Efficient Detection and Combining for Cooperative Wireless Systems Over Frequency Selective Channels

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Abstract - The cooperative relay network is the integrated part of the long distance communication system and the optimum performances of it makes communication reliable as well as improve better quality of service. Cooperative communication means wireless nodes can help each other for communication. In this work, study of cooperative wireless communication is done, and proposes a cooperative system with different relay selection modes for the better error rate performance of the cooperative communication system. In this paper we have simulated the cooperative relay network with relay selection modes having harmonic and maximum values of SNR without collaboration. The proposed approach contains the combining techniques employed at the receiver to combine various signals received from different cooperative channels like SD, SR and RD. The combining techniques referred here is MRC and C-MRC with no cooperation without coordination threshold Max (min (snr)) modes and two cooperative modes DF(Detect and Forward). The combined signals are followed by detection technique, Minimum Mean Square Error (MMSE) and Maximum Likelihood(ML)to reduce the bit error rate(BER) and found enhancement in the existing results.

Keywords - Frequency Selective Channel, DF, C-MRC Combining, MMSE, ML.

I. INTRODUCTION

wireless communications keeps on developing with different upgraded advancements, the communicate idea of the wireless medium has been misused to accomplish better performance for information transmission .One particular viewpoint is that multiple hubs in a network can help each other to forward information to a coveted goal. The vitality squander and the undesirable impedance that have been normally considered as disadvantages of the common media now become a potential asset in helping the communication between centers. The weakening in flag quality caused by extreme fading of the source-goal connection could be unraveled with the assistance of intermediate hubs whose channels are free of the channel between source hub and goal hub. Consequently, the likelihood of effective transmission may be improved for a more dependable communication if these issues are tended to.

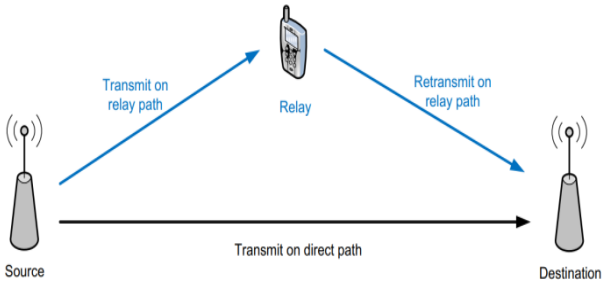

Fig.1.1Cooperative Wireless communication.

Decode and forward (DF)

Basic system model and transmission technique is same as on account of Amplify and Forward protocol. The main contrast lies in the working of transfer station. Transfer station, simply interpret the got signal and then re-encode the information which is sent to the goal. This protocol is favored when hand-off has expansive computing time and power. Error remedying methods are utilized as a part of request to accomplish revise information at the goal. In the event that the got information isn't right then it is disposed of at hand-off station.

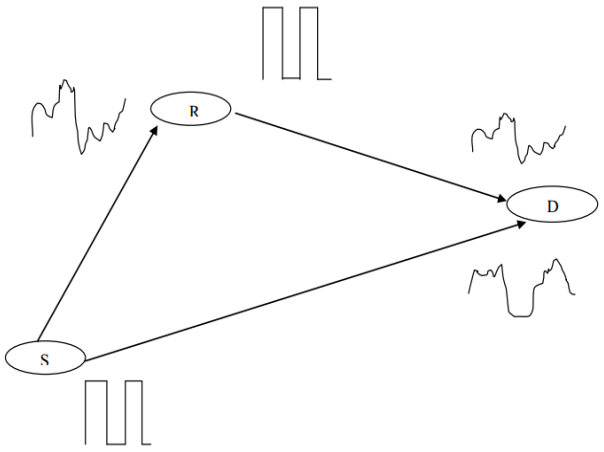

Fig.1.2 Decode and forward protocols.

