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Multiple Relay Hybrid Approach Improved Security and Reliability Trade Off In Cognitive Radio Network

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Abstract – Cognitive Radio has been the solution for the problem of underutilization of radio spectrum in which cognitive radio devices intelligently sense and exploit the part of spectrum. Hybrid Cognitive Radio Network is useful to improve the security and reliability of the network. Hybrid cognitive radio network jointly utilize both the cognitive and licensed radio networks. This paper analyses the performance of Hybrid Cognitive Relay network for single relay and multiple relay under AWGN and Rayleigh fading channels. The performance metrics such as Capacity, Bit error rate and Spectral efficiency are formulated and numerical simulations by using MATLAB are performed. This analysis is helpful in determining the Capacity and Bit error rate for optimum usage of power and bandwidth is better. This analysis is also helpful to compare the result of single relay and multiple relay hybrid graphs.

Aim of study: Improve Security and reliability in Cognitive radio network (communication) by using hybrid relay approach.

Methodology: MATLAB R2016a is used for implementation and Hybrid technology is used.
Findings: Data is more secured and reliable during transmission when this multiple relay hybrid approach is used.

Keyword: Amplify-and-forward, Decode-and-forward, Hop-wise harmony, Relay network, Cognitive radio, Many input many output.

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1:- INTRODUCTION

In wireless channel when broadcasting is in process than a user transmits data to another user and nearby users can also receive the signal. These nearby users can act as relays to forward the received data from the source to the destination. Such kind of collateral networks are known as relay networks. Relay Selection is important for powerful communication and to main quality of service (QoS) and different parameters in Cooperative Networks (Zhou, et. al., 2011). To improve the performance of relay networks various relay selection strategies have been proposed. The simplest strategy involves the selection of a single relay that gives the strongest end-to-end path from the source to the destination (Bharadia, et. al., 2011). Another processing techniques such as amplify-and-forward (AF), decode-and-forward (DF) and network-coded cooperation are also suggested.

In Wireless Communication the data from source to destination is sent through the participation of intermediary relays (Nasir, et. al., 2014). Wireless networks are characterized by the phenomena of multi path fading, shadowing and path loss. The relays i.e. single relay or multiple relay form a virtual antenna array and with united strategy they can get the benefits of multiple-in multiple-out (MIMO) system. We analyze the performance Hybrid relaying scheme that reduces the required bandwidth and bit error rate. We will mainly analyze, A Hybrid relaying scheme over fading channels by using single relay and multiple relay.

2:- RESEARCH OBJECTIVE

Hybrid relay selection scheme (Decode and forward + Amplify and forward) is considered to enhance the wireless secrecy capacity and to reduce the implementation complexity. Also analyzed the SRT by

using hybrid relay scheme of the conventional direct transmission and over fading channel transmission. Apply Hybrid relay selection scheme in cognitive radio network based on multiple relay approach.

3:- LITERATURE REVIEW

- **Jia Zhu, Zhida Liu, Yuan Jiang, and Yulong Zou(2015):** In this paper, the SRT performance of a cooperative AF relay network in the presence of an eavesdropper, in which the source transmits it signal to the destination with the help of multiple AF relays. We analyzed the SRT performance of the best-relay selection over Rayleigh fading channels, while the direct transmission is presented as a benchmark. It was shown that the best-relay selection scheme outperforms the direct transmission in terms of its SRT. In addition, as the number of AF relays increases, the SRT performance of the best-relay selection scheme improves significantly.

- **Amitav Mukherjee, , S. Ali A. Fakoorian, *Student Member, IEEE,* Jing Huang, and A. Lee Swindlehurst, *Fellow, IEEE*(2014):** In this paper the essential premise of physical layer security is to enable the exchange of confidential messages over a wireless medium in the presence of unauthorized eavesdroppers, without relying on higher-layer encryption. This can be achieved primarily in two ways: without the need for a secret key by intelligently designing transmit coding strategies, or by exploiting the wireless communication medium to develop secret keys over public channels.

- **Cheol Jeong*, Member, IEEE*, Il-Min Kim*, Senior Member, IEEE*, and Dong In Kim*, Senior Member, IEEE*(2014):** In this paper, we studied an AF MIMO relay system where the relay was considered as a potential eavesdropper. The cooperative scheme should be used when the number of relay antennas is large, the relay transmit power is high, and the distance between the source and the relay is small compared to the distance between the source and the destination.

- **Yulong Zou, Xianbin Wang, and Weiming Shen(2013):** In this paper the physical-layer security in cooperative wireless networks with multiple relays where both amplify-and-forward (AF) and decode-and-forward (DF) protocols are considered. an asymptotic intercept probability analysis to evaluate the diversity order performance of relay selection schemes and show that no matter which relaying protocol is considered (i.e., AF and DF), the traditional and proposed optimal relay selection approaches both achieve the diversity order M where M represents the number of relays.

- **A. Olteanu and Y. Xiao(2010):** In this paper security conventional way is to apply cryptographic techniques. But this increases system complexity together with introduces computational overhead. The existing cryptographic approaches are not perfectly secure and can still be decrypted by an eavesdropper (E), provided that it has the capacity to carry out exhaustive key search with the aid of brute-force attacks.

