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Dynamic Resource Allocation based on priority approach in MIMO Cognitive Radio Networks – A Literature Surve

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***Abstract*—** Cognitive radio networks (CRNs) are presently gaining massive recognition as the most-likely next-generation wireless communication paradigm. Naturally it has characteristic like attractive aptitude of modifying insufficient spectrum usage and/or underutilisation challenge. CRN is an excellent intellectual wireless radio communication system and it has great awareness of its environment. Here, heterogeneous hops spectrum sensing is great problem by means of fluctuating computing energy, range of sensing, and distribution of spectrum dynamically in CRN where there exist multiple primary users and secondary users have been considered. The scheduling of dynamic spectrum access methods provides a lot of challenges. Due to its demand many researchers were developed different system for spectrum allocation in dynamic fashion. The secondary users (SUs) likely exploit the spectrum when primary user's absences, this technique would be improved the spectrum usage effectively. In this article we studied the different techniques were used to improve the spectrum usages and present the comprehensive analysis and comparison of each method which are used to improve the effective utilization of unused spectrum in CRN.

***Keywords*—**CRN, OFDM, MIMO, Femtocel, SINR,

I. INTRODUCTION

Wireless communication system is wide and emerging network technology. Now days, cognitive radio (CR) is playing an important role in CRN. It is an emerging and intelligent technology which provides an excellent solution to the insufficient usage of spectrum [1]. Wireless communication system has two terminals such as primary (licensed) users (Pus) and secondary (unlicensed) users (SUs) [2]. Now a day the wireless communication system requires great data degrees in all aspects of the networks. The multiple input and multiple output (MIMO) systems provides great data degrees depending on its demand. MIMO systems are well furnished with multiple antennas on both sender and receiver side provides spatial and diversity gains with trade-off between bit error rate (BER) and data rates [2].

The SU must share the spectrum utilization with the PUs by using overlay, interweave, or underlay approaches without interference of the PU and not destroyed the quality of service (QoS) of PU [1]. Due to the broadcast nature of wireless links, it is difficult to prevent eavesdroppers from overhearing wireless communications. To address this concern, physical layer security has been widely considered as an effective technology to prevent information from being intercepted. In wireless communication system security issues are great challenges, particularly in CRNs, for which the licensed frequency band is shared between the PUs and SUs, leading to an increased possibility of eavesdropping of the transmitted information for both PU and SU [1] [2].

MIMO is an intelligent technique to improve channel utilization between transmitting node and receiving node. It employs the usage of several antennae at both terminals like transmitter node and receiver node to propagate multi-data stream simultaneously with the same channel to increase transmission dependability and transmission range [4]. The MIMO have advantage that gives a lot of hope in the field of emerging wireless communication technology. The CR and MIMO technology works in an independent and concurrent manner [3][4].

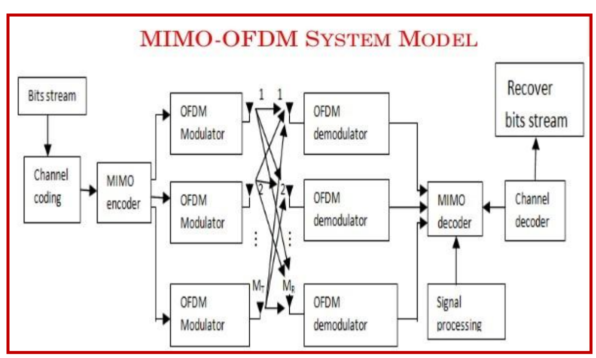

Figure 1. MIMO-OFDM System model

MIMO combines multiple input multiple output technologies, where capacities are multiplied by transmission of different signals across several antennas, and OFDM (orthogonal frequency division multiplexing) where a radio channel is divided into a large number of closely spaced sub-channels for better and dependable communication at high speed [4]. This is a powerful combination because MIMO alone does not reduce the severity of multipath propagation and OFDM avoids the necessity of equalizing the signal. MIMO-OFDM can achieve very high spectral efficiency in any given network of operation (figure 1).

Femtocell [5] is an access point based on wireless technology that strengthens reception of cellular signals inside a home or office building. In telecommunication, a Femtocell acts a small cellular base station with low power. In telecommunication industry, use of low-power access points in licensed and unlicensed spectrum, with femtocell as the subset has been widely used. A femtocell allows extension of service coverage for the service provider at locations where access is usually very limited. Femtocell range exists in the order of 10 mts.

Rest of the paper is organized as follows, Section I contains the introduction of wireless system, Section II contain the related work of dynamic resource allocation, Section III contain the comparative analysis of different techniques used to improve dynamic resource allocation in MIMO CRN and Section IV contain conclusion of the system with future directions.