Without utilizing error amending methods the performance of Decipher and Forward protocol is most noticeably awful as compare to the Amplify and Forward protocol. Error

revising methods expands the complexity at the hand-off station, as hand-off needs to unravel the entire signal which is transmitted by the source and send the encoded adaptation of signal to the goal. In any case, there is no problem of noise amplification as on account of Amplify and Forward protocol. In this proposal, the main concentration is to think about the performance of cooperative communication utilizing amplify and forward protocol. Figure 1.2 shows translate and forward handing-off protocol utilized as a part of cooperative communication system.

Selective DF relaying

In a selective DF relaying scheme, if the value of received SNR from source at the relay is above a threshold value, the relay decode and forward received information to destination. If received signal SNR is low because of fading, the relay is idle. Selective relaying has beter performance than fixed DF relaying. Due to inherent problem in fixed DF relaying, threshold is determined at the relay. The selective relaying scheme achieves diversity order two because of that to become a outage, both of two links should be in outage. At high SNR, selective DF and AF have the same diversity gain.

II. FREQUENCY SELECTIVE CHANNEL MODEL

Employing different circulated relay nodes between two terminal hubs can enhance cooperative decent variety in remote relay frameworks as appeared in Part 3. Be that as it may, by and by, there is a compelling issue of synchronization between these appropriated relay hubs because of a few factors, for example, unique engendering delays and relay areas. Accordingly, the transmitted signals touch base at various time moments at the relays and recipient hub which may cause an image level synchronization issue. In this section, a novel vigorous plan for two-route transmission more than four relay nodes to utilize in cooperative relay systems with flawed synchronization between relay nodes and the two terminals is proposed.

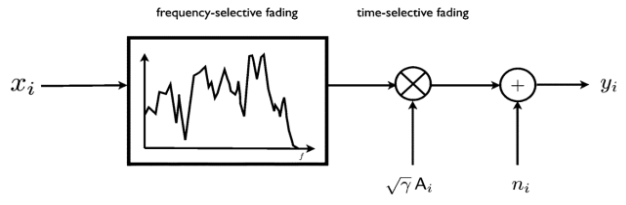

Fig. 2.1 block diagram of frequency selective channels.

To minimize the intersymbol obstruction and added substance noise impacts, the equalizer coefficients can be optimized utilizing the minimum mean squared error (MMSE) paradigm. At the point when the SNR has hoisted values the MMSE equalizer fills in as Zero Compelling does, however when the SNR has bring down qualities, the way that MMSE equalizer considers the noise and signal fluctuation, makes to not amplify the noise as Zero Constraining does

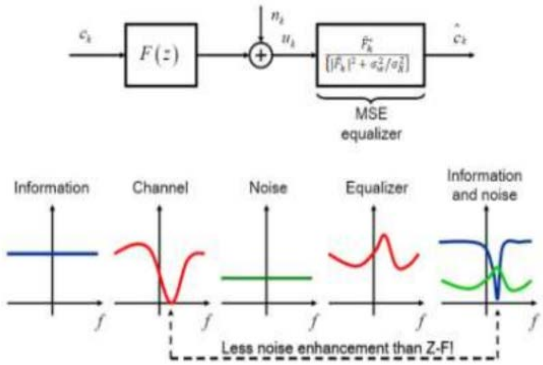

Fig. 2.2 MMSE Equalizer.

As it can be found in the Fig,2.2 when the Signal to Noise Proportion (SNR) has high esteems, the MMSE equalizer fills in as the Zero Constraining does, yet for whatever remains of qualities that SNR can take, the MMSE equalizer works better in terms of mutilation.

III. PROPOSED METHODOLOGY

The cooperative relay system is made the communication possible with relay based approach which is the operation similar like amplification during transmission to reduce the effect of interferences and noises mixed with the signal during transmission over wireless channel.

