Abstract-- In this research paper we have reviewed the cooperative network methodologies for a wireless communication. The wireless communication protocol can be considered an implicit cooperation protocol if it applies rules for medium sharing among users such as ALOHA. In general the concept behind cooperation in wireless communications is to make the independent, and by nature non-cooperative, users of the network share their limited resources. Implicit cooperation is a primitive form of cooperation and does not require any pre-established cooperative framework. On the other hand, explicit cooperation requires advanced cooperative protocols to be pre-established. In this type of cooperation, the elements of the system are directed to cooperate by these protocols. Cooperation is also extended to the relaying procedures, which are targeted to extend the coverage range of the communication systems.

Keywords-- Cooperative Network,

I. INTRODUCTION BACKGROUND

Increasing interest in wireless applications has led to the continuous development of wireless technologies. Users of wireless applications now get more and more dependent on wireless devices that provide mobile data usage, real-time information processing, and multi-media sharing. Moreover, present-day convergence and interoperability of wireless technologies has further increased the amount of services that can be provided. Consequently, there has been a proportionate surge in research and development efforts which aim to ensure that wireless technologies meet the expectations of high quality of service. Existing conditions, specifically the nature of the wireless communication channel however poses a major challenge to the performance of these wireless technologies. Radio waves propagated through wireless channels are affected by static and mobile obstacles in the surrounding environment. These obstacles which may vary from buildings, hills, and vehicles in outdoor environments, to walls, furniture, and people in indoor environments, reflect, refract, diffract, or attenuate the propagated signal. The result is that the propagated signal is scattered out in different directions and multiple independent copies of the original transmitted signal arrive at the receiver at different times. The receiver thus observes multiple delayed versions of the transmitted signal which may add up destructively leading to erroneous detection.

This phenomenon is referred to as 'multi-path fading', and it severely hampers the quality of service that can be provided by wireless technologies.

One of the promising methods to combat multi-path fading is to employ 'diversity' techniques. Diversity techniques employ a concept whereby multiple independent copies of the transmitted signal are deliberately propagated over multiple channels with different characteristics. The concept is based on the fact that it is unlikely that different channels will experience identical fading events. Thus the probability that all the multiple independent signals will be corrupted by fading is considerably low.

There are several types of diversity techniques that have been popularly employed to combat fading in wireless networks. These include temporal diversity, and spatial diversity. While temporal diversity techniques transmit multiple copies of the transmitted signal at different time instants, frequency diversity techniques spread the transmitted signal across different frequency channels or across multiple frequency carriers in a wide spectrum. Spatial diversity techniques on the other hand have received the widest attention compared to other popular diversity techniques. Spatial diversity is achieved by propagating independent versions of the transmitted signal over multiple transmit antennas, or employing multiple receive antennas to recover the transmitted signal. When multiple antennas are used at the transmitter it is referred to as transmit diversity. Conversely, when multiple receive antennas are employed at the receiver it is referred to as receive diversity. Spatial diversity techniques have been well exploited by multiple-input multiple-output (MIMO) systems. MIMO systems, also, referred to as multiple-antenna systems, improve the robustness and reliability of communication by employing multiple transmit and/or multiple receive antennas, and utilizing spatial diversity techniques. In order to reap the benefits of spatial diversity, the multiple antennas need to be spaced sufficiently far apart, usually antenna separation of at least a few wavelengths is required to guarantee spatial diversity.

II. CHANNEL MODELS AND SYSTEM MODEL

As discussed, the transmitted signal is propagated across multiple independent paths.
Consequently, the signal arrives at the receiver at different trajectories. Fig. 2.1 illustrates a typical scenario where a transmitted signal is propagated in different ways en route the receiver section. Multipath components of transmitted signal arrive at the receiver because of the random nature with which the signal is propagated across the wireless environment. Based on this, researchers [33-35] have examined the fading effects of the wireless channel from the perspective of two independent phenomena; the ‘multipath time delay’ and the ‘Doppler spread’.

The Rayleigh flat fading channel vector between the source node and the \( p_{th} \) relay node is denoted by \( f_p \) while \( g_p \) denotes the Rayleigh flat fading channel vector between the \( t_{th} \) relay node and the destination. The coherence time of \( f_p \) and \( g_p \) is assumed to be larger than \( T \).

