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New Approach for Network Modulation in Cooperative Communication

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Abstract
Cooperative conversation is a communication, where users cooperate with every other in wireless network. Improving the performance of a wireless community transmission has continually been an essential lookup topic in both in industry and academia. In this paper, we will advise a new approach to improve wi-fi community performance with the aid of using network modulation (NM). Network modulation is a software bit remapping technique. In this paper we are proposing new Network Modulation schemes (NM_schemes) to improve the throughput machine sothat we can be direct advantage from the more suitable wireless channel reliability through employing cooperative transmissions at the physical layer. Scheming of NM scheme depends on the SNR and BER of wireless channel. In this paper, we have proposed five NM constellations which are the usage of the quadrature amplitude modulation (QAM) technique and also presented throughput for planned NM scheme transmission for identical power allocation and for Optimal power allocation.

Keywords : Adaptive Modulation and coding (AMC), Bit Error Rate (BER), Signal to noise ratio (SNR), Quadrature Amplitude Modulation (QAM), Equal power allocation, Optimal strength allocation Network Modulation (NM), Scalable Modulation (SM).

I. Introduction

Cooperative conversation is the task to enhance overall performance with restricted availability of resource. Cooperation amongst the customers in a wireless community affords an efficient way to make the most the gadget assets to improve the high-quality of wi-fi link. Unlike the conventional multi- hop transmissions, the place every node is solely accountable for the transport of data to the subsequent node, Cooperative communications allow environment friendly utilization of conversation resources, by permitting nodes or terminals in a verbal exchange network to collaborate with every other in records transmission. It is a promising approach for future conversation systems. In this article, we first survey cooperative conversation schemes and talk about their advantages in enhancing system potential and diversity. In cooperative communication, an essential undertaking is to discover and recognize the first-rate neighboring nodes, which can be used as relay to maximize the performance attain [1].

Cooperation takes place when a direct communication between a supply and vacation spot is accelerated due to the assist supplied by using neighboring node. This neighboring node is regarded as relay.

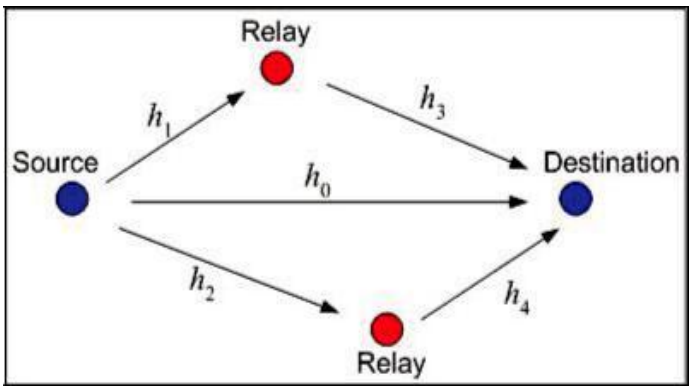

Fig. 1: The supportive Relay Network, Also Known as the Relay Channel

Data broadcasted by using source is obtained by way of vacation spot by way of direct transmission and/or by way of one or more relay. By combining the copies of records obtained immediately and/or via independent relays, vacation spot node exploits the benefits of spatial diversity which improves the overall performance of wi-fi transmission. In wireless communication, fine of provider (QoS) at physical layer is measured in time period of bit error rate (BER) or throughput, which can be increased with cooperation among users. In conventional information transmission, all bits in a symbol are dealt with in comparable manner, having identical bit error fee (BER) performance.

In order to supply differential service at physical layer, the bits in a symbol can be divided into layers the use of scalable modulation [2-3]. Potential benefits of cooperative communication consist of overall performance enhancement at bodily layer such as multiplied channel reliability, multiplied gadget throughput, seamless service provision, and operational fee reduction [3]. In cooperative wi-fi transmission network, transmission can be received by many nodes in the vicinity of the source. These neighboring nodes play an essential function in transmission by using forwarding the records to the destination. Hence, a couple of copies of facts may additionally be obtained at vacation spot by using specific relays nodes. Because of non-stop variation in channel parameters, each character copy of data experience unique sorts of fading and interference. Multiple copies of identical statistics acquired at destination supply a kind of spatial diversity. Depending on the level of sign processing carried out at the relay, cooperative relaying scheme can be labeled as follows,

- Amplify and forward
- Decode and forward

Amplify and forward- as the title suggests, the Amplify and forward method simple enlarge the sign obtained via the relay before forwarding it to the destination. This technique is perfect when the relay station has the minimal computing power. However, one primary disadvantage of this method is that the noise is the sign is also amplified at the relay station, and the destination receives two independently diminished versions of the sign [4].

