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EFFICIENT THROUGHPUT USING MODIFIED AODV WITH CHANNEL VARIATIONS IN MANET

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ABSTRACT

In this papers, we study the joint problems of cooperative transmission and cooperative diversity in a Mobile Ad-Hoc Network(MANET)with variable wireless channels. In MANET the wireless nodes are coordinates to achieve energy savings, infrastructure less in nature and e quipped with omnidirectional antenna. The major problems faced by wireless communication in realtime environment are that of interference and un-reliable communication links. Much research work has been done to overcome this by using various techniques. Cooperative communication and transmission side diversity in the network are the two of the techniques that help in reducing interference and achieve energy savings. We have also proposed a new technique to find the optimum route as a joint problem of the transmission power at the physical layer and the link selection at the network layer that incurs the minimum cost in terms of energy, no. of hops, available bandwidth and link quality (SNR), outage probability. Analytical results show that our cooperative transmission schemes opportunistic Minimum Cost Cooperative Transmission Shortest Path (OMCTSP)achieves significant amount of throughput is increased than other algorithms.

Indexitems:cooperative transmission, diversity, noncooperative transmission outage diversity, linkcost, minimum energy routing, channel gain. Variable wireless channels, MANET, wireless broadcast property, SNR, Throughput.

1. INTRODUCTION

A MANET is a multi-hop wireless network that is formed dynamically without infrastructure support. In this thesis we study the joint problems of energy efficient and diversity in wireless ad-hoc network. In wireless network the energy is spend by nodes on communication [1].First ,Nodes are small in size and typically battery powered, inefficient use of power causes network life time is decreased [2][3]. Sopast several years most attention in energy-efficient communication in adhoc networks. The problem is approached in two different ways. At the network layer to find the energy efficient routes selection and at the physical layer energy efficient for wireless channel is called cooperative communication[5],[6].

A. Multi-Hop Relay Model: The propagation of electromagnetic signals through space, the energy required to establish a link between two nodes are proportional to distance between nodes which are in communication set is raised to fixed exponent is called path loss is assumed to be between 2 or 4.It is advantages ,in terms of energy saving through multi- hop routing in adhoc network. The multi-hop network extends coverage range. Figure 1.1showsthemulti-hop route between nodes In this paper we exploit the wireless broadcast property and take the advantages of transmissions ide diversity to achieve energy savings.

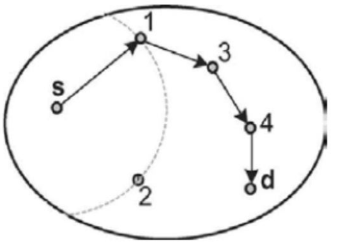


Figure1.1: Wireless broadcast advantage

When omnidirectional antennas are used for communication, the signal transmitted by source nodes is received by all nodes for example here is nodes are1 and 2 within a certain radius is referred to as the wireless broadcast advantage (WBA)[8]. The problem of finding the minimum energy multi carstand broadcast tree in a wireless network is studied in [2]and[3].This problem is shown to be NP-Complete in[4]and[5].In this dissertation we have assumed each node is equipped with single omnidirectional antennas allow many nodes can cooperate to each other is transmitting the information from source to other nodes and through this cooperation effect achieve same energy saving as multiple antenna As we refers as the wireless cooperation advantage(WCA)[11].

B. Cooperative Transmission: Our objective is to take advantage of the wireless broad cast property and the transmission side diversity through cooperation and in addition, consider the channel variation to find routes that reduce the end-to-end energy consumption, outage probability and some minimum end-to-end throughput. Take the simple example of cooperative transmission Figure 1.1exploits the broadcast nature of the wireless medium. An example of cooperative transmission of minimum energy path from nodes to node D using dark line is given in Figure1.2, in which we allow the last two predecessor nodes along the path for cooperative transmission to the next hop ,i.e.,hop= 2.

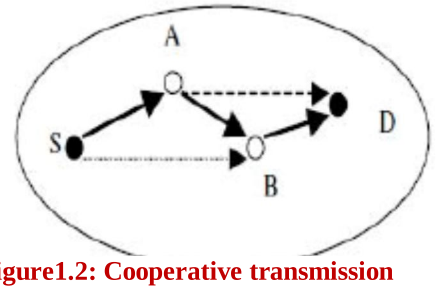


Figure1.2: Cooperative transmission

The following steps are for operation of cooperative transmission. The first transmission from Node S and receive Node A, and then B receives the signals transmitted co-operatively by node A and node S.