Let \( s = [s_1, ..., s_T] \) denote the symbol vector transmitted from the source node at the \( t_{th} \) transmission interval. The signal vector received at \( p_{th} \) relay node is given as:

\[
r_p = f_p \odot s + n_p
\]  

(2.7)

Where \( n_p = [n_{p,1}, ..., n_{p,T}] \) is the additive white Gaussian noise and \( \odot \) represents entry-wise operation. With due cognizance of the DF model, the \( p_{th} \) relay node provides estimates \( \tilde{s}_p = [\tilde{s}_{p,1}, ..., \tilde{s}_{p,T}] \) such that matrix \( S \) is formed by arranging the transmitted symbols from each relay node in a predefined array as follows:

\[
S = \begin{bmatrix}
\tilde{s}_{1,1} & \tilde{s}_{1,2} & \cdots & \tilde{s}_{1,T} \\
\tilde{s}_{2,1} & \tilde{s}_{2,2} & \cdots & \tilde{s}_{2,T} \\
\vdots & \vdots & \ddots & \vdots \\
\tilde{s}_{p,1} & \tilde{s}_{p,2} & \cdots & \tilde{s}_{p,T}
\end{bmatrix}
\]

Where the \( i_{th} \) row of \( S \), given as \( \tilde{S}_i = [\tilde{s}_{i,1}, ..., \tilde{s}_{i,T}] \) contains the \( T \) information symbols transmitted by the \( p_{th} \) relay node, and the \( j_{th} \) column of \( S \), given as \( \tilde{S}_j = [\tilde{s}_{1,j}, ..., \tilde{s}_{p,j}] \) contains the space-time symbols transmitted across all cooperating relay nodes at the \( t_{th} \) transmission interval, \( [\cdot]^T \) denotes transpose. This scheme achieves optimization in terms of unitary code-rate because from (2.8) it is clear that the \( P \) relay nodes transmit \( T \) information symbols in \( T \) transmission intervals.

III. ADAPTIVE COOPERATIVE DIVERSITY PROTOCOLS

The availability of a feedback channel can also be used to optimize the performance of the AF and DF cooperative diversity protocols. For example, in the case of adaptive AF schemes, the amplification factor used by the relay nodes can be systematically selected based on feedback information (e.g. CSI) obtained from the destination. Similarly, adaptive DF schemes can use feedback information to systematically select the modulation scheme employed by the relay nodes. All of the aforementioned techniques can significantly improve the performance of DSTBC in cooperative networks. However, such extensions of DSTBC may also introduce additional signalling overhead, which subsequently increases system complexity. Thus it is vital to obtain a good trade-off between system complexity and signalling overhead.
Since it is unlikely that the multiple independent paths will experience identical fading events, thus spatial diversity is guaranteed. MIMO communication is a spatial diversity technique that has been successfully used in multiple-antenna systems to improve communication performance. To replicate such strategy in single-antenna systems like cellular networks and wireless sensor networks where size restrictions preclude the use of multiple antennas, cooperative communications was introduced. In cooperative networks, the single-antenna nodes that make up the network cooperate to emulate MIMO systems. Cooperative diversity is achieved by making the single-antenna nodes form a virtual multiple-antenna system. STBC were introduced to MIMO systems to improve the reliability of data transmission and enhance diversity gain. As a result, research efforts have concentrated on designing DSTBC for cooperative systems as a counterpart of STBC in MIMO systems. Future Work The DSTBC schemes designed in this work can be combined with other transmission schemes to improve the performance of the cooperative network. This can be achieved in many different interesting ways.

IV. LITERATURE REVIEW

Peng Liu and Andreas Springer “Impact of Mobile Antenna Mismatch on Receive Antenna Diversity in Frequency-Flat Rayleigh Fading Channels” in 2013

In this paper, others first explain the mechanism of antenna mismatch and then derive analytic results on the distribution and mean value of the combined SNR in a general frequency flat Rayleigh fading situation. Three combing techniques are considered, MRC (maximal ratio combing), EGC (equal gain combing) and SC (selection combing). We present simulated results on BER performance show that, in a mobile terminal with two receiver antennas, single mobile antenna mismatch up to \(-7\) dB causes considerable degradation in array gain, other than only negligible reduction in diversity order such that the diversity system still exhibits significant improvement in BER performance compared to an ideal single receive antenna system still both antennas have a mismatch up to \(-7\) dB, the diversity system shows noticeable improvement in BER performance at high SNR.


Others consider a sub-optimum joint transmit/receive antenna selection (JTRAS) scheme in multiple input multiple output (MIMO) systems equipped with \(N\) transmit and two receiver antennas. At the transmitter, researchers keep one antenna as fixed and select the best among the remaining \(N-1\) antennas. After selecting two transmit antennas for each of the receiver antennas, researchers select the receive antenna for which the signal to noise ratio (SNR) is maximum. Then they assume spatially independent flat fading channels with perfect channel state information (CSI) at receiver and an ideal feedback link. They use Alamouti transmit diversity and derive the exact closed-form expression for the pdf of received SNR, using which we obtain bit error rate (BER) for BPSK constellation. They have presented simulation results and compared them with the derived analytical expressions. They have discussed some special cases of the considered antenna selection scheme. They have compared performance of the considered scheme with the other available schemes in terms of number of feedback bits and Bit Error Rate. We conclude that the considered JTRAS scheme reduces number of feedback bits.

