www.ijecs.in
International Journal Of Engineering And Computer Science ISSN: 2319-7242
Volume 4 Issue 9 Sep 2015, Page No. 14387-14390

Multiple Antenna Adaptation for Secondary Users Using Data Rate Assessment

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)**Abstract:** ***In the paper a method for multiple antenna communication with switching of users between different antenna loads is presented for cognitive radios networks, this process is an enhancement to the problem of spectrum sharing, after the detection is processed for spectrum space, the paper also discusses about the CR basics and importance of spectrum management. The performance of the proposed system is assessed by calculating the total average power of primary to secondary receiver and the overall SEP (Symbol Error Probability).***

Key Words: *CR, primary user, QPSK, modulation, spectrum sensing, MIMO*

1. INTRODUCTION

The cognitive radios are capable of providing a reliable way of communication to users. This technique helps in determining presence of licensed users in the spectrum. Apart from doing so, it also makes it possible to know about the exact portion of the spectrum which is being utilized. The main objective behind the use of cognitive radios is that it makes the unlicensed user well aware of the presence of the licensed user so as to reduce the interference caused by them to licensed users.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 [1].The cognitive radio possess 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.

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 [3].

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.

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 [4].

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.

The use of cognitive radios becomes more advantageous in the case which involves high number of users [2].

The advantages provided include:

- The utilization of the spectrum available is done in more efficient way.
- It provides better connectivity.Because of availability of information regarding its surroundings and the bandwidth, they have the capacity to tune the spectrum usage in a dynamic way on the basis of location.
- The power consumed is also lower.
- It also makes the communications with higher priority to precede in times of requirement.
- The categorization of cognitive radios on the basis of parameters that need to be considered to decide the transmission and reception variations.
- It is categorized in two types: Full cognitive radio and Spectrum sensing cognitive radio.
- The former type takes into account all the parameters that can be observed by the network.
- On the other hand, the latter type only considers the spectrum of radio frequency.

The spectrum sensing in cognitive radios can be classified as [5]:

Non- cooperative spectrum sensing: In this kind of sensing, the cognitive radio is assumed to operate on its own. In this case the configuration is performed by keeping into account the signals that are detected and the information with which the cognitive radio is preloaded.

Cooperative spectrum sensing: In a cooperative sensing system, there exists a number of radios that are being used at the same time and each of them will have to sense the spectrum. In this case, there is the need of a central station. This central station keeps an account of the signals being received from the radios and this station is responsible for the overall working of the system.

Spectrum Sensing based on interference detection: this is further of two types: Interference temperature detection and Primary receiver detection.

In the first type, the Cognitive Radio system makes use of the Ultra Wide band technology wherein both the secondary users as well as the primary users coexist. However, the secondary users have to face the restriction that has been imposed based on interference temperature levels. This is done to make sure that they do not pose any sort of interference to primary users. For the second type, the detection of spectrum is performed on the basis of local oscillator leakage power of the primary receiver.

2. LITERATURE REVIEW

NawafHadhalKamil et al have proposed a technique that can be employed for carrying out the function of spectrum sensing. They have proposed two approaches for this purpose [3]. The approach is to be employed when the primary signal parameters are known. In such a case use is made 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. In such a case a new strategy is employed for the purpose of detecting energy in both the cooperative and non cooperative schemes. Then the proposed system is simulated and the results obtained prove that this sytem performs better in comparison to the other energy detection based techniques.

Ruilong Deng et al. have suggested the division of these sensors in a number of feasible subsets which are nondisjoint [6]. 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. Each of the subset activates in a successive order and those sensors which have not been activated are rendered in the sleep mode which requires lower energy; thus extending the lifetime of the network. They have formulated the problem related to the energy efficiency of the cooperative sensing as a problem of scheduling in the CR networks which are aided by the sensors. With the aim of achievement of a better balance between the lifetime of the network and the level of computational complexity; they have proposed the use of a λG which is new approach. The results obtained after simulating depict that the proposed approach performs well. Apart from this they have also studied the effects of the changing parameters on the system performance.

YAO Hai-Peng et al. put forward the concept of analyzing the spectrum sensing performance over fading channel [7], 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. The overall likelihood of detection and false alarm by mutually considering the fading and the locations of all secondary users into delineation and is derived, by taking both these probabilities and a cumulate static model of interference is constructed. Based on the effect of cumulate interference, a closed-form expression for outage probability at the primary user's receiver with respect to a specific distribution of the fading is derived. Finally, the parameters of sensing are taken into account to reduce the total spectrum sensing error and increase the average opportunistic throughput is obtained. It is noted that the overall average performance analysis and results are improved.

Mohamed Hamid et al. The problem regarding wireless networks regulation agencies is how to use the unused electromagnetic radio spectrum in a way that accomplishes the requirement of the growing wireless systems both economically and technically. Hence, cognitive radio systems that support dynamic access to the unused spectrum have been appeared recently and is proved as a supporting solution for the wireless system. Mohamed 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 [8].

3. Proposed Work Model

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: The use of single wideband space for multiple channel at one time is not present. Delay caused loss of communication info. Average SNR from PU to Secondary user is present for multiple users. The SEP reduction lags in high traffic.

