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Enhancing the signal strength using Novel approach with Directional Antenna in Integrated Mobile Adhoc Network

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Abstract— As we know in Mobile Ad hoc network our Nodes are highly mobile. They move around the Network. Due to this network topology and number of neighboring nodes in each node frequently change. Movement of nodes from one to another network also affect to the communication between them. As the number of nodes increases complexity of MANET increases in various issues. We remove the limitation using the Cluster Head Gateway node (CHG) [1], As we know in Booster Approach [2,3] if CHG nodes move or far away from other nodes (CHG or Cluster Node) then using booster technique, communication can takes place between nodes. But establishment of communication is no sufficient we should maintain and require relevant and reliable communication having less packet drops give better QoS. Considering all these points we are focusing over antenna i.e. Directional antenna with Novel booster approach in order to enhance the signal strength. The directional antenna radiates data in a particular direction. By applying this approach we will reduce the interferences, data loss, overhead [4], try to reestablish the break link between nodes and increase the performance (throughput and SNR) and QoS for an ad hoc network and also prevent link break during CHG Nodes mobility at data transaction time in order to maintaining the communication link between nodes. Finally, this paper conducts simulation experiments in the conditions where we are connecting CHG to CHG or cluster nodes using same or different networks.

Index Terms— MANET, CHG, Directional Antenna, Throughput, SNR, Booster, QoS, Bit Error Rate, Overhead.

1 Introduction

Mobile Ad hoc network is a latest technology composed of mobile terminals that communicate with each other through broadcast radio transmissions within the transmission power range. However, due to radio range limitations, we may require a multi-hop scenario, where packets are relayed by intermediate terminals, to the destinations. Applications of mobile ad hoc networks use in military field communications, where the networks must be deployed immediately without the support of base stations and fixed network infrastructures, to inter-vehicle communications, designed for both traffic safety enhancement and entertainment purposes. In ad hoc networks every node is self-organized and can communicate directly with all other nodes. This infrastructure-less communication fulfills the desire of users, but we are still lag behind to use the full advantage of wireless communication, think about the area where war is going on and a natural disasters area, a defense application, where there is no infrastructure, to serve the such kind of application mobile ad hoc network based communication is introduced, Ad hoc networks are key to the evolution of wireless networks [5]. Ad hoc networks are typically composed of equal nodes that communicate over wireless links without any central control. Although military tactical communication is still considered the primary application for ad hoc networks, commercial interest in this type of networks continues to grow [6, 7]. Ad hoc wireless networks inherit the traditional problem of wireless and mobile communication; we have some various challenges like Battery Back up, Node Mobility, Bandwidth constraint, Routing Protocols, Security problems and transmission quality enhancement. A mobile Transaction is structured as a Distributed transaction. In which the transaction is completed by the help of mobile nodes, providing different services. The mobile environment produces the significant challenges to transaction processing. The wireless network provides limited bandwidth so network bandwidth is a scarce resource. Battery power drains with data transmission and transaction processing. Due to the Dynamic mobility of CHG nodes it affect to the communication link which should be maintain properly during mobility. Here we are trying to prevent data loss during CHG nodes mobility. For this we develop a Booster Technique. Booster is a kind of Device and Algo's combination attached within CHG nodes and Cluster nodes like equipment as laptop, mobile etc. and as per the requirement Booster operate automatically need not require manually. Before operate first it will check the device parameters which are require for operating this. Once Booster activated the CHG nodes can cover to its neighbor nodes including another CHG without any difficulty. Various approaches have been given to manage a MANET. The Booster approach using for CHG is newest and latest in this direction which can be helpful for Mobile Ad hoc Network.

The rest of the paper is organized as follows: Section II presents the related work. Section III describes our proposed working model. Section IV presents the simulation experiment setup and gives the performance evaluation of our proposed strategy. Section V concludes the paper.