C. Cooperative Diversity: Second interesting property of wireless adhoc networks is diversity at the physical layer .The routing protocols point-to-point link and multi-hop link are used to transmit a signal from source node to destination node. Multi-hop link combines the transceiver transmission results that produce increasing SNR or decreasing SNR. SNR fluctuations occur across both frequency and time, also wireless channel variations called as fading, shadowing, and other forms of interference.

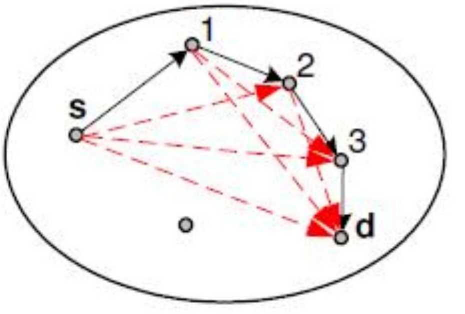


Figure1.4:Cooperative diversity

Using diversity, the channel interference due to fading is reduced and increases there liability of the wireless network[4],[7],[9] it can transfer same signal and receiver can detect these multiple copies of sent message correctly by using single Omni directional antenna with space diversity instead of multiple antennas which is costly and occupies more spaces. Then this new technique is known as cooperative diversity. An overview of different transmission diversity techniques is given in [10].the cooperative diversity is achieved by fully decodes and amplifies each information's. In addition to these, the algorithms is evaluate with repetition codes requires low complexity in the terminals by contrast space-time coded cooperative diversity requires more complexity in the terminals Our goal is to achieve energy saving through jointly cooperation and selection of energy routes with diversity .In order to achieve maximum energy saving by finding optimal routes election and shows probability
Of error is reduced. The existing literature Khandaniet al. [12] they formulate the energy consumption in a static cooperative wireless network shows the maximum energy saving of 50% compare with non cooperative scheme, the energy savings achieved through cooperation, by using point to point scheme the heuristic algorithms to find energy efficient routes and also consider cooperative Multiple-Input Single-Output (MISO) technique for data transmission and energy savings can be achieved using cooperative routing techniques. In this static network the transmitting nodes must know about channel state information hence nodes are cooperatively beam forming it requires synchronization [15]which is difficult in mobile adhoc network.

Zhangetal.[13] extend Khandani's work to a multi-source multi-destination network. The power allocation that minimizes the outage probability with cooperative diversity system was derived in[14]. Our proposed coded cooperative transmission encode the information by using simple repetition code and detect at the receiver, the channel is fully characterized by the channel gain h. The channel gain capture the effects of asynchronism, multipath fading, shadowing and path-loss and it is inversely proportional to . Using cooperative transmission achieves significant amount of throughput than existing on cooperative transmission.

D. Summarization of the paper: We formulate the energy optimal cooperative routing between two nodes in fading environment subject to a constraint each node transmission power. We formulate the power allocation for a cooperative diversity with random location of nodes where only mean channel gain is available at the transmitters and are exponentially distribute We develop optimal static routing algorithms to find minimum- energy routes in a network. We derive a Opportunistic cooperative routing as well as develop heuristic cooperative routing algorithms, and evaluate their performanceusingNS-2.32simulator. The dissertation is structured as follows. In Section II, we describe our system model and formulate cooperative link. Section III presents our optimal routing formulation and power allocation. Section IV presents Opportunistic cooperative routing Simulation results are presented in Section VI, and Section VII conclusions and future research works are discussed.

2. SYSTEMMODEL

The wireless network consisting of N devices are called nodes and it is distributed randomly in an area, where each node has a single omnidirectional antenna. We assume that each node can adjust its transmission power and that multiple nodes can coordinate their transmissions at the physical layer to form a cooperative link. So beam forming is not performed, only rough packet synchronization is required[16]. The data throughput, network reliability, link range is increases and reducing fading by using MIMO transmission. We model MIMO transmission as multiple MISO transmission[17]. Using MIS Owe formulate energy consumption in a cooperative MIMO transmission. Let N be the set of the nodes in the network N, and assume that there are N =│N│nodes in the network.

