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SURVEY ON THE SPECTRUM SENSING METHODS FOR COGNITIVE RADIO

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ABSTRACT

The use of cognitive radio technique for wireless transmission becomes a demand in the field of data communication. The spectrum sensing is an important part of cognitive radio. There are number of research work has been carried out in the field of the spectrum sensing for cognitive radio. In this paper we have presented the various methods of spectrum sensing along with pits and falls of methods. A comparative analysis on the basis of the performance parameters is also given in the paper. The probability of detection with respect to probability of false alarm and SNR is key parameter for detection. Single sensor and multiple sensor based detection is also given in the paper.

KEYWORDS: Cognitive radio, Spectrum sensing, energy detection etc.

INTRODUCTION

Today, most spectrum sensing technique is used ineffectively, and their utilization varies through the time and location. With Cognitive Radio being used in a number of applications, the area of spectrum sensing has become increasingly important. As Cognitive Radio technology is being used to provide a method of using the spectrum more efficiently, spectrum sensing is key to this application. The ability of Cognitive Radio systems to access spare sections of the radio spectrum, and keep monitoring the spectrum to ensure that the Cognitive Radio system does not cause any undue interference relies totally on the spectrum sensing elements of the system.

Cognitive radio is a novel technology which improves the spectrum utilization by allowing secondary users to borrow unused radio spectrum from primary licensed users or to share the spectrum with the primary users. As an intelligent wireless communication system, cognitive radio is aware of the radio frequency environment, it selects the communication parameters (such as carrier frequency, modulation type, bandwidth and transmission power) to optimize the spectrum usage and adapts its transmission and reception accordingly. By sensing and adapting to the environment, a cognitive radio is able to fill the spectrum holes and to serve its users without causing harmful interference to the licensed users. In order to detect the re-appearance of the primary user, the cognitive radio must continuously sense the spectrum it is using. Once the primary user is detected, the cognitive radio should withdraw from the spectrum instantly so as to minimize the interference. This is very difficult task as the various primary users will be employing different modulation schemes, data rates and transmission powers in the presence of variable propagation environments and interference generated by other secondary users [1].

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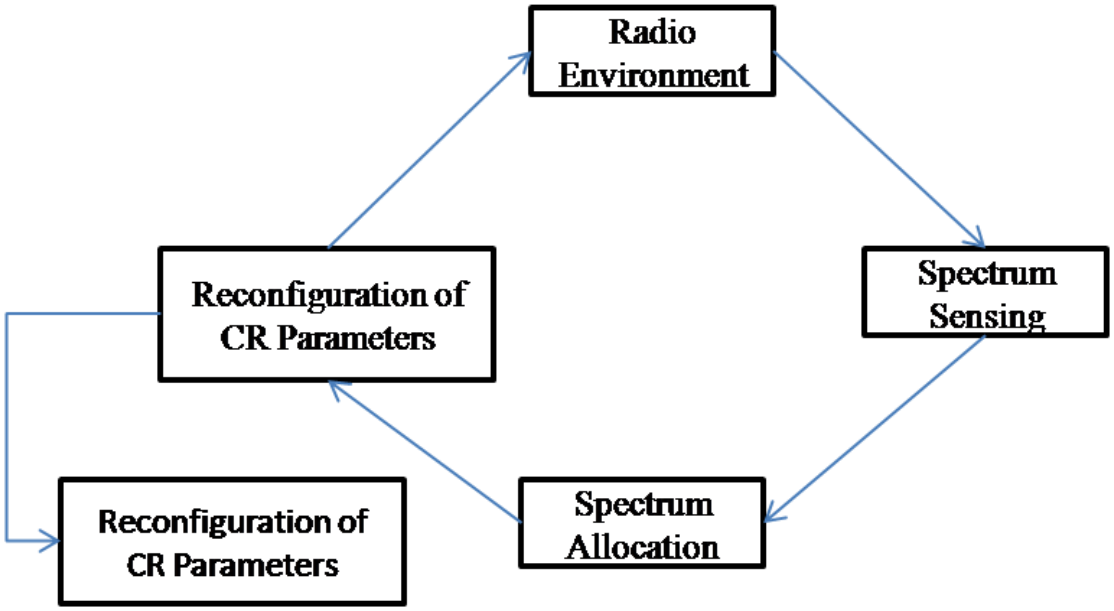

Fig. 1 Block diagram of spectrum sensing in cognitive radio

LITERATURE REVIEW

The many researchers have been done a significant work in the field of spectrum sensing cognitive radio problem. Some of the work is described in this paper.