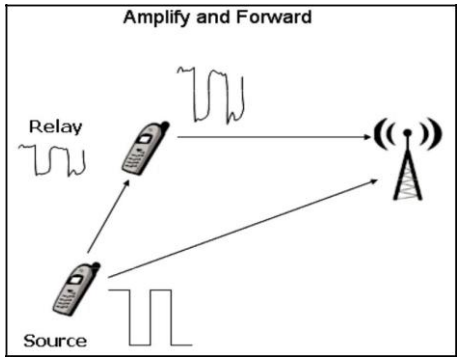

Fig. 2: Amplify and Forward Technique

Decode and Forward- Decode and Forward approach is a Digital relaying method. It is most favored technique of processing facts in the relay nodes, and is closest to the thinking of a typical relay. In this the relay detects the supply data, decodes and then transmits it to the preferred destination. A fault correcting code can also be implemented at the relay station. If the resource and performance constraints permit, digital relays can additionally decode and re-encode the received data. This could help the received bit blunders to be corrected at the relay station. However, this is solely possible when the relay station has the adequate computing power. This way some of the errors happening at the supply relay link can be corrected at the relay [5].

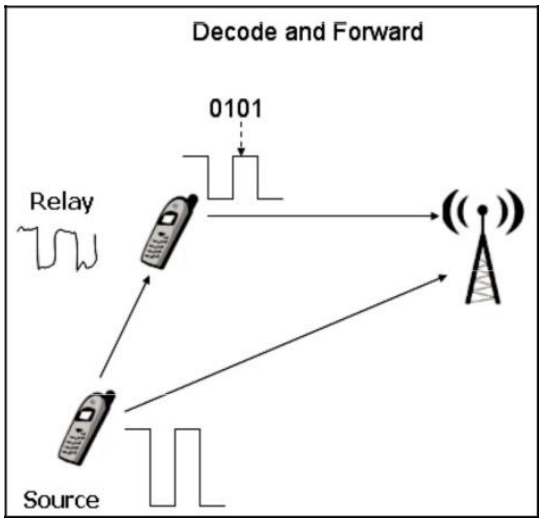

Fig. 3: Decode and Forward Technique

Adaptive modulation and coding (AMC) - To improve the spectral effectivity of cooperative range systems, adaptive modulation makes use of [6]. In Adaptive modulation, Signal to Noise Ratio (SNR) of a wi-fi link varies with time. The characteristics of signal acquired at vacation spot deteriorate with expand in the distance between source and destination. Adaptive modulation and coding scheme (AMC) have been used to improve the gadget throughput in time

various wireless channel [7]. The power of the transmitted signal is held regular over a body interval, and the modulation and coding format is changed to fit the modern obtained signal fine or channel conditions. In AMC, the wi-fi channel is monitored continuously and based totally on the prediction of channel condition, transmitter selects the gorgeous modulation and coding scheme which maximizes the throughput whilst maintaining the Bit Error Rate (BER) under threshold value.

