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Minimizing the Eavesdroppers in Massive MIMO Relay Network using OFDM

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ABSTRACT: In this paper, the signal received by active eavesdroppers will be minimized by reducing the bit error rate in Massive Multiple Input Multiple Output (MMIMO) relay networks using Orthogonal Frequency Division Multiplexing(OFDM).The Massive MIMO system is furnished with a more number of antenna elements in the presence of a passive and active multiple antenna eavesdroppers. Secrecy rates are derived and the simulation results reveal that the bit error rate has been reduced with respect to the Signal to Noise Ratio which will be beneficial for the secrecy performance.

KEYWORDS: Massive MIMO, Beam-forming, Spatial multiplexing, OFDM, Eavesdroppers, BER, SNR.

I.INTRODUCTION

In wireless Communication, Massive MIMO (Multiple Input Multiple Output) consist of more number of transmitters and receivers that transmits the data at the same time. Massive MIMO is developed for wireless links to provide additional signal enhancement and data capacity.[3]It is furnished with more number of antenna components as there is an increase indemand for Communication reliability, wireless throughput and user density. Massive MIMO (MMIMO) is a promising technology widely used for 5G wireless communication system. [1]Processing techniques such as beam forming can concentrate the signal energy from Massive MIMO antenna arrays to overcome the propagation losses immanent in high frequency transmission in 5G systems. Physical layer security plays an important difference between Massive MIMO and normal MIMO against eavesdropping. A Massive MIMO system operating in time division duplex is a weak spot that overlaps the pilot symbols sent from the intended users.The emerging Massive MIMO promises tremendous performance gain by employing simple coherent processing across arrays of hundreds or even thousands ofBase Station(BS).[5] When we use a number of antennas at user side and relay side, then the transmit power will be inversely proportional to each other.

In security, the information hiding plays an important role, also it has been extended to various other Scenarios such as multiple access, interference, broadcast, relay channels, fading channels, etc. Secure Communication is securing the information when transmitter and receiver communicates with each other without interruption of third party. So that the information should be kept confidential to eavesdroppers and now days there is no security for Communication.[6]Eavesdroppers are the one who secretly listens to the information shared between two users and may mishandle for own advantage. The practice of eavesdropping is highly considered as unethical and in many jurisdiction it is illegal. Some of the eavesdropping factors include Cellular networks, telephone lines, email and other modes of private instant messages. Normally we need to check that the receiver will receive the proper transmission or not. [4]The eavesdropper mostly attacks the uplink transmission phase at the Base Station to know the Channel State Information (CSI). The resulting mismatched channel estimation will increase the information leakage in the subsequent downlink transmission. In the downlink transmission phase, the eavesdropper does not attack but focuses on eavesdropping the data. Eavesdroppers can try a different ways to attack a confidential information in communication. There are two types of Communication attack and they are passive attack and active attack. The passive attackers does not affect the communication rather attempt to gain the information. But the active attackers interrupt the communication by changing the existing messages, retrieving the old messages and alter the information which is stored in the computer. In general, it is very hard

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to identify the active attackers and hence, the proposed design can effectively eliminate the impactof the eavesdropping of active attackers by reducing the bit error rate as the signal to noise ratio increases in relay networks by the derivation of asymptotic secrecy rates.

This paper is organized as follows: Section II describes the flow chart and its explanation. Section III represents the OFDM technique which is applied to gain robustness, channel estimation, signal synchronisation, channel equalisation and subcarrier modulation selections. Section IV represents experimental results showing that the bit error rate has been reduced. Finally, Section V represents conclusion.

II.RELATED WORK

The main idea of the proposed work is to reduce the bit error rate when the communication happen between sender and the receiver. When the bit error rates is reduced, the signal which reaches the eavesdropper gets degraded without changing the performance capacity in high frequency data Communication.This can be derived by applying OFDM technique. Fig.1 shows the flowchart of Massive MIMO relay network and it is summarized as follows.

1. The radio frequency signal is generated by randomized signal process method which creates the sample process communication.
   Int number=a+rand () %n;
2. The interference levels and the system capacity can be improved by using Beam-forming. [1]It makes radio signals to focus on its target from transmitter to receiver with different phase angle using multiple phased antenna arrays. The Signal to Noise Ratio has been increased by receiving high data rate from transmitter.SNR value for voice application networks is greater than or equal to 25 db and for data networks is greater than or equal to 20 db. The Channel State Information (CSI) is assumed at the transmitter and the receiver and by concentrating on the target path and by providing flexible phase range for multiple users, BER is likely to be reduced by increasing SNR.
3. The high data rate has been transmitted in the form of Streams which includes Signal to Noise Ratio in db and variance and thus it can be referred as Spatial Multiplexing. [3]Zero forcing equaliser has been includedto invert the channel.The given equation describes that the number of streams is equal to the minimum number of transmitter antennas (N_t) and the receiver antennas (N_r).
   $$N_s = \min (N_t, N_r)$$
4. Orthogonal Frequency Division Multiplexing(OFDM) has multiple signals with one signal at peak level and other at zero level. So signals are independent from each other and have the ability to perform with many modulated narrow band signals. Guard interval in signal will neglect inter Symbol Interference by distinct transmission of each signal for improvement of Signal to Noise Ratio(SNR). OFDM has been used as the channels are split into number of sub channels for high speed efficient communication. The signals in sub channel have been modulated by Quadrature Amplitude Modulation (QAM) or Quadrature Phase Shift Keying (QPSK) to reduce bit error rate.

