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List of Publications

[1] Dobaria, A. D., & Vora, V. S. (18 Sep, 2021). Concise examination of Spectrum sensing Techniques in Cognitive Radio - Issues and Challenges. *National Conference on Emerging Technologies for Intelligent Electronic System Design, Sponsored by IETE Sub Centre Indore*, 9.

[2] Dobaria, A. D., & Vora, V. S. (30 Dec, 2022). Performance Evaluation of DCSS using Two Level 1-Bit Hard Decision Strategies over TWDP Fading Channel. *International Journal of Electrical and Electronics Research,* 1064-1070.

[3] Dobaria, A. D., & Vora, V. S. (03 Apr, 2023). Efficacy of Decentralized CSS clustering model over TWDP fading Scenario. *International Journal on Recent and Innovation Trends in Computing and Communication.317-324.*

Concise examination of Spectrum sensing Techniques in Cognitive Radio - Issues and Challenges

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Abstract. With the rapid emergent of wireless technology in world, day by day the usage of wireless services is increases by client. To accomplish wireless services the fixed spectrum strategy is used in this wireless network. By use of this fixed spectrum strategy the difficulty of spectrum scarcity arises in several part of spectrum bands. Due to this scarcity problem an enormous amount of spectrum is not properly utilized by the clients, which is called spectrum underutilization. The discrepancy among necessitate of spectrum and spectrum underutilization a modern spectrum access strategy called cognitive radio which is able to accomplish such problem. Spectrum sensing is an important function of cognitive radio network (CRN) to circumvent harm interference with licensed users and identify the unused spectrum to get better the spectrum utilization. In this paper, a brief survey of different spectrum sensing methods is provided by discussing its models, characteristics, issues and challenges.

Keywords: Cognitive Radio, Primary user, Secondary user, spectrum sensing.

1 Introduction

The persistently rising the users demand for data traffic in wireless communication systems, demanding the innovative techniques of handling and managing the current radio spectrum resources. This challenge, along with a scarcity of existing spectrum resource, has encouraged researchers to derived with the new idea of cognitive radio (CR), introduced in elementary works by J. Mittola [1]. Due to fixed spectrum assignment strategy faces the spectrum scarcity in some part of spectrum bands. In accordance with this problem, a large portion of frequency bands are unoccupied most of the time or some bands are completely not utilized or some are heavily utilized [2]. The radio spectrum is an inadequate natural resource and its right to use is regulated by government bodies like Federal Communication Commission (FCC) in the United States and European Telecommunications Standards Institute (ETSI) [2-4]. In the cognitive radio terminology, the frequency which is temporary unused from the radio spectrum is called Spectrum Hole. The users who use a frequencies from the licensed band is referred as primary user (PU) and having a highest priority to use that spectrum. The users who use a vacant frequencies form the licensed band which are not utilized by primary user in order to devoid of creating any interference to primary

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Performance Evaluation of DCSS using Two Level 1-Bit Hard Decision Strategies over TWDP Fading Channel

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ABSTRACT- The spectrum sensing method's dependability is greatly influenced by two of the most crucial factors, including various fading channels and nearby wireless users. Multipath fading, buried terminals, and shadowing are just a few of the challenges encountered by users of non-cooperative spectrum sensing systems. Cooperative spectrum sensing approach gives a remedy for this issue. With the use of the common receiver, CSS permits the user to detect the spectrum. Additionally, it has been separated into distributed CSS (D-CSS) and centralized CSS (C-CSS). By using particular rules to identify the presence of the licensed user, both concepts are compared to one another in this article. The effectiveness of cluster-based distributed cooperative spectrum sensing over two-wave diffuse power fading channels (TWDP Channel) is also examined in the article. Wei-bull and Hoyt fading channels are two examples of fading channels that have previously exploited this idea. In this paper, simulation findings for the less well-known two-wave with diffuse power channels are reviewed. This work mainly focused on CSS over TWDP fading channels along with several proposed approach for two stage hard decision strategies using AND fusion and OR fusion. The simulation performance findings for TWDP fading situation enhance the OR_AND fusion strategy detection performance at various SNR levels. The presented D-CSS approach helps users to get beyond the difficulty they have when using non-cooperative spectrum sensing and lists the relationship among detection efficiency and power consumption for Cognitive radio technology used in constrained wireless environments.

General Terms: Spectrum underutilization, licensed user.
Keywords: Cognitive Radio, Cooperative spectrum sensing, hard fusion strategies, Detection probability, Two-wave with diffuse power fading (TWDP), Missed-detection probability.

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1. INTRODUCTION

As is common knowledge, for humans to address more specific needs like relationships and mental and physical health, certain physiological demands like food, water, air, clothes, shelter, and sleep must be met.