Network modulation and Scalable modulation – Scalable modulation scheme (SM) remaps the constellation of usual rectangular quadrature amplitude modulation (QAM) schemes using a software approach. Inspired through the scalable modulation, Network modulation scheme (NM) can be used as to enhance the throughput of a relay network. Network modulation offers us a new dimension to improve wireless community throughput and shop energy. Scalable modulation having bits in a image can be divided into layers to furnish differential priorities to the bits. Bits with higher precedence are mapped into base layer which can be decoded by means of all the users. Bits with lower precedence are mapped into enhancement layer and can be decoded only by way of targeted users [6]. In modern wireless systems, when a supply transmits data to the receiver via a single-hop or multi-hop wireless path, the bodily layer modulates and demodulates the data bits hop-by-hop, and the transmission over every hop is handled the equal as in a point-to-point verbal exchange link. Network modulation is a software program mapping technology, is the usage of to redefine the constellation of typical Quadrature Amplitude Modulation (QAM) scheme when a supply transmits the records to multiple receivers simultaneously and when given the broadcast nature of wi-fi medium and the quality of wi-fi channel is of broad variation. In any relay network, there ought to be at least three nodes for apply network modulation. Scalable modulation scheme can be used in wireless video multicast in order to furnish one-of-a-kind video great to distinct users. Network modulation can be used to enhance network performance in a extensive range of scenarios, for anycast (broadcast, multicast and unicast) services, NM can also be used in one-way or two-way visitors and single-hop or multi-hop wireless paths, in infrastructure or ad hoc networks.

II. Related Work

In this paper, we advocate a network modulation scheme stimulated by means of Super-Positioning Precoding (SPC). It was once designed for multicast transmissions and now currently it is the usage of for relay communication [8-9]. Although SPC is not ideal for wi-fi devices because it requires specialised hardware and sophisticated signal processing techniques. But right here in cooperative communication, statistics is transmitted by a single consumer may also be destined for greater than one receiver. Due to dissimilar channel condition of these channels, use of AMC is unsuitable. So here we are the usage of Super-Positioning Precoding (SPC) scheme has been proposed to enhance the spectrum efficiency of broadcast channels [10]. Using SPC, a transmitter can ship data to a couple of customers with the aid of superpositioning the information targeted to special receivers in a single time slot. Here we are going away to explain an example of SPC in fig. 4, in the instance the place a supply is transmitting one bit to first person and two bits to 2d users. Instead of transmitting the bits in extraordinary time slots, signal constellation is modifies in such manner that bits for one-of-a-kind receivers are superpositioned in single symbol.

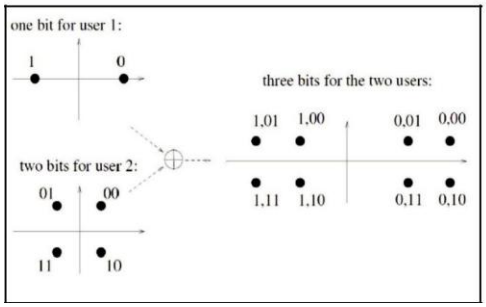

Fig. 4: Super-Positioning Precoding

After in receipt of the signals, each receiver can decode bits targeted to it. However due to the fact of complicated hardware requirement and signal processing, SPC is now not proper for transportable wireless devices.In this paper, we are proposing a new approach to enhance wi-fi network by using using network modulation. It is based on software bit remapping, NM scheme can be carried out using current transceiver hardware. Modulation kind is chosen on the groundwork of channel high-quality to maximize the data rate underneath the constraint that the Bit Error Rate (BER) is below a threshold. If we talk about sign to noise ratio, is distinct for exclusive channels. In this paper we are providing a three node scenario. These three nodes are source, vacation spot and relay. Here single node works as a relay node between source and destination nodes. According to SNR information of exclusive channel in the community a approach is presented to pick high-quality scalable modulation scheme to maximize the community throughput.

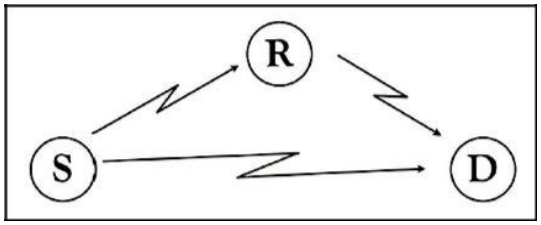

Fig. 5: Three Node Network

In traditional relay transmission, R forwards all bits of facts to D hence, misguided copy of facts and direct transmission from S is obtained at D, is wasted completely. Here in paper [12], Network modulation has been described for using this faulty replica of data. In NM scheme, points in standard rectangular QAM are divided into clusters in such manner that D can demodulate some bits of acquired image and R can demodulate all bits of received image correctly. Now, instead of forwarding all bits to D, R relays only those bits which can't be decoded effectively by D in direct transmission from S. In NM, bits represented through a image are divided into layers. Bits of layer one (L1) are demodulated by means of D and bits of layer two (L2) are demodulated by using R.