But system still need to be improved to make long distance communication possible with less noise and distortions during transmission. The same thing kept in mind the a cooperative relay system is proposed in this work. This is brief here. the block diagram of the proposed cooperative relay selection scheme with multiple modes amplify and forward and detect and forward followed by combining technique selection combining (SC) and efficient detection (ED). To reduce the effects of errors detection algorithms are applied which are maximum likelihood (ML), minimum mean square error (MMSE) and zero forcing (ZF). Where data is randomly generated to achieve the all the possibility of noise encounters. The channel considered here Gaussian channel which is the most near to practical channel behavior. After applying combining techniques at the receiver signal is then detected by the detection algorithms and then finally get the data at the output.

The proposed system is explained using the block diagram in the Fig. 3.1, and this system is simulated in the simulation environment and the simulation steps are shown

in the Fig. 3.2 with the help of flow chart. In the simulation step first the simulation environment need to be created with the help of variables, followed by the initialization of the channel coefficient initialization which are Efficient detection (ED) having relay selection schemes. The data is generated randomly to achieve all the possibilities with the system integration. Then the proposed methodology is applied i.e. combining techniques followed by linear (MMSE, ZF) and non-linear (ML) detection techniques to get the optimum results. Last step is to compare and display all the possible relay selection results with different techniques and modes.

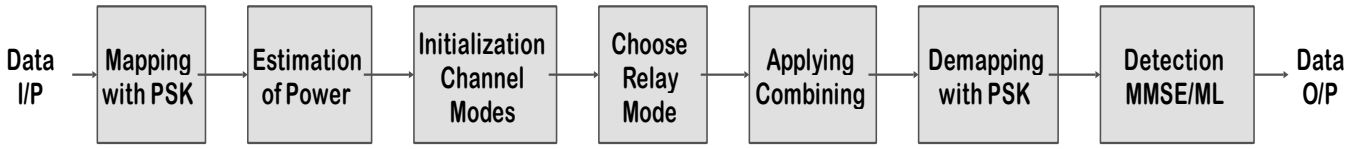

Fig. 3.1 Block Diagram of Proposed Methodology

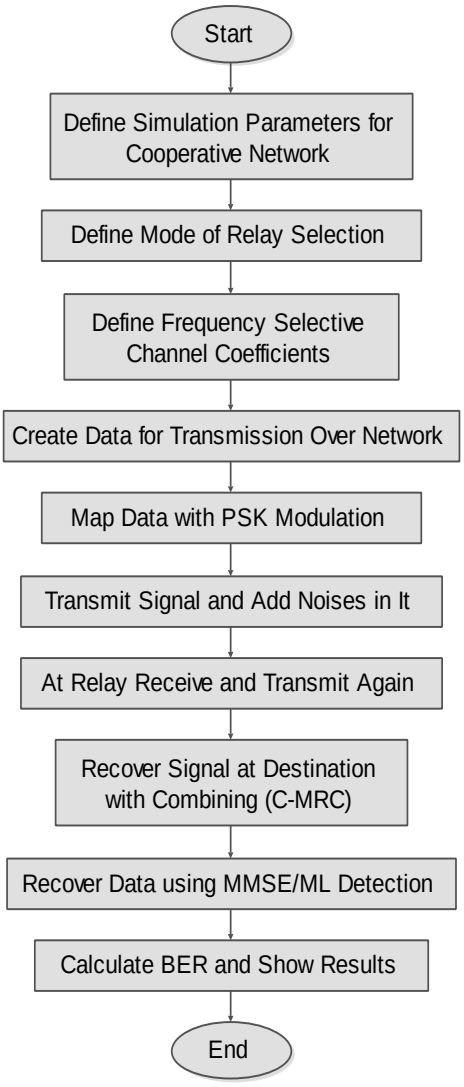

Fig. 3.2 Flow Chart of Proposed Methodology

IV. SIMULATION RESULTS

In this section the simulation results of the proposed system utilizing different cooperative modes and Various Relay Selection Modes and the optimum BER is achieved using minimum mean square error(MMSE) and maximum likelihood (ML) detection. The detected signals at the receiver side from various cooperative modes are than combined using efficient combining techniques(e.g. MRC, Coherent-MRC etc.) and outcomes are given in below figures.