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2 Related Work

In this model assuming that each node in MANET is booster enabled, a threshold value is used to activate and deactivate the booster. The threshold power level (TMIN) [2] value is related to strength of signal. All the nodes in the cluster send the performance table using DSDV protocol to the cluster head (CH). According to efficiency of the node CH maintains a Performance table. On the basis of efficiency the CH assign the task to the nodes in the cluster. If any node goes out from the cluster and receiving a low signal (equivalent to link failed), then outgoing node checks the value of signal strength, if signal strength is less than threshold power level (TMIN) then booster becomes active, the booster amplifies the signal, the node which is somehow connected to outgoing node also activate its booster when it realize the equivalence of link failure.
Here, The provided approach showing that the cluster head always try to tie up with the efficient node within its cluster, through the use of signal booster technology. This approach provides the new directions & dimensions in MANET. Using this technique we can increase strength to the various QoS models in MANET, & designing of low weighted and less battery consumption enabled boosters.

3 Proposed Working Model

As in figure 1, instead of using two different nodes (Cluster Head and Gateway) we have single node (CHG). This is decreasing the no. of nodes, Average Transmission Delay and overheads.
One problem of this approach was transmission range which we overcame using Booster approach. But this is not sufficient we have to maintain connectivity with minimum data loss also and this can be happen only selection of appropriate antenna. Here we are focusing over Directional antenna which fulfilling our all requirements which is needed. Using directional antenna we can decrease the Interference and enhance signal strength with better QoS.
In figure 1, if cluster head gateway node (CHG) wants to send the data to another CHG exist in different network, it will send data to particular CHG at specific direction only, using directional antenna.

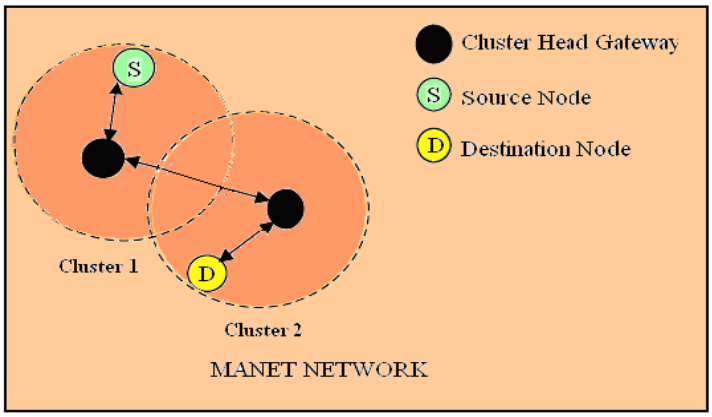


Figure 1. Showing the Current approach having Cluster Head Gateway (CHG) and Cluster Nodes with Directional antenna.

So after analyzed figure 1, we can say Nodes mobility and data interference (Data Quality) both are the major challenges in MANET. These are also one of the reasons for data loss. In Ad hoc we can not restrict over the speed of nodes. Nodes are free to move any where. So we developed a novel approach which will work without disturbing the existing network called Booster Approach. But still Interference (Data Quality) is existing. We can minimize it using Directional Antenna. Using directional antenna all MANET Nodes including CHG will transmit data in a particular destination direction due to this occurrence of interference and packet drops are very less. This will enhance signal strength also.

4 Simulation Setup And Results Discussion

4.1 Simulation Setup

To simulate our Cluster Head Gateway Network, we used Opnet 14.0 v. The simulation parameters and their values are given in Table 1.

TABLE I. Simulation Parameters

PARAMETER	VALUE
Number of MANET Nodes	12
Number of Moving Nodes	2
Number of Simultaneous communication	10
Size of Area	8*4 (k.m.)
Transmission Range	250 (m.)
Traffic Type	Constant Bit Rate (CBR)
Standard Ad hoc Speed	20 m/s
Datagram forwarding rate	100,0 (packets/sec)
Simulation Time	900 (sec)
Wireless Channel Bandwidth	10 (KHz)
Node Movement Model	Reference Point Group Mobility (RPGM)
Data rate	1.024 (kbps)
Transmission Power	146 (db)
Maxi. Receive Life time	1800 (sec)

4.2 Result Discussion

The Performance of the proposed Directional antenna is analyzed with respect to Throughput, Bit Error Rate, SNR Ratio, Traffic Received and Packet loss ratio.
Figure 2 to 6 shows the performance with respect to the throughput, bit error rate, signal/ noise ratio, traffic received and packet loss ratio respectively. The performance is evaluated using Directional antenna with booster approach.
Figure 2 showing the Throughput of the whole network with respect to time Duration graph. Using Directional antenna when time period below and equal to 2.5 min throughput is varying between 0 and 1 (packets/sec), After 2.5 min

throughput is constantly varying across 1 (packets/sec) up to 15 min time period.
Means Directional antenna radiates data in a particular direction in order to avoid interference.