Furthermore, it is difficult to imagine humans existing in a world without wireless technology like mobile smart phones, which enable human communication. Due to the same, the market for electromagnetic radio frequency spectrum has expanded over the past 20 years, making it a precious resource. Wireless communication services have increased significantly as a result. Because of these fixed frequency allocations over a region, a sizable percentage of the spectrum are left unutilized for a sizable period of time or area. The advancement of CR technology is essential for overcoming spectrum shortage. The governments fixed allocation procedures, which allot licensed spectrum to main users (PU), result in an underutilized spectrum since the bulk of it is idle at odd hours and places. The development of new paradigms opens new opportunities for the development of cognitive radio (CR). Joseph Mitola first presented the idea of Cognitive Radio (CR) Technology in 1998 as a revolutionary way to wireless communication in order to overcome the congestion problems [1]. To utilize an unused spectrum over a licensed radio frequency spectrum by the unlicensed user or Secondary user (SU), the CR technology acts a very helpful role which allows the well-organized usage of spectrum by use of spectrum sensing based on opportunistic sharing.

When the licensed frequency channel is not being used by the principal user in CR technology, the unlicensed user or secondary users may use an unused channel for communication. But, as soon as the primary user wants to use the same then secondary users can quit the communication immediately.

While such type of switching occurs, there is a possibility of overlapping. To keep away from this type of overlapping or hindrance the effectual detection of the primary user is a must which is the foremost problem of CR. Spectrum sensing is the prime requirement of CR technology. Understanding a spectral contact or measuring the energy level of radio frequency defines

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Efficacy of Decentralized CSS Clustering Model Over TWDP Fading Scenario

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Abstract— Cognitive Radio technology, which lowers spectrum scarcity, is a rapidly growing wireless communication technology. CR technology detects spectrum holes or unlicensed spectrums which primary users are not using and assigns it to secondary users. The dependability of the spectrum-sensing approach is significantly impacted from two of the most critical aspects, namely fading channels and neighboring wireless users. Users of non-cooperative spectrum sensing devices face numerous difficulties, including multipath fading, masked terminals, and shadowing. This problem can be solved using a cooperative- spectrum-sensing technique. For the user, CSS enables them to detect the spectrum by using a common receiver. It has also been divided into distributed CSS and centralized CSS. This article compares both ideas by using a set of rules to find out whether a licensed user exists or not. This thought was previously used to the conventional fading channels, such as the Rician, Rayleigh and the nakagami-m models. This work focused on D-CSS using clustering approach over TWDP fading channel using two-phase hard decision algorithms with the help of OR rule as well as AND rule. The evaluation of the proposed approaches clearly depicted that the sack of achieve a detection-probability of greater than 0.8; the values SNR varies between -14 dB to -8 dB. For all two-phase hard decision algorithms using proposed approach and CSS techniques, the detection probability is essentially identical while the value of signal to noise ratio is between -12 dB to -8dB. Throughout this work, we assess performance of cluster-based cooperative spectrum-sensing over TWDP channel with the previous findings of AWGN, Rayleigh, and wei-bull fading channels. The obtained simulation results show that OR-AND decision scheme enhanced the performance of the detector for the considered range of signal to noise ratios.

Keywords- Cognitive Radio, Secondary user, Decentralized Co-operative Spectrum Sensing, Cluster head, detection probability, false-alarm probability.

I. INTRODUCTION

Various international and national administrative agencies have implemented a series of laws over the last few decades, leading to radio spectrum crowding. As a possible consequence of devoting vast spectrum allocations to services that are inconsistent but quite demanding, there is now an artificial scarcity in spectral range to support the ever-growing wireless applications. As reason of a contradiction in national interests, the possibility of spectrum reallocation is economically unfeasible, and any future allocations would require global discussions. Cognitive radio (CR) platform provides an intriguing alternative by enabling secondary users (commonly referred as CR terminal) to access the spectrum beside the licensed users (referred as PU's) which have subscribed for the sole use of the radio spectrum.

In contrast, FCC spectral occupancy measurements indicat e that the majority of licenced bands are not used for large part s of time [1-3]. The idea behind cognitive radio is that it will help the radio system make better use of the available spectrum by employing intelligent and learning processes. Cognition's goal is to provide a means of coexistence for both licensed and unlicensed users of CR technologies by minimizing the amount of interference between them. Non-licensed users can send and receive data during the times when licensed users are not using such frequencies. When looking for licensed users, spectrum sensing plays a crucial role in determining their existence or non-existence [3-7]. Spectrum sensing relies heavily on CR's ability to perform following functions as depicted in figure 1 [8-10]. Spectrum sensing is the process of identifying empty channels within a frequency band by identifying the existence or non-existence of a PU inside a permitted spectrum. By capturing the optimal spectrum for a given application, as part of its spectrum management process, CR meets the needs of its users in terms of their ability to communicate. When a prime user has to transmit again, a secondary user with spectrum mobility