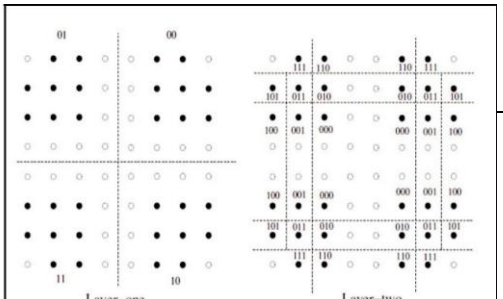

Fig. 6: Choice Region for L_1 and L_2 Symbols for a Sample NM Scheme

In paper [11], NM constellations are the usage of QAM and only 5 NM constellations are examined the use of 16, 64 and 256 QAM. In [11, 12], while considering the BER constraint 10-3, five NM scheme have been presented. For every image transmission, S selects one of these NM schemes and R selects a usual QAM such that general throughput is maximized whilst retaining the BER under 10-3. In this paper, goal is to diagram new constellations to improve the throughput while thinking about same BER requirement and channel SNR an in [11-12].

Throughput calculation- in a relay network for three nodes, standard throughput between source to relay can be calculated as;

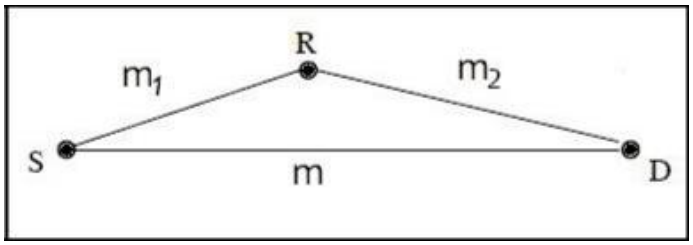

Fig. 7: Here $m_1 > m_2 > m$

For ordinary relay transmission using common QAM, if S transmits ms bits per symbol period (b/sym) to R and R forwards mR b/sym to D, then standard throughput between S to D is given in [12].

$$Th = \frac{m_s m_R}{m_s + m_R} \text{ b/sym} \qquad (5)$$

For NM transmission, if S transmits mS1 bits of L1 to D and mS2 bits of L2 to R in one image period and R forwards mR b/sym to D, then universal throughput between S to D is given as [12].

$$Th = \frac{(m_{S1} + m_{S2}) m_R}{m_R + m_{S2}} \text{ b/sym} \qquad (6)$$

Proposed NM Scheme- Design of NM scheme depends on channel SNR and BER requirement. Euclidean distance of intra-cluster factors in NM constellation depends on SNR of S RD channel. Channel SNR of SR channel always greater than SNR of SD channel. consequently of distance of intra cluster points is much less than that of inter cluster points.

$$SNR_{SR} > SNR_{SD}$$

Considering identical BER requirement as in [11], In this paper presenting five new NM schemes. These five NM schemes are NM_B1, NM_B2,NM_B3,NM_B4,NM_B5, Presented in this paper.

III. Conclusion

It has been proven that by means of using five these new NM constellation in this paper, throughput of a three node topology can be improved. Here, equal average symbol power has been used for each transmission. Hence, electricity can additionally be saved through accomplishing greater throughput whilst spending same energy. Our outcomes of this paper have proven that network modulation is applicable and suited in many situations with the minimal of at least three nodes need to be in the wireless communication. In network modulation, there can be generate different more NM schemes, which may additionally function higher than proposed NM scheme of this paper and until now all the NM schemes.

IV. Future Work

Scope of NM scheme format is still under-explored. Design of an NM scheme depends on channel SNR and BER constraint. In future, chance of error of these NM schemes can be confirmed mathematically. In this paper, design of NM constellation is restricted to QAM. NM constellation may additionally also be designed the use of other modulation techniques. Network modulation can additionally be used concurrently with network layer techniques such as Network Coding (NC), which may additionally improve the spectral efficiency.

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