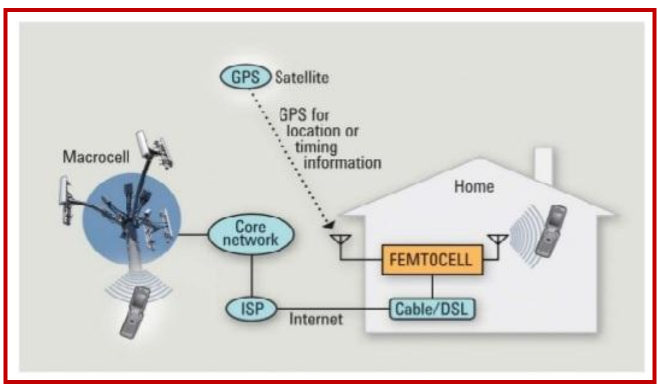

Figure 2. Femtocell Technology

II. RELATED WORK

Wenhao Xiong et al [2] have proposed and evaluated several schemes for SU selection that are applicable to both best-effort PU interference mitigation and hard interference temperature (IT) constraints. The proposed scheme has a complexity which is relatively lesser than any exhaustive search scheme with very little performance degradation.

Xingyu Zhou et al [6] have proposed greedy relay antennae selection algorithm to avoid the exhaustive search and to increase the sum rate in AF (amplify-and-forward) MIMO TWRCs (AF two-way relay Channel) where power consumption of the circuit is considered. The proposal algorithm is capable of significantly reducing the computational complexity, whilst attaining near-optimal performance compared to exhaustive search.

Ye Wang et al [7] have proposed a scheme for antenna selection based on a genetic algorithm for very large MIMO systems in the presence of channel estimation error (CEE). The proposal gives a better performance than the traditional antenna selection algorithms with respect to channel capacity, especially for low signal-to-noise ratio (SNR) scenarios.

Yajun Zhang et al [8] have proposed Transmit Antenna Selection (TAS) – jamming protocol which selects two antennas at the transmitter that maximizes and minimizes the instantaneous SNR at the receiver, respectively. Then, the antenna with maximum SNR (strongest-antenna)is used by the transmitter to transmit valid data, and the antenna with minimum SNR (weakest-antenna) is used to transmit jamming, simultaneously. TAS-Jamming protocol offers higher secure performance than other existing TAS protocols when the SNR of transmitter-receiver channel is below a specific value.

Utpal Pandey et al [9] have proposed channel selection algorithm and this algorithm selects a desired channel matrix based on maximization of complex tap coefficients from all available estimated channels corresponding to different delay indexes. This algorithm provides better performance.

Hongjiang Lei et al [10] have proposed and investigated the secrecy outage performances of optimal antenna selection (OAS) and suboptimal antenna selection (SAS) schemes for MIMO based CR systems over Nakagami-m channels, and we compare them with the space-time transmission (STT) scheme. The expressions for the exact and asymptotic secrecy outage probability (SOP) for various schemes are derived in closed-form. This algorithm provides a better performance.

III. COMPARATIVE ANALYSIS

Publication Year	Proposed System	Result
2017 [11]	• They proposed symbol error rate (SER) of a Transmit Antenna Selection (TAS)-Maximal	• SER of the proposal over non-identical fading channels is enhanced by the the multi-relay diversity