After applying all these steps, secrecy rates of bit error rate which represents that the signal reaches the eavesdroppers will be reduced so that the eavesdroppers will not be able to get the exact data communicated between the transmitter and the receiver.

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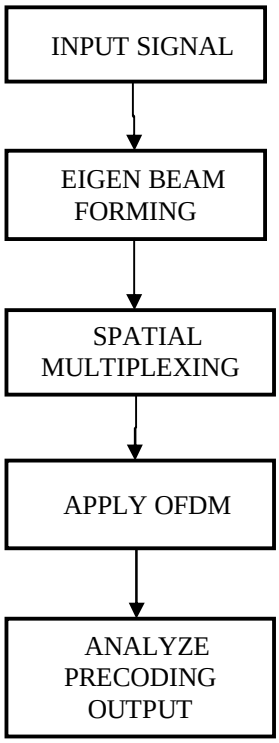

Fig. Flow chart of Massive MIMO relay network

III. OFDM TECHNIQUE

OFDM is abbreviated as Orthogonal Frequency Division Multiplexing is a technique used to divide a high data Streams into number of low data streams and each stream has a symbol and by inserting guard intervals which is known as cyclic prefix extension, the Inter symbol Interference (ISI) can be reduced. Each sub channel has been sent as a parallel sub channels which are orthogonal to each other and thus the output is a modulated signal. The Channel estimation is done by pilot subcarriers. In our project, a slot is considered as the sum of 1 preamble symbol and 25 data symbols.[2]The preamble in the proposed scheme can be used much less frequently in mobile environments, leading to the higher spectral efficiency of the OFDM, MIMO scheme. It generates data and transmitted signal by using FFT. Then the cyclic prefix and noise is added to create the Guard intervals. The channel has been estimated by inverting the channel effect. Thus the errors can be counted in the data by ignoring preamble symbol. The channel co-efficient are modelled as uncorrelated Rayleigh fading channel with modulation order of M-QAM schemes.

IV. SIMULATION RESULTS

The following Figures shows that the results of Eigen Beam forming, reduction of the Bit Error Rate by using the OFDM technique.Fig.2 represents the Eigen Beam formingwhich illustrates the symbol error (P_r) has been decreasing as the number of information symbol energy per symbol to noise power spectral density (E_s/N_o) increases. Fig 3 represents the reduction of Bit Error Rate (BER) as the Signal to Noise Ratio (SNR) increases.

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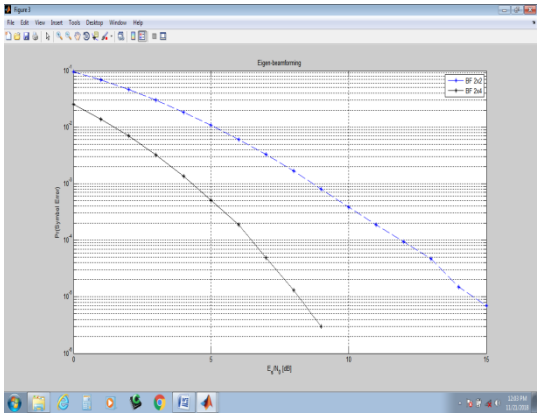

Fig.2 Eigen Beamforming ($P_r$vsE_s/N_o)

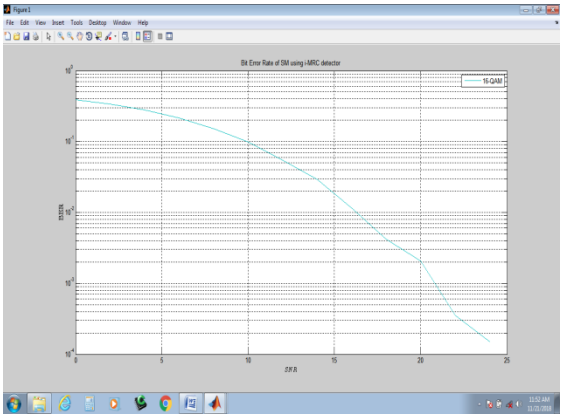

Fig.3 Bit Error Rate (BER) performance vs. Signal to Noise Ratio (SNR)

V. CONCLUSION

In the proposed work,a secure communication model for massive MIMO relay network is implemented by degrading the eavesdropper's ability to decode confidential data. Thus the bit error rate has been controlled by using OFDM technique to minimize eavesdroppers

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