4:- METHODOLOGY

CR represents a paradigm change in spectrum regulation and access, from exclusive use by primary users to shared spectrum for secondary users, which can enhance spectrum utilization and achieve high throughput capacity. Cooperative communications represents another new paradigm for wireless communications (Sun and Letaief, 2008), (Bharadia, et. al., 2011) We assume a primary network with multiple licensed bands and a CR network consisting of multiple cooperative relay links. Each cooperative relay link consists of a cognitive radio transmitter, a cognitive radio relay, and a cognitive radio receiver. The objective is to provide an analysis for the comparison of two representative cooperative relay strategies, i.e., *decode and forward* (DF) and *amplify and forward* (AF), in the context of CR networks.[9] We first consider cooperative spectrum sensing by the CR nodes. We model both types of sensing errors, i.e., miss detection and false alarm, and derive the optimal value for the sensing threshold. We develop expressions i.e. closed form for the network wide capacities. This can be achieved by decode forward and amplify forward respectively, as well as that for the case of direct link transmission for comparison purpose. Through analytical and simulation evaluations of DF and AF-based cooperative relay strategies, we find the analysis provides upper bounds for the simulated results, which are reasonably tight. [11]There is no case that one completely dominates the other for the two strategies.

5:- PROPOSED MODEL

Multi-Hop Relay Selection is the most informal relaying approach in the treatise is to select a relay to help a transmission from a sender to a destination. Data send by direct transmission also from source to destination. [7]Single transmission/data transmission can do by using with and without hybrid approach. The clogging free shortest path from source to destination is found by using the routing algorithm. When applied to multi-hop networks, this method desires the repetition of the relay selection procedure for each hop from sender to destination.

We design a network with multiple nodes. In this methodology first node behaves as a source and last node behave as a destination. Decode and forward technique is chosen from source to relay. This will help to reduce the error present in the transmitted signals, and retransmit to the next relay or destination (Bharadia, et. al., 2011) Hybrid can work combination of decode forward and amplify forward approach. If the next node is a relay, then decode and forward is chosen else if the next node is destination, then amplify and forward is chosen. Amplify and forward is mainly used to amplify the received signals. So hybrid protocol is used to obtain secured data.

The steps to be followed in the proposed technique are

Step 1: Random SNR Generation.

Step 2: Check the SNR value and choose the acceptable signals.

Step 3: Source to relay and relay to destination apply direct transmission.

Step 4: Again signal transmission by using single relay approach.

Step 5: Again signal transmission by using multiple relay approach.

Step 6: Again signal transmission Source to relay communication –decode and forward, Relay to destination communication –amplify and forward for single relay Hybrid approach.

Step 7: Again signal transmission Source to relay communication –decode and forward, Relay to destination communication –amplify and forward for multiple relay Hybrid approach.

Step 8: Final output

6:- RESULT

The X-axis represents the outage probability and Y-axis represents the intercept probability. From our proposed methodology the signal transmitted by direct transmission, artificial noise, single relay, multiple relay data transmission through source to destination without hybrid approach and also single relay, multiple relay data transmission through source to destination with hybrid approach.

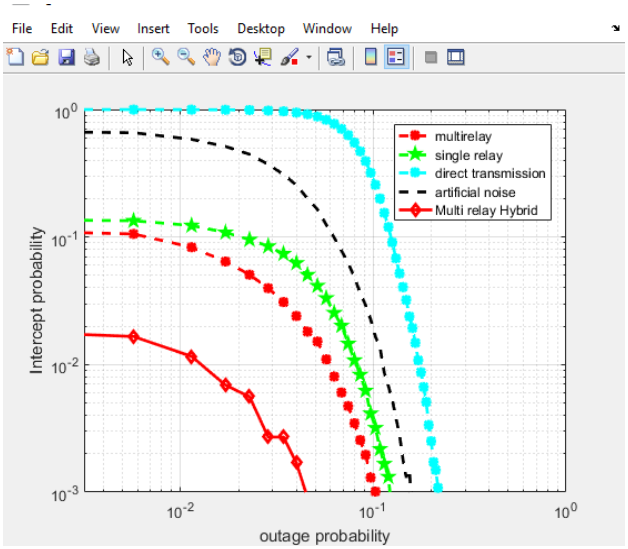

Fig 2:- IP versus OP of the direct transmission, artificial noise, single relay scheme, multiple relay scheme, single relay hybrid scheme, multiple relay hybrid scheme for (Pcd, Pfd) = (0.9, 0.1)

Graph shows that as the spectrum sensing reliability (*Pcd, Pfd*) = (0.9, 0.1). For an improved security and sensing reliability, an unoccupied licensed band would be detected more accurately and less mutual interference occurs, which results in a better security and reliability trade off.

Result shows that multiple relay hybrid approach gives better security and reliability trade off rather than direct transmission, artificial noise, single relay scheme, multiple relay schemes, single relay hybrid approach. Means signal transmission through multiple relay hybrid approach gives better security and reliability trade off in cognitive radio network.

7:- CONCLUSION

We examined the security and reliability performance of the signal transmitted by direct transmission, artificial noise, single relay, multiple relay data transmission through source to destination without hybrid approach and also single relay, multiple relay data transmission through source to destination with hybrid approach secondary transmissions in the presence of relay sensing and spectrum sensing. The security and reliability of secondary transmissions are denoted in terms of IP and OP, respectively. The above results and analysis shows the importance of including the relaying links and the combining techniques into the performance analysis of cognitive networks. The novel approach to improve security and reliability by using hybrid approach i.e for multiple hybrid approach.

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