A. Channel model :We consider a time-slotted wireless channel between source and destination nodes, it is assumed to be fading channel is consist of pair of transmitting node ti, receiving node rj and remaining nodes are serves as a relay nodes(i.e)N-2nodesinaN nodes. The source transmits binary symbols. To minimize the effect of noise, fading and reduce the errors of received signal coding technique is used. Encoding of transmitted bits is done before being transmitted and then decoded at receiver. The encoder is using simple repetition code to encode the source output. The decoder is using minimum Hamming distance to detect the transmitted signal. The noise at receiver is assumed to be complex, White Additive Noise with Gaussian distribution of zero mean and without loss of generality the power spectral density Pηj is N0. Binary modulation technique is used to modulate the code word. The repetition code is used in a coding scheme that they added redundant bits are just are petition of the original bits across the channel to achieve an error free communication. Repetition coding gets full diversity Let we assume that the channel is fully characterized by the channel gain hij. The effects of symbol asynchronism, multipath fading, shadowing and path- loss are captured by channel gain and it is inversely proportional to

B. Cooperative Model:

In this model cooperation at each stage has a collection of multiple-input single-output (MISO) links, where a set of transmitters T cooperatively send data to a set of receivers R. Let hij, hik, hkj are channel gains between nodes ij, ik and jk and we assume that they are independent, exponentially distributed random variables with mean smi,j,mi,k and mk,j, respectively. the receiver node will receive the signal in a two different phases which is transmitted by transmitting node Phase I: At first time slot the transmitting node i transmit with power ps1, and all other relay nodes and receiving node will listen. The transmitted signal xs1(t) and noise is ηj(t) received at rj ,it is assumed to be complex additive white Gaussian with power density Pnj

The same information to a single receiver node is called as cooperative link. Assume the channel gain is known at the transmitter, hj is the vector of channel gains between transmitting nodes in T and a receiver rj R and vector was the powers caling factor for nodes in T and dij as the distance between nodes I and j,hij is the channel gain between ti and receiver j. In this case at the receiver the signals are add up, and complete decoding is possible as long as the received SNR is above the minimum threshold SNR min for all nodes in R. Now let us consider the two vectors then the received signal at receiver rj is we can conclude that the transmitted signal is proportional to path loss attenuation there for e all nodes in there liable set cooperate to send the information to a single receiver. Also the cooperative cost is smaller than each point-to-point cost. Hence it proves that always cooperative transmission saving more energy by taking the advantages of WCA.

3. OPTIMALCOOPERATIVEROUTING

In this section, we develop optimal cooperative routing algorithms and thus find the least cost route from a source node s to a destination node din an arbitrary wireless network.

It is multi-hop in nature and selects a cooperative link in every time slot. Let Tk, Rk are the transmitting and receiving sets in every time slot k. Starting from the source node, the initial transmitting set, T0, is simply{s}, and a route is found as soon as the receiving set at sometime-slot k contains the Per channel, and as a function of the fading coefficient hij/dα satisfies Cover and Thomas,1991;Telatar,1999 Let the propagations model as consider path loss, Rayleigh fading, Shadow. The wireless link between the node si and jis hij/dijα Where dij is the distance between node si and j, hij represents channel gain it captures the effect of channel fading, α is the path loss exponents between the range 2 and 4. The mutual information as a function of the fading coefficients become a random variables[24]. INC ≤log (17)
Most important parameter in communication systemic outage probability or probability of error. An error occurs due to either channel is in outage or decoding error. When the probability of error is 0 the channel is not in outage otherwise outage probabilityis1 ISRDF = (23)

Assuming the assigned bandwidth is same for both source and relay nodes, outage probability(23) interms of data rate, distances and transmission power can be further expressed as
PError ≈P(outage) (18) α (d + P/P d α) 24)PCout = 1/2dij α iks r kj The outage probability is then the probability that a mutual information falls below fixed rate R chosen a priori. The outage probability for rate R, in bits per channel use, is then given by Ozarowetal.,1994 PNCout =Pr[INC ≤R] =Pr (19) Without lose of generality the outage probability is given by
P(Outage) =Pr (20) To simplify subsequent derivation, define the function for outage and success as follow; 1Outage = {1
3.Optimal Link Selection: At each step of routing we should choose R from all the nodes so that the end-to- end power consumption is minimized..Let P(T)denote the total transmission power to reach the destination from transmitting set T using multi-hop cooperative transmissions. Then, R is implicitly given by the following optimization problem C. Cooperative Routing Algorithm: An iterative implementation of the routing algorithm works in rounds. Let h denote the round number, and augmental l routing related variables with h,e.g.,Ph(T)denotes the routing cost from T to the destination in round h. Routing variables are updated in each round as follows.
Out Ph+1(T) =min({ LC(Sk,Uk)+PC +available B,w+ if* 1 (21) {0 else and 1Success =1-1Outage 2.CooperativeTransmission:Outage results for cooperative transmission are an extension of non cooperative transmission. The simplest amplify-and- forward algorithm for a single source and relay produces an equivalent one-input, two-output conditional complex Gaussian noise channel with different noise levels in the outputs. As L ane manet al.,2004 details, the mutual information random variable is IAF = (22) For the simplest decode-and-forward algorithm with repetition coding, the mutual information random variable is SNRij})/4 (25) ph(T)= min(pk+1(T))

4. OPPORTUNISTICCOOPERATIVE ALGORITHM

In a static routing algorithm, route (a set of intermediate relays) is computed a priori and all messages are transmitted over same route only.A teach intermediate relay,a unicast link is formed in a many-one manner. When a channels arevariable this static routing is inefficient as itunicast. To overcome this problem the channels can be explored in broadcast manner to determine the best relay opportunistically after message has be broadcasted .An opportunistic routing algorithm any cast messages at intermediate nodes and select the next set of nodes that have successfully received. We refer to this set of receiver is referred as combined relay set. LetR(tk)is the combined relay set for transmitter tk.