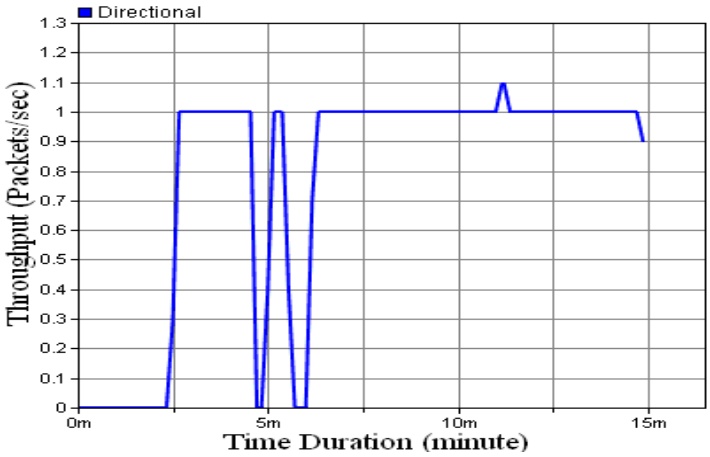


Figure 2. Throughput Vs Time Duration

Figure 3 showing Bit Error Rate Vs time Duration graph. In this graph for Directional antenna, up to 2.5 min the bit error rate is around 0.057 but after 2.5 min it is showing zero value while at 5 min. time period Bit Error rate value is 0.38 which is maximum and at 6 min. time period value is 0.28 after 6 min. bit error rte is zero till 15 min. time period.
This means Directional antenna has acceptable i.e. less bit error rate and less data loss.

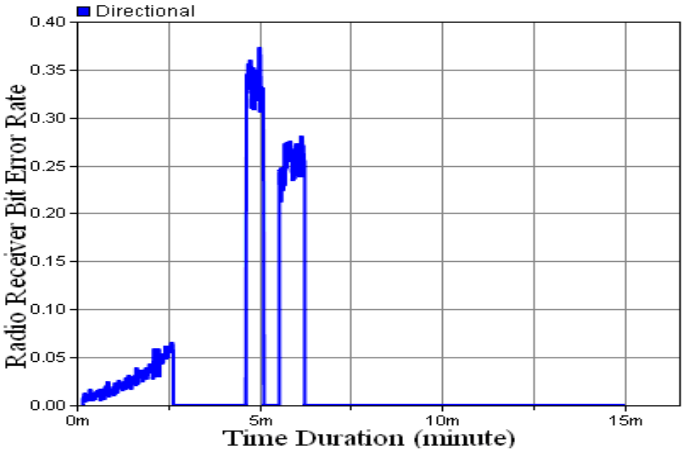


Figure 3. Radio Receiver Bit Error Rate Vs Time Duration

Figure 4 shows the Signal to Noise Ratio (SNR). For Directional antenna when time period below 2.5 min SNR is varying between 16 and 30 (db), At 2.5 min SNR is 194.5 (db). While time period is 2.5 min to 6 min SNR value is varying between -1.5 and 193.6 (db). After 6 min. time period SNR value is constantly moving across 195.3 (db) till 15 min time period.
So, we can say directional antenna is providing better SNR values. Means transmitting more data signal as compare to noise.

