feedback by continuously monitoring the environment.

Table 1. Comparison of various Spectrum Sensing Techniques.

Sensing Technique	Advantage	Disadvantage
Matched Filter Detection	Performance is optimal and the cost incurred is low.	It requires the prior knowledge of the signals of primary user.
Energy Detection	It does not require any prior knowledge of signals of primary user. Another advantage is the low cost.	It cannot be employed in low SNR. Also, it cannot differentiate between primary users and secondary users.
Cyclostationary Detection	It possesses robustness in low SNR.	The computational cost is high and some prior knowledge of the signal is required.

SURVEY OF TECHNIQUES

Table 2. Shows the comparison of previous Literature

S.no	Title	Author	Published in	Introduction
1.	Detection Proposal Schemes for Spectrum Sensing in Cognitive Radio.	NawafHadhal Kamil, Xiuhua Yuan	Wireless Sensor Network, 2010, 2, 365-37.	The approach is to be employed when the primary signal parameters are known. In such a case use of a code value along with matched filter for the purpose of detection of the primary user. The second approach is applicable when there is no knowledge regarding the parameters of the primary signal.
2.	Sensing and Probing Cardinalities for Active Cognitive Radios	Thang Van Nguyen, Hyundong Shin, Tony Q. S. Quek, and Moe Z. Win	IEEE TRANSACTIONS ON SIGNAL PROCESSING, VOL. 60, NO. 4, APRIL 2012.	They have taken into consideration a wideband cognitive network whose frame energy is limited and have treated only the fundamental problem of energy allocation. Then they have casted the

				mentioned problem in the form of multiarmed framework under the probably approximately correct learning
3.	Energy-Efficient Cooperative Spectrum Sensingby Optimal Scheduling in Sensor-AidedCognitive Radio Networks	Ruilong Deng, Jiming Chen, Chau Yuen, Peng Cheng, and Youxian Sun	IEEE TRANSACTIONS ON VEHICULAR TECHNOLOGY, VOL. 61, NO. 2, FEBRUARY 2012	They have suggested the division of these sensors in a number of feasible subsets which are no disjoint. This means that only one of the sensors will be operational at a given instant of time while fulfilling all the thresholds related to the detection and the false alarm.
4.	LI Bin Location based spectrum sensing performance analysis over fading channels in cognitive radio networks	YAO Hai-Peng, ZHOU Zheng, SUN Xuan.	JCUPT: The Journal of China Universities of Posts and Telecommunications	Put forward the concept of analyzing the spectrum sensing performance over fading channel, in that concept there is a fully knowledge where a licensee and multiple unlicensed users exist at the same place and operated in the licensed channel in a local area.
5.	Computing On Spectrum Sharing and Dynamic Spectrum Allocation: MAC Layer Spectrum Sensing in Cognitive Radio Networks	Mohamed Hamid, Abbas Mohammed and Zhe Yang	2010 International Conference on Communications and Mobile	Hamid proposed a method to investigate the MAC layer sensing schemes in cognitive radio networks, where both reactive and proactive sensing is considered into the account. In proactive sensing the adapted and non-adapted sensing time intervals schemes are also assessed.
6.	Relay Selection for Cooperative Spectrum Sensing in	Hongbin Chen	2010 International Conference on Communication	The proposed technique finds the detection probability and false alarm probability and evaluates them, when relay

	Cognitive Radio Networks		s and Mobile Computing	selection is executed for cooperative spectrum sensing in cognitive radio networks

CONCLUSION

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 with single antenna adaptation, the system worked in two phase environment and reduced the channel interference with user detection based adaption during sensing, but the following were concerns which were not addressed. To design detection and spectrum access system for multiple user CR. To enable detection of the SUs using pre assignment post occurrence probability. To minimize the outage time for SUs for network balancing by using multiple user assignment in single slot channel. To estimate network stability, efficiency of capacity, SUs per channel and received data correlation for SUs. These will be the future objectives which will be taken as future reference

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