Definition2 (OpportunisticRoute).Because of any casting, messages reach the destination through potentially different routes. An opportunistic route is the unionofall possible routes between a source and a destination created by a choice of combined relays at each intermediate node. In this section we are going to discuss about our proposed algorithm with reference to in[22]which is without channel variation . We show that the proposed algorithm with channel variation will consumeless energy as compared to existing algorithm Cooperative transmission Shortest Path Algorithms (OMCTSP) the routing protocol AODV is to be modified to implement the routing. In that every step of cooperative routing, all nodes can be overhearing when source nodes sending the route request pkt. After the transmission to then ext node along then on-cooperative shortest path all the nodes that are not in outage, available Bandwidth, size of the packet, residual power available, number of hops will be added to the transmitting set for the next step of the routing. Procedural steps for implementing our proposed algorithm is as follows 1. First modifythe MAC layer protocol 802.11 to include SNR calculation 2. Next modify the routing protocol AODV to implement the routing algorithm proposed. We have selected AODV protocol because it consumes less energy this we already discussed in[23] 3.Network is deployed with defined no of nodes with specified initial energy 4. SNR value is estimated based on receiving power and distance, while receiving the hello message and SNR value is stored in snr 5. Unit variance model estimates expected value for channel gain for each slot index. Once the square of expected value is 1 then outage probability is estimated. 6.Every node goes for calculating available bandwidth. 7.The number of hops for each path is also calculated.

8.The source node when sending the route request pkt, will include outage probability, residual power available and available bandwidth, size of the pkt. 9 .Intermediate nodes updates the link cost based on point to point connection, and push in to request packet alongwith available bandwidth information. 10.All the forwarding nodes will calculate SNR value of its received pkt, its available bandwidth, residual energy. These values with number of hops are also included in the route request pkt. 11. When the destination node receives the route request packet, it selects the best path based on four parameters. 12. Generate route reply msgto source nod in the reverse path. 13. Once a best path is selected, the destination node sends a route reply pkt to the source node. 14.This calculation goes on for all the pkts forwarded towards the receiver. So that whenever the receiver finds a better path, it discards the old path and picksup the new path for data communication. We compare with noncooperative transmission

5.OPTIMAL COOPERATIVE ALGORITHMS

In this section, we present two possible general suboptimal algorithms and related simulation results. The simulations are over a network generated by randomly placing nodes and randomly choosing a source–destination pair of nodes. For each realization, the minimum energy non cooperative path was found. The proposed suboptimal algorithms were used to find the cooperative paths. The performance results reported are the energy savings of the resulting cooperative strategy with respect to the optimal noncooperative path The two suboptimal algorithms analyzed are outlined as follows. A. Progressive cooperation PC-l: This is a MISO
Cooperative routing algorithm, where in everytime-slot, the next node along the optimal non-cooperative route toward the destination is selected. Progressive cooperation PC-L: In this algorithm, the best path is selected after each transmission by using non cooperative shortest path Dijkstra's algorithm. It combines last three nodes into a single node because here L=3 alongwith the source node i.e, supernode[28].

The three nodes will be combined into single node under only when no of hopes are less and higher SNR value. This algorithm turns out to have a complexity of O(n3)[12] since the main loop is repeated O(n)times and each repetition has a complexity of O(n2). B. CAN-l: In this suboptimal approach, the optimal noncooperative route is first selected. In each step of the cooperative routing, the last nodes along the optimal non cooperative route cooperatively send the information to then ext node along the optimal noncooperative route. The only processing needed in this class of algorithm is to find the optimal non cooperative route. For this reason, the complexity of this class of algorithms is the same as finding the optimal noncooperative path in a network or O(n2), where n is the total number of nodes in the network. C Non Cooperative :This is the least-cost non- cooperative route computed using Dijkstra's algorithm Fig.6.2 shows the packet delivery ratio for cooperative algorithms proposed OMCTSP, PC-3 and CAN-3,and non-cooperative algorithm for various No of nodes. The proposed algorithm delivers 17% morethan existing Non–cooperative algorithm, also compare with PC-3 15% more packet delivered and with approximately 10% more delivered.