Hector Reyes, in his paper, studies spectrum sensing method based on Euclidean distance and its comparison with energy detection for CR technique. His paper presented for spectrum sensing method is based on the autocorrelation of the received samples. The plattform used for the experiments was a set of Universal Software Radio Peripheral™ (USRP™) devices acting as radio frequency front ends in combination with GNU Radio software. The method was evaluated through means of experiments wherein the probabilities of detection and false alarm at various signal-to-noise ratios were observed. The proposed technique was compared with two methods: one based on the value of the autocorrelation at the first lag and another one based on the power of the signal, known as energy detection spectrum sensing system. The simulations and excremental showed that the Euclidean distance technique proposed herein is more effective than the ACF in terms of probability of detection and false alarm, and more efficient than the energy detection scheme in terms of probability of false alarm. This includes characterization of the type of noise introduced by the USRP device, application of the method in scanning several channels, in order to estimate their utilization level, and measurement of the speed of the method [1].

Mansi Subhedar, in research paper, investigates spectrum sensing and cognitive radio. A fixed spectrum assignment has lead to underutilization of spectrum, as a great portion of licensed spectrum, is not effectively utilized. The cognitive radio is a promising method which provides a novel way to increase utilization efficiency of available electromagnetic spectrum. The spectrum sensing helps to detect the spectrum holes providing high spectral resolution capability. The challenges and issues involved in implementation of spectrum sensing scheme are discussed in detail giving comparative study of different methodologies. In this paper, the development of the CR network requires the involvement and interaction of many advanced techniques, including distributed spectrum sensing, interference management, cognitive radio reconfiguration management, and cooperative communications. Furthermore, in order to fully realize the cognitive radio system in wireless communications for efficient utilization of scarce RF spectrum, the method used in identifying the interference and/or spectrum sensing should be reliable and prompt so that the primary user will not suffer from cognitive radio system to utilize their licensed spectrum [2].

M. S. Asif, develops dynamic compressive sensing work, efficient algorithms for updating the solutions of l_1 minimization for streaming measurements, where the underlying signal changes and new measurements of a fixed

signal are sequentially added to the system. The proposed algorithms are based on homotopy continuation, which breaks down the solution update into a small sequence of linear steps. The idea is to estimate the initial signal support by compressive sensing, run a reduced order Kalman filter over the estimated support, and apply compressive sensing to the Kalman innovations or filtering error upon any change occurs to the support [3-4].

Md. Shahnawaz Shaikh, in his paper, studied cognitive radio spectrum sensing techniques. The radio link between transmitter and receiver varies randomly during signal propagation. This radio link may offer simple line-of-sight or multipath propagation of communication signal depending on channel condition and channel type. Sensing performance of cognitive radio network may also get affected over various channels and required to be calculated. This paper enlightens the implementation and analysis through simulation of Matched filtering, Energy detection, cognitive radio spectrum sensing techniques over AWGN and Rayleigh channels. This paper investigated different spectrum sensing techniques in cognitive radio network. Comparative analysis of spectrum sensing capability of matched filtering, Energy detection and cyclostationary feature detection technique was carried out in terms of decision accuracy vs SNR under varying channel conditions including AWGN [5].

Y. Wang, studied that there are several recent applications of compressive sensing in wireless communications. A two-step compressed spectrum sensing scheme for efficient wideband sensing is proposed. Bayesian compressive sensing framework reduces the sampling requirement and computational complexity by passing signal reconstruction [6].

Fanzi Zeng, in his paper, collected spatial diversity against wireless fading, multiple CRs collaborate and establish consensus among local spectral which estimates through running a decentralized consensus optimization algorithm. Compressive sampling is performed at local CRs to scan wide spectra, and measurements, from multiple CR detectors are fused to collect spatial diversity gain, which improves the detection quality, in particular, under fading channels [7].

CONCLUSION

A comparative analysis on the basis of the performance parameters is also given in the paper. Single sensor and multiple sensor based detection is also given in the paper. Spectrum is a very valuable resource in wireless communication systems and it has been a major research topic from last several decades. Cognitive radio is a promising technology which enables spectrum sensing for opportunistic spectrum usage by providing a means for the use of white spaces. Considering the challenges raised by cognitive radios, the use of spectrum sensing technique appears as a crucial need to achieve satisfactory results in terms of efficient use of available spectrum and limited interference with the licensed primary users.

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