	Ratio Combining (MRC) with relay and user selection in the multiple-input multiple-output (MIMO) systems over non-dentical Nakagami fading channels.	and multi-user diversity and sum of non-identical fading parameters for different transmit antennas, relays and destinations.
2016 [12]	• Downlink transmission over a sparse massive MIMO channel system. • Novel path selection algorithm to maximize sum rate. • They introduced a bipartite graph, which connects angle of departure (AoD) to users in the beam-space domain.	• The proposed path selection algorithm outperforms the conventional user selection algorithms.
2017 [13]	• Analysis of the Downlink multiple-input multiple-output decode-and-forward relaying network is done by considering Nakagami-m fading as a model for the channel gains. • The system performance is analyzed by using a joint scheme (JS)	• Improved performance of the proposal.
2016 [14]	• Proposed Dinkelbach's method for relay selection. • Proposed mathematical property of monotonicity used to calculate Lagrangian multipliers	• Numerical results illustrating the performance gain due to relay selection.
2016 [15]	• optimal antenna selection technique in the case of the correlated MIMO downlink channel due to RF module cost	• The proposed system provided the channel capacity significantly enhance considering equal power transmission.
2016 [16]	• Tabu Search (TS) and three bio-inspired optimization algorithms were used for choosing an antenna in Massive MIMO systems. • The three bio-inspired algorithms were: Particle Swarm Optimization (PSO), Genetic Algorithm (GA), and Artificial Bee Colony (ABC).	• Proposed TS algorithm by achieved higher capacity with GA than PSO and ABC, and much shorter CPU time than any of the bio-inspired techniques.
2016 [17]	• They proposed joint selection strategy and the optimal strategy profile which maximizes the sum rate . • Then a distributed algorithm is proposed to achieve the Nash equilibrium.	• Proposed algorithm provided an optimal sum rate performance with low complexity.
2017 [18]	• Proposed the Block Diagonalization (BD) and user selection based on limited feedback in multiple antenna broadcast channels. • Also proposed Channel Quality Indicator (CQI).	• Proposed BD achieved an asymptotically optimal growth in throughput with the proposed CQI, based solely on a finite-rate feedback of channel information.
2016 [19]	• Proposed an algorithm to compute the transmit-power that is to be allocated using water filling method and antenna subset selection schemes.	• Achieved optimaum channel gains and better performance.
2013 [20]	• They considered transmit antenna selection in the downlink of massive MIMO systems, and the maximization of capacity/sum-rate is used as selection	• With antennae selection algorithm they achieved significant performance.of cylinderical array. • Without antennae selection algorithm they achieved lower

	criterion.	performance than linear array.
2013 [21]	• Transmit Antenna Selection (AS). • propose an efficient technique for both complexity and search reduction. • The mutual information maximization algorithm and generated look up tables (LUT), which specify the MIMO order, are used. • Proposed different low complexity techniques to find the optimal/sub optimal subset in a selected MIMO order.	• proposed technique fully exploits spatial multiplexing and proved to have reduced complexity as compared to already available schemes with no or minor performance degradation as well. • For future enhancement, the discussed concepts should be extended to the receiver side of the wireless link and solutions to avoid the lookup table should be proposed
2014 [22]	• Proposed a new Transmit Antenna Selection (TAS) scheme. • For secure data transmission, Alamouti (TAS-Alamouti) coding system is proposed at the selected antennas. • They proposed optimal power allocation system at antennae transmitter.	• TAS-Alamouti scheme outperforms • TAS-Alamouti-OPA always outperformed the traditional single TAS scheme. TAS-Alamouti-OPA required only one extra feedback bit relative to TAS-Alamouti in order to provide improved secrecy performance. • Future directions for our work include integration of our new schemes with location verification techniques for even more enhanced security at the wireless physical layer.
2012 [23]	• They proposed a fast selection algorithm as the suboptimal solution for channel capacity maximization. • proposed to use only a part of available radiation patterns based on the estimation of	• The proposal provided significant improvements with respect to channel capacity and diversity order.

	the correlation before performing the pattern search.	
2012 [24]	• They proposed orthogonality based user and receive antenna selection algorithms	• The proposed orthogonality-based user and receive antenna selection achieved much better complexity and performance tradeoff than the existing capacity-based and norm-based algorithms.
2014 [26]	• They proposed introduction of queues for secondary users to control channel accessing system. • Markov chain models are proposed to analyse performance of channel assembling system.	• The proposed system increased the capacity of the secondary network and spectrum utilization while decreasing probability of blocking and forced termination.
2010 [27]	• Minimum Mean Square Error (MMSE) channel estimation method is proposed • To improve BER, a fast antenna selection scheme is proposed.	• The proposed antenna selection scheme improves the MIMO system BER performance.
2011 [28]	• They propose a suboptimal transmit antenna selection for MIMO relay system	• The proposed suboptimal antenna selection considers all links and it hence has insignificant performance loss while the other suboptimal methods have significant performance losses.
2011 [29]	• They proposed Nash equilibrium and modified algorithm to improve sum rate performance.	• The proposed algorithms could achieved optimal or near optimal sum rate performance with low complexity.
2010 [30]	• They proposed a new selection scheme via an improved particle swarm optimization (IMP SO)	• The proposal scheme achieved excellent performance in correlated MIMO channels.

	algorithm.	

IV. CONCLUSION and Future Scope

In this article we presented a comparative study and analysis of dynamic resource allocation in MIMO heterogeneous services in cognitive radio networks. In this literature survey we studied different system used to achieve best performance over secondary networks, effective resource utilization, channel allocation throughput, delay; power consumption etc., each method provides improvised performance based on them approaches. In future we can develop an efficient priority scheduling and channel allocation algorithm for MIMO heterogeneous CRN to achieve a significant overall network performance like throughput, delay.

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