Jae-Shin Han, Jong-Seob, Sungho Jeon, and Jong-Soo Seo “Full-Duplex Multiple Relays: A High Data Rate Cooperative Communications over Rayleigh Fading Channels in 2013

In this paper, we present a cooperative network with multi-node amplify-and-forward (AF) full-duplex relays (FDRs). In particular, researchers propose a new concept of transmission protocol to achieve the spatial diversity in a distributed fashion. Firstly, they propose delayed FDRs equipped with two transmit and receive side antennas. Every relay delays a received signal, where transmits the delayed signal to the destination. Delayed full duplex relays also receives signals from the source, adjacent relays and the loop-back interference signal from their transmit antenna when loop-back channel impulse response is not accurate. Then, we analyze the pair wise-error-probability (PEP) analysis, particularly in terms of signal-to-noise ratios (SNRs) between the source to relays and the source to destination links. Finally, we accomplish bit-error-rate (BER) the performance evaluations of the proposed system.


This paper investigates the effect of antenna diversity for a double transmit and multiple receive antenna supported wireless communication system that employs multi-user Alamouti’s space time block coding (STBC) and maximal ratio combining (MRC) scheme on secured text message transmission. The FEC encoded Alamouti MRC transmission method under investigation implements RSA cryptographic algorithm and deploys various multi-level digital modulations (16-PSK, 16-DPSK and 16-QAM) techniques over an Additive White Gaussian Noise (AWGN) and Rayleigh Fading Channels.
It is being observed from the study that in case of without receive antenna diversity the system shows comparatively worst performance in 16-DPSK scheme and satisfactory performance in 16-QAM. It is clear that the system performance is improved with increase in number of receive antenna. The performance study shows that with implemented Alamouti-MRC scheme (6 receive antenna) under 16-QAM digital modulation, the system provides outstanding performance over a significant low signal to noise ratio (SNR) values.


Fading occurs when the transmitted signal is affected by objects in the wireless environment thereby causing deficiency in the quality of the received signal. Diversity techniques, namely frequency diversity, temporal diversity, and spatial diversity, have been popularly used to combat the detrimental effects of fading in wireless channels. Of all the diversity techniques, spatial diversity has gained the widest attention because of the simplicity of implementation and the feasibility of deployment. In spatial diversity; multiple antennas are deployed sufficiently far apart at the terminals to produce multiple independent fading paths for the transmitted in formation signals.

V. CONCLUSION AND FUTURE WORK

The recent rapid advancement in research, and design and manufacture of wireless systems has been largely instigated by the massive demand for wireless applications. Users of wireless applications now depend immensely on technologies that provide real-time high-data rate transmission and mobile broadband communication. If wireless technologies are to meet the requirements and expectations of users, then the principal design objective is; ‘high quality of service’. One phenomenon that hinders the realization of high quality of service in wireless communications is fading.

In this paper, an approach to improve the data rate over the multiple antenna channels for reliable communication system. Unlike, most of the technique exists to achieve full diversity and full rate, researchers aim to increase the data rate over the channel by using dent channel model. O exploit the time and space diversity simultaneously to improve the performance of the system under mobile radio channel. In addition, simulations and analysis s are carried out using dent’s channel model in terms of BER and the coding methods is suggested for 2x2 Alamouti STBC MIMO systems. Even though the technique of two transmit antennas is the main focus of this work.

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<th>Year</th>
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<td>2013</td>
<td>Peng Liu and Andreas Springer</td>
<td>Impact of Mobile Antenna Mismatch on Receive Antenna Diversity in Frequency-Flat Rayleigh Fading Channels</td>
<td>MRC (maximal ratio combing), EGC (equal gain combing) and SC (selection combing).</td>
<td>Improvement in BER performance at high SNR.</td>
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<td>2013</td>
<td>Jatin M. Chakravarti and Y. N. Trivedi</td>
<td>Performance Analysis of Alamouti Transmit Diversity with A Sub-Optimum Joint Transmit-Receive Antenna Selection Scheme</td>
<td>Alamouti transmit diversity (ATD), bit error rate (BER), Rayleigh fading channel, joint transmitreceive antenna selection (JTRAS)</td>
<td>Obtained signal to noise ratio (SNR) is maximum with BER for, BPSK constellation and reduces number of feedback bits.</td>
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<td>2013</td>
<td>Jae-Shin Han, Jong-Seob Baek, Sungho Jeon, and Jong-Soo Seo</td>
<td>Full-Duplex Multiple Relays: A High Data Rate Cooperative Communications over Rayleigh Fading Channels</td>
<td>Multi-node amplify-and-forward (AF) full-duplex relays (FDRs)</td>
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<td>2012</td>
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<td>BER Analysis of Alamouti Space Time Block Coded 2x2 MIMO Systems using Rayleigh-Dent Mobile Radio Channel</td>
<td>Alamouti codes; Space time block codes</td>
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REFERENCES


Author’s Profile

Ashish Tirkey is research scholar at TIT College Under Rajiv Gandhi Proudyogiki Vishwavidyalaya, Bhopal. He is pursuing his M. Tech. in Digital Communication. He has keen to work on Cooperative Networks for modern wireless Communication.