4. Methodology

The proposed system works with first integrating the two network in one frame. The first step is to decide the number of users for simulation by inputting the user defined user number. Every user is firstly assigned in the general energy detection and transmission energy is assigned to the user, the energy and selection of the antenna is based on the region division, where the users are deployed, there are numerous regions in the network where the users are interpreted as low or high bandwidth and the other areas are considered as the PU cell area where only the primary users are considered. The simulation is carried out by initializing the users as gain based with a threshold set to the average energy required for transmitting the data to the nearest SU station, after detecting the user type, assignment of the antenna is done for the user and secondary level switching and defection to track the calculated detected space in spectrum till its unavailable. The network simulation is for a particular number of simulation runs which ensure the robust test for the system network. The users are simulated under QPSK based modulation under 64 bit index for each ser. The secondary user communication is analyzed on the basis of average interference power reduction for SU. The number of symbols are calculated for transmitter and receiver end. The density of users is measured with average power fading in random fading scheme with interference based on the primary user density, the user density increases and adjusts according to the antenna for a given number of user.

5. Results for Proposed System

Results for Average power reduction in 10 user network with 2 Mhz bandwidth

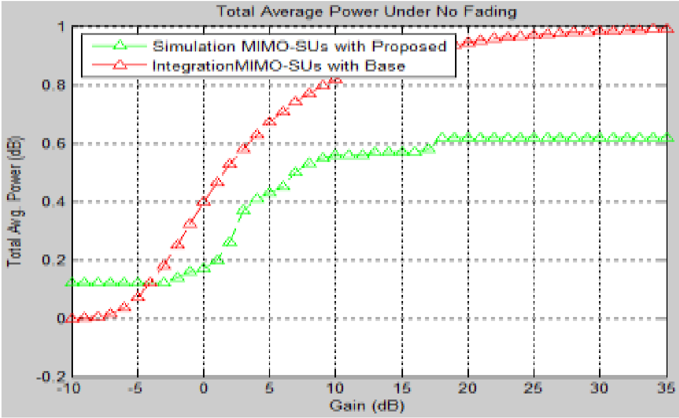

Figure 1 Shows the comparison of Base system and proposed for ideal non fading channels under MIMO

The above graphical analysis shows the response of power adaptation antenna theory and data rate based multiple user multiple antenna proposed theory, the actual simulation with ideal state is shown without considering the fading due to the PUs setup and noise channel. He average power ratio between the pimary and secondary receiver for base only reaches 0.6 probability with maximum allowable gain of 35 db as comparison to base system which shows instability with increase in traffic rate under 2 Mhz bandwidth

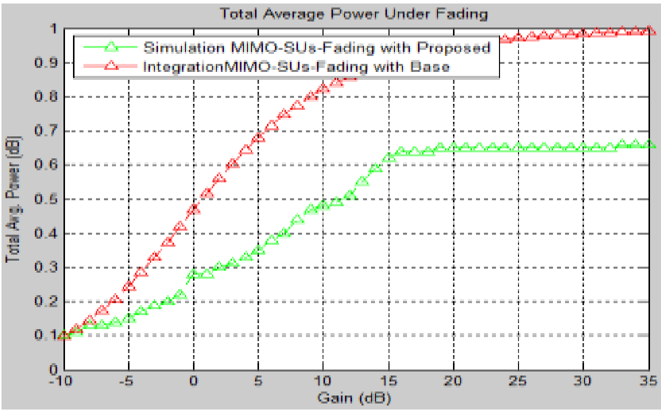

Figure 2 Shows the comparison of Base system and proposed for fading channel under MIMO

The above graphical analysis shows the response of power adaptation antenna theory and data rate based multiple users, multiple antennas proposed theory, the actual simulation with fading state is shown considering the fading due to the PUs setup and noise channel. The average power ratio between the primary and secondary receiver for base only reaches 0.65 probability with maximum allowable gain of 35 db as comparison to base system which shows instability with increase in traffic rate under 2 Mhz bandwidth.

This is for system under QPSK based modulation and base system based single antenna adaptation and proposed system based multiple antenna detection and spectrum assignment under gain of -33 dB.

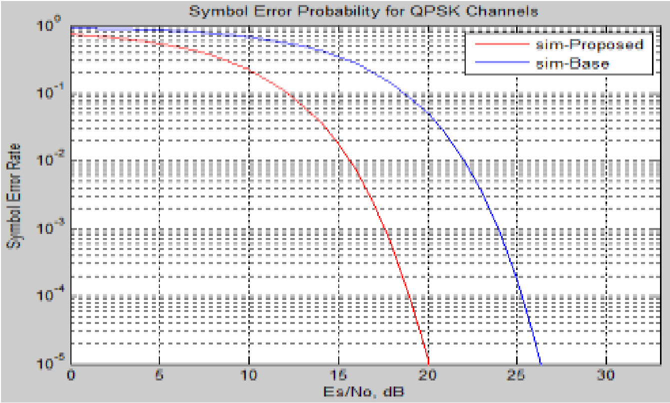

Figure 3 shows the SEP simulation for base and proposed system under theory and actual simulation

The above figure shows the reduction in interference due to the proposed and base strategy in the network, as it can be seen the interference compensation given by the base strategy when analyzed for a low area gives good results, whereas the proposed system strategy gives better results for much greater distance.

6. Conclusion

The proposed system is based on multiple antenna assignment for detection of SU space in an environment full of random activity by the Pus and therefore adaption is needed for maintain a proper balance in the secondary user domain, as the secondary user needs to adjust according to the available spectrum, to avoid the interference of the primary transmitter to the secondary receiver when the gain is too high this was present in the power adaptation system and needed to be subdued as the number of secondary users increased with time, in order to minimize this occurrence, the proposed system was designed and it operates for multiple users rate with multiple antenna adaptation with confined gain values, the proposed system is based on the data rate system which calculates the total symbol rate and finds the optimal gain antenna which will send the signal with minimum transmission error and reduced symbol error rate, the QPSK modulation is used for SU communication.

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