6. RESULTANALYSIS

A.Delay

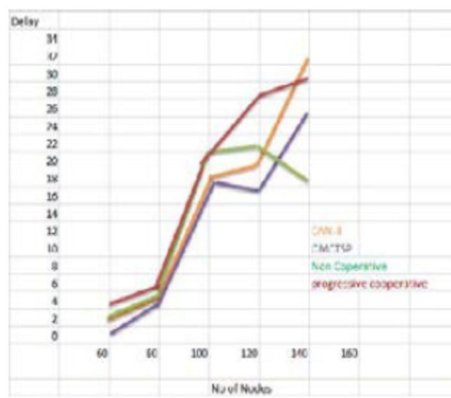


Figure6.1:ShowsDelayVsNoofNodes

The above figure shows the delay in the three different cooperative transmissions alone with the existing non cooperative transmission with the variation in the number of nodes .It is seen the delay incase of non cooperative is always more when compared with cooperative types. Between the three different cooperative type the delay is least always in our proposed OMCTSP algorithm B. Packet Delivery Ratio

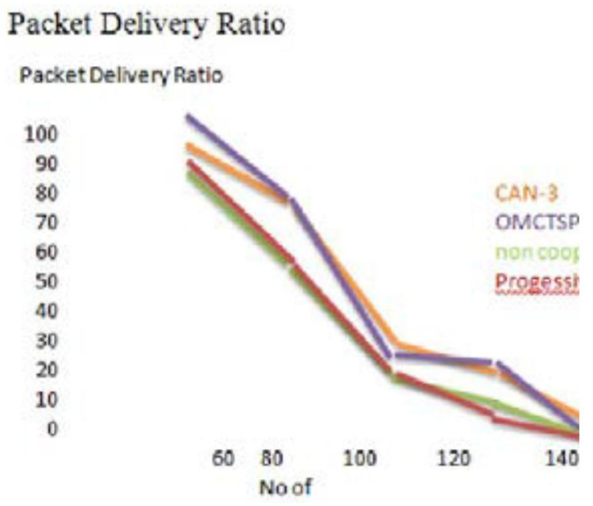
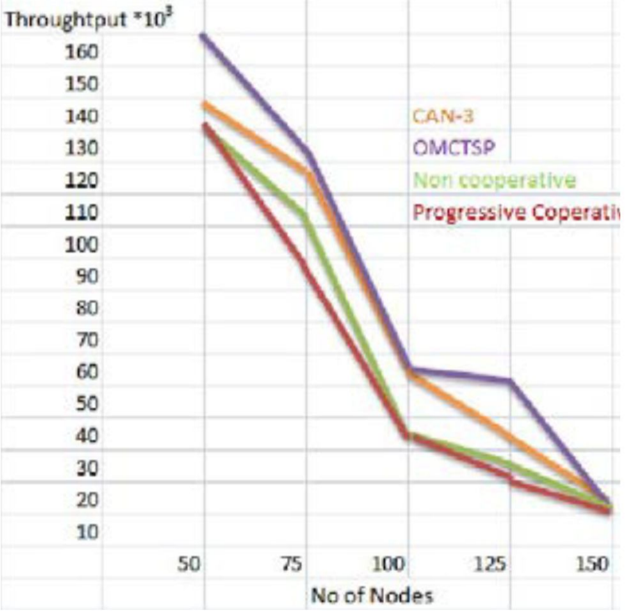


Fig.6.2 shows the packet delivery ratio for cooperative algorithms proposedOMCTSP,PC-3 and CAN-3, and non-cooperative algorithm for various No of nodes. The proposed algorithm delivers 17% more than existing Non–cooperative algorithm, also compare with PC-3 15% more packet delivered and with approximately 10% more delivered.

B.Throughput



The Above Figure6.3 Shows the Throughputs for various nodes, on comparison of the throughput for CAN-3 and Non Cooperative it is more in CAN. On further Comparison ofCAN-3 with proposed algorithm the throughput is always more in proposed OMCTSP.

7. CONCLUSION

In this paper we discussed the joint problems of cooperative transmission and diversity at the physical layer in order to develop energy efficient cooperative routing algorithms for wireless networks Our network and routing models are considered by other researchers such as single-input-single-output, single-input- multiple-output, and multiple-input-single-output models. We formulated the optimal routing problem and opportunistic routing problem. Using simulations, we showed that the proposed algorithms achieve a significant amount of throughput compared to existing non cooperative routing algorithm and also compare with optimal algorithms.

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