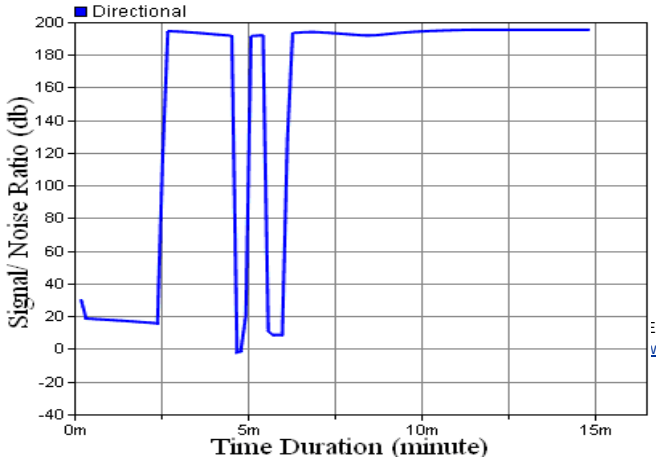
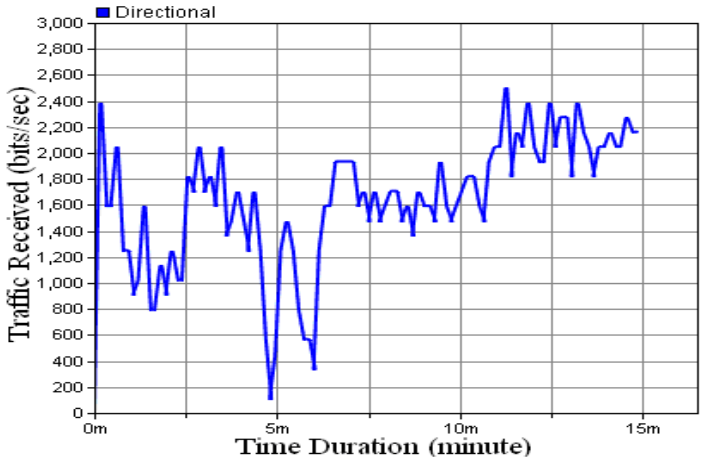


Figure 4. Signal/ Noise Ratio Vs Time Duration

Figure 5 shows Traffic Received Vs time Duration graph. Here for Directional antenna Traffic Received value is increasing with respect to time duration, between 800 and 2,503 (bites/sec).
In the given Figure 5 we can say Traffic Received value is increasing with respect to time period.

Figure 5. Traffic Received Vs Time Duration

Figure 6 shows Packet loss Ratio Vs time Duration graph. Here for Directional antenna Packet loss ratio is varying between 1 and 0, below and at 6 min. time period.
After 6 min. time period packet loss ratio value is zero up to 15 min. time period. Analyzing the packet loss ratio we can say we have less data loss (packet drops).



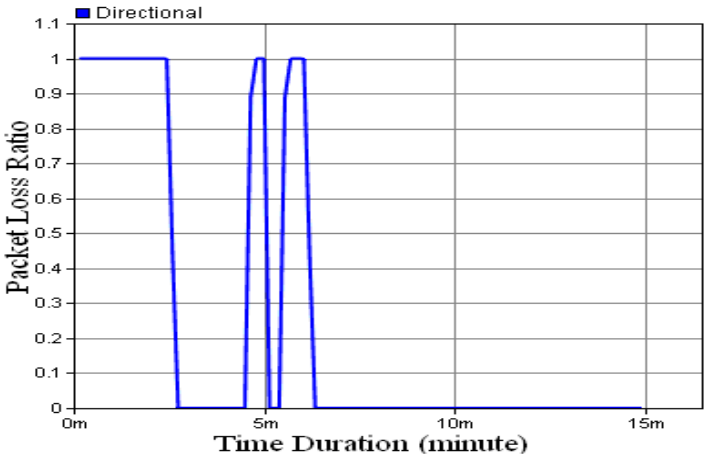


Figure 6. Packet Loss Ratio Vs Time Duration

5 Conclusion

In this paper, we have proposed Enhancing the signal strength using Novel approach with Directional Antenna in Integrated Mobile Adhoc Network. Mobile Adhoc Network is the future technology; here we provided how to enhance the signal strength using the Booster approach with directional antenna. Using directional antenna, this will be helpful to reduce interferences and data losses for mobile ad hoc network during CHG nodes or Cluster nodes mobility. The simulation results confirm that, the proposed approach in which Cluster Head Gateway (CHG) or Cluster node always try to tie up with the other Cluster Head Gateway (CHG) or cluster node present at same or different cluster through the use of Booster Technology with directional antenna. Using this we can prevent the packet drop during node mobility and reduce bit error rate along with overheads. So this approach can increase Network efficiency (better SNR and Throughput), Network performance (minimum bit error rate), Link availability (maximum Traffic Received), reduce the call drops (less packet loss ratio) and also increase the QoS of network.

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