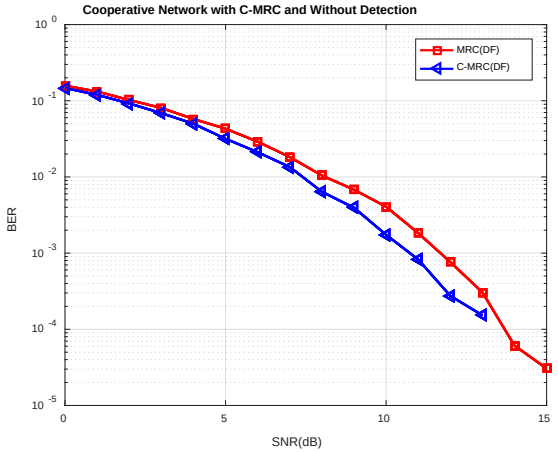

Fig. 4.1 BER Vs SNR Curves using Relay Selection and without Detection Relay Selection with MMSE Detection, Different Combining Techniques and Cooperative Modes

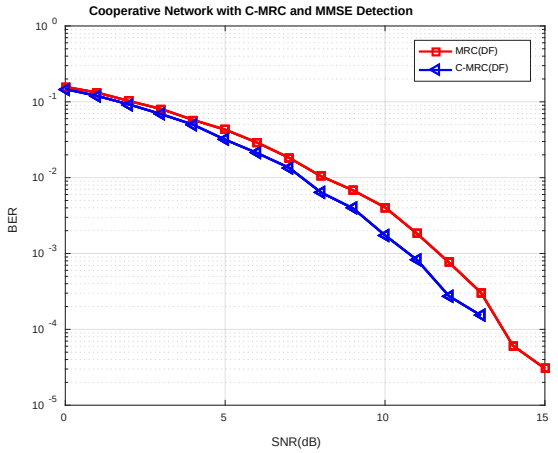

Fig. 4.2 BER Vs SNR Curves using Relay Selection and MMSE Detection Relay Selection with MMSE Detection, Different Combining Techniques and Cooperative Modes

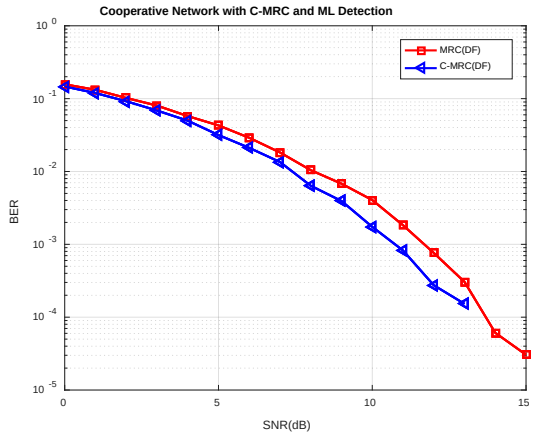

Fig. 4.3 BER Vs SNR Curves using Relay Selection and ML Detection Relay Selection with MMSE Detection, Different Combining Techniques and Cooperative Modes

From the above simulation results of proposed system with Coherent-MRC and MRC with relay selection schemes and MMSE and ML detection technique, and it can be seen that the cooperative relay communication system outperform with C-MRC with DF cooperative mode with No Collaboration Threshold Harmonic(SNR) and MRC with DF cooperative mode with Collaboration threshold Max (min (SNR)) relay mode.

V. CONCLUSION AND FUTURE SCOPE

From the simulation results we can say that the results of the proposed approach is better with the coherent maximal ratio combining (C-MRC) using Detect and Forward (AF) followed by detection algorithms MMSE and ML using No Collaboration Threshold Harmonic (SNR) relay mode and MRC combining technique with DF cooperative mode followed by MMSE and ML detection using Collaboration threshold Max (min (SNR)) relay mode. It can been seen the simulation results in the previous section if this paper. For further enhancement in the existing system the application of digital filtering with more efficient detection algorithms make system more robust and error free.

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